OECD Environmental Performance Reviews

PERU

2017

OECD

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OECD Environmental Performance Reviews: Peru 2017

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This English language edition is the official version of the work. A Spanish edition of this work is also published under the title: Evaluaciones del desempeño ambiental: Peru 2017.

Please cite this publication as:
OECD/ECLAC (2017), *OECD Environmental Performance Reviews: Peru 2017*, OECD Publishing, Paris.
http://dx.doi.org/10.1787/9789264283138-en

ISBN 978-92-64-28312-1 (print)
ISBN 978-92-64-28313-8 (PDF)

United Nations reference number: LC/TS.2017/88-P

Series: OECD Environmental Performance Reviews
ISSN 1990-0104 (print)
ISSN 1990-0090 (online)

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Preface

The Republic of Peru has experienced notable economic growth in recent years. Between 2005 and 2015 Peru's gross domestic product grew by an annual average of 5.8%, owing to a combination of macroeconomic stability, openness to trade and growing inflows of foreign direct investment attracted by the country's wealth of natural resources and high commodity prices. Despite the marked significance of this growth phase, the challenge that remains is to transform that growth into more inclusive and sustainable economic development.

Peru is a multicultural and megadiverse country with abundant ecosystems and natural resources and an age-old tradition of managing its resources sustainably. However, the increasing pressure of the extractive industry, unplanned urbanisation and deforestation are threatening both this natural heritage and the wellbeing of the Peruvian people, undermining what could be the foundations of solid long-term growth.

The country's high vulnerability to environmental changes, particularly those caused by climate change and extreme weather events such as El Niño, poses additional challenges to the development model. It is therefore ever more necessary to develop an institutional environmental strategy to ensure that economic progress goes hand in hand with proper environmental protection and that costs and benefits are shared fairly. That strategy must also promote the sustainable use of the natural heritage and anticipate environmental changes in order to help boost resilience.

During the period under review—from the early 2000s to the present—significant progress has been made towards this end: the legal framework and environmental institutions have been strengthened, information systems have been improved, management tools that integrate economic and environmental components have been applied and progress has been made in defining a green growth strategy. Efforts made in environmental education, promoting citizen participation and access to justice on environmental matters are contributing to a more aware and active society in support of sustainable development.

Continuing to promote sustainable growth requires a State commitment to actively incorporate environmental protection into economic and sectoral policies, building synergies with environmental policy. Peru has good environmental indicators, including moderate waste generation, a small vehicle fleet and a limited contribution to climate change. This situation may make it easier to promote the changes needed to achieve sustainable development.

The aim of this environmental performance review is precisely to help Peru assess its progress towards achieving its environmental goals, enrich and ensure that the necessary policy dialogue continues uninterrupted, promote better accountability and deepen the awareness of all actors involved in the economic and social development of Peru. The 66 recommendations included in this study target some of the country's main environmental challenges:

- Continue to strengthen environmental institutions and environmental management systems at all levels, and ensure the effective implementation of environmental protection policies.
- Ensure that the green growth strategy is a central pillar of development that involves sectoral ministries and makes them responsible for the environmental impact of their policies.
- Promote greater use of economic instruments for environmental management, particularly environmental taxes, and eliminate damaging subsidies.
- Ensure better environmental management in the extractive industries, tackling informality, improving the handling of chemical and dangerous substances and combating their negative effects on biodiversity and ecosystems.
- Incentivise the sustainable use of the country's rich natural heritage and the opportunities it generates for eco-innovation and the development of new economic sectors.
- Continue strengthening information systems, education, participation and justice in environmental matters with a view to raising awareness of sustainable development throughout the country.

This review has been prepared by the Economic Commission for Latin America and the Caribbean (ECLAC) and the OECD, and it benefited from the constructive dialogue between Peru and the countries participating in the OECD Working Party on Environmental Performance. This joint effort helps to build awareness of the situation in different countries and facilitates continuing collaboration both among countries and with ECLAC and OECD, especially in the current framework of the 2030 Agenda for Sustainable Development and the Paris Agreement on climate change, which urge the international community to work decisively towards sustainable development and the common well-being of all people.

Alicia Bárcena
Executive Secretary

Economic Commission for Latin America and the Caribbean (ECLAC)

Ángel Gurría

Secretary-General

Organisation for Economic Co-operation and Development (OECD)

Foreword

This is the first Environmental Performance Review of Peru. It is the result of the joint work of the OECD and United Nations Economic Commission for Latin America and the Caribbean (ECLAC). Environmental Performance Reviews aim to help member and partner countries improve their individual and collective performance in environmental management by:

- helping individual governments assess progress in achieving their environmental goals;
- promoting continuous policy dialogue and peer learning; and
- stimulating greater accountability from governments towards each other and public opinion.

Progress in achieving domestic objectives and international commitments provides the basis for assessing the country's environmental performance. Such objectives and commitments may be broad aims, qualitative goals or quantitative targets. A distinction is made between intentions, actions and results. Assessment of environmental performance is also placed within the context of Peru's historical environmental record, present state of the environment, physical endowment in natural resources, economic conditions and demographic trends.

The team that prepared this review comprised the following experts: Angélica Romero (Ministry of Foreign Affairs, Chile), Alejandra Salas (Ministry of Environment, Chile), Lothar Winkelmann (Federal Institute for Geosciences and Natural Resources, Germany), Ainhoa Pérez and Alicia Pollo (Ministry of Agriculture, Food and Environment, Spain), and Gérard Bonnis (Environment Directorate of OECD). The following ECLAC staff members also participated in the review: Guillermo Acuña (Office of the Executive Secretary), Claudio Bonacic, Carlos de Miguel, José Javier Gómez, Mauricio Pereira and Joseluis Samaniego (Sustainable Development and Human Settlements Division), Germán González (consultant) and Adrián Rodríguez (Division of Production, Productivity and Management). Elvira Berrueta-Imaz, Carla Bertuzzi and Clara Tomasini from the OECD and Karina Martinez from ECLAC provided editorial and statistical support. The review also benefited from the co-operation of Ivana Capozza and Nathalie Girouard from the OECD Environment Directorate.

The OECD and ECLAC are indebted to the government of Peru for its co-operation in providing information, for the organisation of the review mission to Lima and for facilitating contacts both inside and outside government institutions.

Thanks are also due to all those who helped in the course of this review and to the representatives of countries participating in the OECD Working Party on Environmental Performance, which discussed the main findings and recommendations of this review at its meeting on 9 March 2016.

Financial support was received from the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety of Germany (BMUB), the Federal Ministry for Economic Co-operation and Development of Germany (BMZ), through the German Agency for International Co-operation (GIZ) in Peru, and the United Nations Development Account.

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Signs

The following signs are used in Figures and Tables:

..	: not available
–	: nil or negligible
.	: decimal point

Country Aggregates

OECD Europe: This zone includes all European member countries of the OECD, i.e. Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

OECD: This zone includes all member countries of the OECD, i.e. the countries of OECD Europe plus Australia, Canada, Chile, Israel, Japan, Korea, Mexico, New Zealand and the United States.

Country aggregates may include Secretariat estimates.

Currency

Monetary unit: Peruvian sol (PEN)

En 2013, 1 USD = 2.70 PEN

En 2014, 1 USD = 2.84 PEN

En 2015, 1 USD = 3.18 PEN

Cut-off date

This report is based on information and data available up to October 2015, with a central period of analysis between 2003 and 2013.

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Executive summary

Peru's rich natural heritage is coming under increasing pressure

Peru is a megabiodiverse country, with a variety of tropical and subtropical climates, the Humboldt current flowing along its coast, the Andes mountains running from north to south and the Amazon in its eastern part, all of which give it a great diversity of ecosystems and natural wealth. Peru has the second largest extent of Amazon forest and more than half of its surface area is forested. Peru is also the world's largest single species fisheries producer (anchovies) and has huge reserves of ores and hydrocarbons: it is Latin America's largest gold producer and the world's third largest producer of copper. The country is experiencing a remarkable economic growth thanks to macroeconomic stability, trade and investment openness and natural-resource-based exports. However, it has failed to resolve its acute social inequality and the pressures on its biodiversity and ecosystems. Moreover, Peru is highly vulnerable to environmental changes, particularly those related to climate change and extreme events such as the El Niño phenomenon.

Despite significant progress, urbanisation processes (such as the Lima-Callao conurbation, which is home to almost 10 million people) testify to unmet needs in relation to drinking water and sanitation provision, air pollution, urban transport, and treatment and disposal of waste, especially hazardous waste. Although Peru's greenhouse gas emissions and intensity are low thanks to the availability of hydroelectric power and natural gas, it does produce significant emissions from deforestation and land use change.

Notable progress in the field of environmental law and institutions that require effective implementation.

The Peruvian Constitution recognises the right to live in a healthy environment. Progress made in the 1990s, such as the promulgation of the Environment and Natural Resources Code in 1990 and the establishment of the National Environment Council (CONAM) in 1994, paved the way for the development of a significant body of environmental protection legislation, which culminated with the General Environment Act of 2005 and the establishment in 2008 of the Ministry of the Environment. Subsequently, the assumption of powers by the environmental authority, previously in the hands of sectoral authorities, the decentralisation of environmental powers to subnational and local authorities, and the development of environmental compliance and certification institutions marked a period of efforts to foster cross-sectoral co-ordination and the effectiveness. However, the pressures exerted by sectoral aspirations on compliance and certification systems that have yet to be fully consolidated, together with uneven regional and local resources and capacity development, have hampered proper environmental stewardship by environmental institutions, as have significant gaps in land-use planning and in the formalisation of land ownership. Henceforth, special attention will have to be paid to effective implementation of policies and legislative frameworks.

In Peru, access to environmental information is guaranteed by the Transparency and Access to Public Information Act. In addition, the country has made efforts to develop an integrated national environmental information system, has taken significant steps to strengthen environmental citizenship and participation and guarantees prior consultation of indigenous communities regarding activities in their territories by law. There is still room for improvement in public participation, especially in environmental impact assessment processes. Significant progress has also been made in relation to environmental justice, with the creation of a special prosecutor for environmental crimes, specific prosecutors within the Public Prosecutor's Office and district courts in this area. However, environmental information still suffers from major gaps, heterogeneity, dispersion and lack of consistency, which affects policymaking and informed participation. Moreover, the large number of socio-environmental conflicts existing in Peru may reflect citizens' limited ability to influence environmental decision-making. The large number of resulting disputes speak to the need to improve the capacities and co-ordination of the justice system.

Achieving an environmentally sustainable and socially inclusive growth model remains a challenge

Peru is well aware of its economic dependence on natural resources and the welfare effects of environmental costs, and has embraced the concept of green growth and undertaken commitments to reduce greenhouse gas emissions in the framework of the Paris Agreement. Furthermore, the country is party to the international conventions on environmental matters and participates actively in regional co-operation efforts. Yet there is still a lack of consistency between development policies, plans and strategies, on the one hand, and environmental targets, on the other; there are failures of co-ordination, both horizontal and vertical, among the various government institutions; and there are problems in reconciling investment promotion measures with efficiency and effectiveness in environmental protection policies.

Peru’s environmental policy is based mainly on regulation and oversight measures, but makes limited use of economic instruments. The success of this strategy requires stronger enforcement and compliance processes. Moving towards a greener growth model will require a more robust system of market incentives that raises environmental considerations higher in the tax system. Environmental tax revenues are very low and tax collection from the exploitation of natural resources could be higher. In addition, there is no way to finance environmental infrastructure while user charges remain below the cost of service provision. Despite continuous growth, public spending on the environment is still too low for the authority to discharge its responsibilities properly and to promote investment in environmental infrastructure taking into account social considerations and territorial disparities. The analysis of the environmental impact of public expenditures and subsidies offers an opportunity to undertake green reforms.

There are numerous unmet needs in relation to environmental infrastructure

Peru’s strong economic growth has helped to close gaps in basic environmental infrastructure services, particularly in urban areas, where drinking water coverage has risen to over 90% of the population and sanitation to over 80%. However, in rural areas the backlog is significant. Despite efforts, considerable investment is still needed to provide universal access to safe water and improved sanitation structures and wastewater treatment. Furthermore, while per capita waste generation is still low in Peru, the infrastructure for disposing of it is inadequate and is concentrated in the capital and other major cities. Large investments are needed for the treatment and recovery of solid and hazardous waste, as well as for its proper disposal.

With the population so highly concentrated in urban areas, much stronger mechanisms are required to monitor, control and mitigate negative impacts on the environment and health. Most major cities suffer from congestion problems, even though the motorisation rate is still very low compared with the OECD countries. These problems are exacerbated by unfettered urban sprawl. More must be done to support urban development master plans emphasising more sustainable transport and aligned with national infrastructure investment. In addition to improving fuel quality, it is essential to develop infrastructure for air quality monitoring networks, given that only partial information is available at present.

Assessment of the environmental impacts of public investment, strengthening of the system of environmental permits and the systematic expansion of strategic environmental assessments in key policies, plans and programmes and, particularly, in the areas of energy and transport, are all tools that will contribute to improving the design and alignment of incentives for a green growth strategy.

Significant efforts are needed in relation to solid waste management and control of chemicals

Peru generates less than half the municipal solid waste per day per capita than the OECD average, which stands in contrast to its poor infrastructure for disposal and treatment. Almost half of all solid waste is improperly disposed of in illegal landfills, by uncontrolled burning or in water courses and the ocean. High tax arrears constrain waste collection by municipal authorities and limit their ability to make the necessary investments in proper collection, treatment and final disposal of waste. Rates need to be devised to guarantee municipal collection and cover the cost of services, while taking due account of social considerations. There have been positive developments: the General Solid Wastes Act seeks to ensure the proper management of waste and the Ministry of the Environment has implemented programmes and projects to support municipalities in modernisation schemes, waste separation at source, selective waste collection and investment in comprehensive waste management, although much remains to be done in terms of awareness-raising and separation at source, reuse and recycling. Certain steps have already been taken to extend the responsibility of producers in respect of electrical and electronic waste, but these need to be further developed. There is little information and only limited traceability with respect to non-municipal waste, which is handled by sectoral authorities.

Imports and the use of chemical substances have both grown considerably, but the information to manage them properly is lacking. The use of pesticides in agriculture and of substances harmful to the ozone layer in industry is subject to controls under the Stockholm Convention on Persistent Organic Pollutants, the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer. Although Peru already has policies of a general nature, it would be advisable to improve the specific regulatory framework for chemicals in order to take into account their life cycle and to include prevention and risk management. Inter-institutional co-ordination and greater investment in the environment, health and agriculture are essential to strengthen oversight and risk management. Peru is implementing a Pollutant Release and Transfer Register; however, the identification, registration, determination of origin and location of chemicals and hazardous substances and products, particularly in the case of those imported without a tariff heading, remain a challenge. There is also room to improve port surveillance infrastructure, including the management and monitoring of product entry.

Peru's ratification of the Minamata Convention on Mercury represents an important step in its efforts to reduce the emission and release of mercury, particularly in small-scale and artisanal mining, but it is essential to tighten regulation and control and tackle illegal mining. The laws regulating mine closure and environmental liabilities address mining-related risks to human beings and the environment. Although Peru keeps an inventory of mining-related environmental liabilities, only 10% of these have remediation instruments.

The use of natural resources and green markets offer multiple opportunities for sustainable development

Peru has a number of different eco-regions, which are home to 84 of the 117 types of biomass recognised in the world, as well as rich and varied marine ecosystems. Cultural and ethnic diversity enshrines valuable traditional knowledge regarding the uses and properties of flora and fauna species and genetic resources. Peru’s agro-biodiversity is among the richest in the world, and represents one of its most valuable natural and cultural assets. On the other hand, nature tourism has become an increasingly important activity in the country.

Peru’s rich ecosystemic, genetic and biological heritage offers opportunities for eco-innovation, biotrade, ecotourism, gastronomy, traditional medicine and the development of new niches of international competitiveness that Peru is tapping more and more. To reap the benefits of this economic potential, Peru must fully take these elements on board in research and development policies, managing scientific and traditional knowledge by fostering the development of knowledge hubs and new market niches, and building approaches that take into account the state of ecosystems and strengthen payment for environmental services.

Part I. Progress toward sustainable development

Chapter 1. Background and key environmental trends

This chapter provides an overview of Peru's main achievements and remaining challenges on the path towards green growth and sustainable development. Drawing on indicators from national and international sources, it assesses the state of the environment and natural resources and key environmental trends, focusing on the period since 2003.

1. Introduction

This chapter presents some of the environmental trends observed in Peru between the years 2003 and 2013, the period analysed in this assessment. It also highlights the main achievements and remaining challenges on the road to green growth and sustainable development. This chapter is based on indicators from national and international sources, and takes as its point of reference the OECD Green Growth Strategy (OECD, 2011). After a brief description of Peru's physical features and its socioeconomic context, the chapter outlines the principal environmental tendencies and, in particular, the progress that has been made in the efficient use of energy and natural resources and in enhancing environmental quality. This chapter is intended to establish a baseline for the subsequent chapters, which will evaluate whether the application of environmental policies in Peru has succeeded in influencing these trends, and whether their objectives have served to create economic opportunities. It also presents the main conclusions and recommendations, and sets them in context.

While Peru's economy is the seventh largest in the region, in recent years it has demonstrated a dynamism that has made it the region's second fastest-growing economy over the years 2003-2013. The main engines driving this growth are the combination of domestic macroeconomic policies and favourable external conditions linked primarily to rising commodity prices.

The socioeconomic progress of recent decades has been reflected both in per capita incomes, which have risen by more than 60%, and in the poverty rate, which fell from 52% to 24% in 2013.[1] Yet the country still faces a great challenge in terms of various dimensions of well-being, which betray persistent inequality and widespread labour informality. Moreover, the growing middle class is placing new pressures on public services such as education, health and transport (OECD, 2015).

Peru's environmental performance must be analysed from the viewpoint of a middle-income country that is experiencing significant economic growth based on the exploitation of renewable and non-renewable natural resources such as fisheries, metal mining and hydrocarbons. Along with its great wealth of mineral deposits, the country has abundant water resources (although distribution is uneven) and a broad and rich biodiversity that places it among the world's leading mega-diverse countries. It has the second largest forested area in Latin America, abounds in ecosystems, species and genetic resources and has a rich cultural heritage.

Over the last decade the country's environmental institutions have been strengthened through the adoption of the General Environment Act of 2005 and subsequent creation of the Ministry of the Environment (MINAM), the Peruvian National Protected Areas Service (SERNANP) and the Agency for Environmental Assessment and Enforcement (OEFA) in 2008. Also to be noted is the establishment of the National Service of Environmental Certification for Sustainable Investments (SENACE) in 2012.

Box 1.1. Peru: physical, economic and social context

Physical context

Peru has the third largest land area among South American countries, covering 1 285 215.6 km² in the western part of the region and to the south of Ecuador. It has 7 062 km of land boundaries, including those to the north with Colombia and Ecuador (1 494 km and 1 529 km respectively), to the east with Brazil (2 659 km), to the south-east with Plurinational State of Bolivia (1 212 km) and to the south with Chile (168 km). To the west lies the Pacific Ocean, with a coastline of 2 414 km. The country is exposed to various risks associated with natural phenomena such as earthquakes, tsunamis, flash flooding, landslides and volcanic activity.

The country's relief is highly varied, with zones of difficult accessibility. The three main geographical regions are: (i) the coastal region, covering 12% of the territory, characterised by extensive plains with dry and sandy soils; (ii) the Sierra, covering 28% of the territory, which has a sharply accentuated and varied relief dominated by the Cordillera of the Andes, where the highest point of elevation is the Nevado Huascaran (6 768 metres above sea level); and (iii) to the east, the Amazon Selva or forest zone, which covers 60% of the national territory, divided into the Selva Alta (High Forest) and the Llano Amazónico (Amazon Lowlands), and is characterised by its slopes and plains.

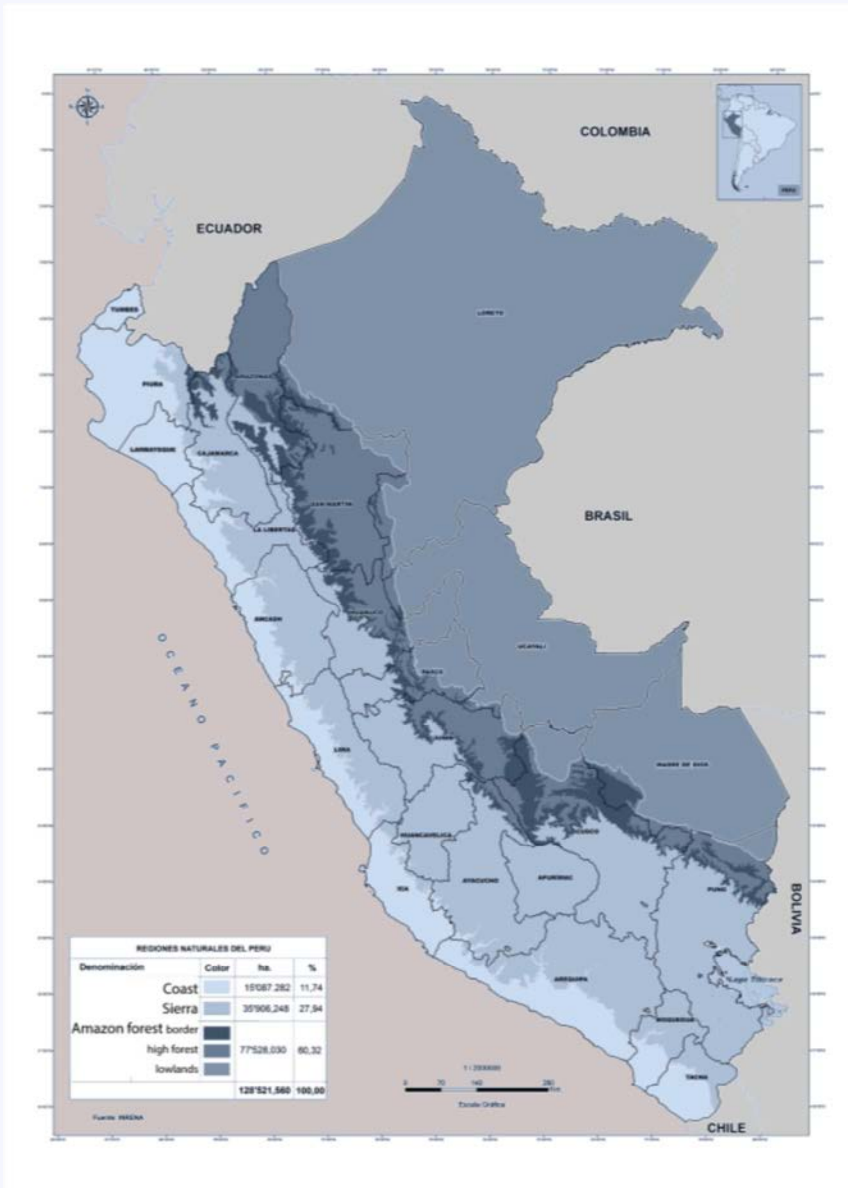
There are three major watersheds or hydrographic regions: the Pacific, the Amazon, and the endorheic or closed basin of Lake Titicaca. These regions embrace 159 hydrographic basins (lakes, lagoons, rivers and swamps). The Amazon watershed contains around 98% of the available surface water. The rivers of the coastal region are characterised by their steep slope and short length, their heavy transport of sediments and their irregular discharges. The rivers of the Sierra are located in narrow valleys, with heavy erosion in the basins and with the potential for hydrological development, while the rivers of the Selva are wide and mighty, with little incline and with long and winding courses. The longest rivers are the Camaná (375 km) and the Chira (334 km), while those with the greatest flow are the Santa (177 m³ per second) and the Tumbes (123 m³ per second).

Peru has tropical and subtropical climates, and microclimates influenced by the presence of the Humboldt Current, the Cordillera of the Andes and the Amazon River. The prevailing climate of the coastal zone is arid. The Sierra presents a varied climate, due to its different levels of elevation, with low temperatures frequent in the heights of the Andes. The climate in the Amazon basin is hot and humid with abundant rainfall.

The country has numerous ecosystems that are distributed across the length and breadth of the land. The main continental ecosystems are the tropical forests, the dry forests and the fragile ecosystems. This variety has produced conditions whereby Peru is considered one of the 17 mega-diverse countries. At least 20 375 species of flora have been counted, along with 523 mammals, 147 birds, 446 reptiles and 1 070 marine fish. The country also contains 84 of the planet's 117 life zones.

Box 1.1. Peru: physical, economic and social context *(cont.)*

Physical context



The economy

The Peruvian economy is the seventh biggest in Latin America and the Caribbean, and its great dynamism makes it the second fastest-growing in the region. GDP rose at an annual pace of 6.4% between 2003 and 2013, above the average for the OECD and for Latin America and the Caribbean. Per capita GDP rose on average by 5% over the same period

Box 1.1. Peru: physical, economic and social context *(cont.)*

Per capita income was, on average, one quarter of the OECD level for the period 2003-2013. The income gap has diminished, thanks to higher labour productivity and higher employability rates for a growing workforce (World Bank, 2011).

Peru's growth has been steady, with a slight slowing in the year 2009 due to the global economic crisis. During the period of analysis GDP nearly doubled. GDP growth for 2015 is estimated at 3.6%, driven primarily by the mining industry (ECLAC, 2015a).

The manufacturing share of GDP rose from 33% in 2003 to 37% in 2012, above the OECD average of 24%. The share of services in GDP is 56%, and agriculture represents 7%. The agriculture sector accounted for 25.5% of the economically active population in Peru in 2013 (ECLAC, 2013).

One of the biggest contributors to the economy is the oil and mining sector, which accounted for 12.1% of GDP in 2013. More specifically, crude oil and gas extraction and related services contributed 2.7%, and mining and related services 9.4% (INEI online statistics).

Trade in goods and service rose from 37% to 49% of GDP, and while it remains below the OECD average it has reached proportions similar to the average for Latin America and the Caribbean. Peru's most important trading partners are the United States and China. The principal export products are copper and gold, which together represent 40% of the value of Peruvian exports. The main imports relate to commodities and intermediate goods such as fuels, lubricants and pharmaceutical chemicals. Imports of capital goods such as industrial machinery are also significant.

Total investment averaged 22% of GDP over the period under analysis. Private investment is very high and represents 17% of GDP (World Bank, n/d).

Between 2003 and 2013 net foreign direct investment flows to Peru rose by 619%, and Peru is currently the fourth largest recipient of FDI in Latin America and the Caribbean.

Peru's total external debt declined considerably during the period, from 50.4% of GDP in 2003 to 30.3% in 2013.

Total public debt, external and domestic, dropped from 48.7% of GDP to 19.6% over the period 2003-2013. The main component of this debt at the beginning of the twenty-first century was with the external sector (38.4% of GDP). However, this amount has shrunk to 8.8% of GDP.

Central government current revenue rose gradually between 2003 and 2013, from 15.4% of GDP to 18.9% of GDP, while total expenditure remained relatively stable, recording a slight increase from 17.3% of GDP to 18.6% of GDP.

At the municipal level, revenues and expenditures have risen sharply, by 86% and 105% respectively. In the last year municipal revenues reached 4.3% of GDP and non-financial expenditures 4.5% of GDP.

Revenues from "green taxation" are dominated by the excise tax on fuels, which in 2012 produced 2.6% of central government revenues. Public spending on the environment reached 0.4% of GDP in that year.

Box 1.1. Peru: physical, economic and social context *(cont.)*

Society

The 2013 population of Peru is estimated at 30.5 million (INEI online statistics). According to the 2007 population census some 25% of the population is indigenous, concentrated primarily in the Sierra zone. Population density is low: in 2013 there were 24 persons per square kilometre. This figure is below the averages for the OECD and for Latin America and the Caribbean.

The population is relatively young: around 56% is under 30 years of age. However, the population is expected to grow at steadily slower rates while life expectancy will increase, pointing to a gradually ageing population.

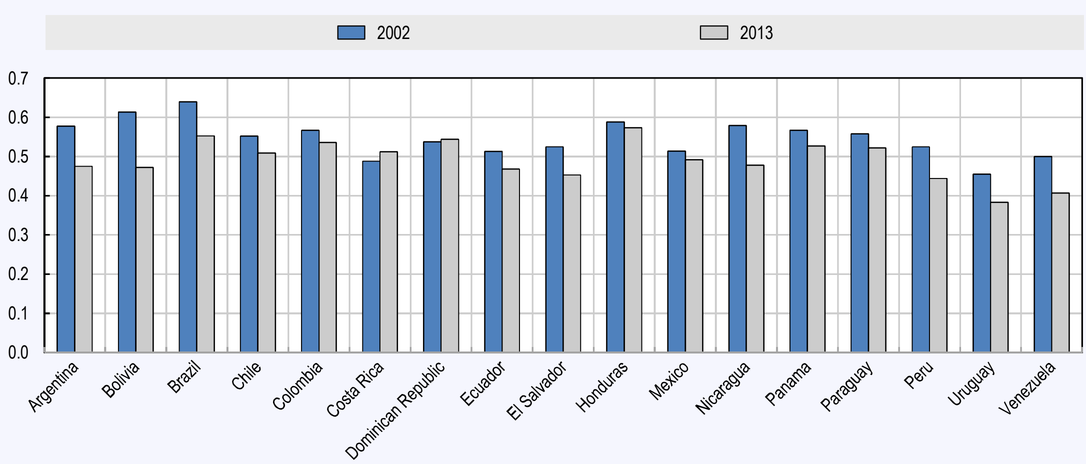
The majority of the population lives in the coastal zone, with more than 31% in the Department of Lima. Over 75% of the population lives in urban areas, and this proportion is expected to increase over time.

The unemployment rate is below the OECD average (around 8%), and has fallen over the last decade from 10% in 2003 to 4% in 2013. Informal non-farm employment has also declined, dropping from 75.2% of the economically active population in 2004 to 68.6% in 2012, thanks to economic growth and institutional factors (ILO, 2014).

With a Gini index of 0.44 for the year 2012, inequality in Peru is greater than that in most OECD countries (with the exceptions of Chile and Mexico), but less than in the majority of Latin American countries. The highest income decile receives around 34% of all income generated in the country, while the share of the poorest decile is only 1.4%.

Latin America (17 countries): income inequality, 2002 and 2013

(Gini index)



Source: J.P. Jiménez, J.P. (ed.), "Desigualdad, concentración del ingreso y tributación sobre las altas rentas en AméricaLatina", *ECLAC Books*, No. 134 (LC/G.2638-P), ECLAC.

The percentage of the population living below the national poverty line has declined significantly from 52.5% in 2003 to 23.9% in 2013. At the present time, rural poverty stands at 48% and urban poverty at 16%.

Box 1.1. Peru: physical, economic and social context *(cont.)*

Life expectancy at birth is 74.8 years, below the OECD average (80 years) but similar to the average for Latin America and the Caribbean.

Expenditure on health rose slightly from 4.7% to 5.3% of GDP over the period 2003-2013. This percentage is less than half the average figure for the OECD, which is 12.3% of GDP, and it is below the average for Latin America and the Caribbean (7.7% of GDP).

Although the infant mortality rate remains high in comparison with OECD countries, it has dropped considerably over the period, from 24.1 to 14.2 deaths per thousand live births. There is a wide geographical variation in this indicator: for example, in 2011 the figure was 9 in the department of Tacna, while in Puno it was 40.

Chronic malnutrition among children under 5 years of age has been declining steadily, from 28.5% in 2007 to 17.5% in 2013. In that latter year, the rural rate was 32.3% and the urban rate was 10.3%.

Spending on education falls short of the OECD average, and remains at around 3% of GDP and 15% of government spending.

As to the quality of education, the census evaluation of 2013 conducted by the Ministry of Education shows that 16.8% of grade 2 pupils in primary school performed adequately in mathematics, and 33% in reading comprehension. In the latest (2012) testing under the Programme for International Student Assessment (PISA) of the OECD, Peru ranked last among the 66 countries participating.

The illiteracy rate among the population aged 15 years and over declined from 10.5% to 6.2% over the period 2003-2013. However, there are still discrepancies between zones: the rural rate is 15.8% and the urban rate is 3.5%.

Source: ECLAC on the basis of World Bank (2011); ECLAC, *Economic Survey of Latin America and the Caribbean*, 2015 (LC/G.2645-P), Santiago, 2015; *Statistical Yearbook for Latin America and the Caribbean*, 2013 (LC/G.2582-P), Santiago, December, 2013; CEPALSTAT database; National Institute of Statistics and Informatics (INEI), "Estadisticas" [online] https://www.inei.gob.pe/; World Bank, World Development Indicators (WDI) [online] http://databank.worldbank.org/; and ILO (2014).

The significant economic growth of recent decades, however, has imposed various pressures on the environment, and these have been exacerbated by the degree of informality in the economy and by certain illicit activities (such as illegal mining and logging) which have made it difficult to increase the degree of environmental monitoring and control in areas remote from urban centres.

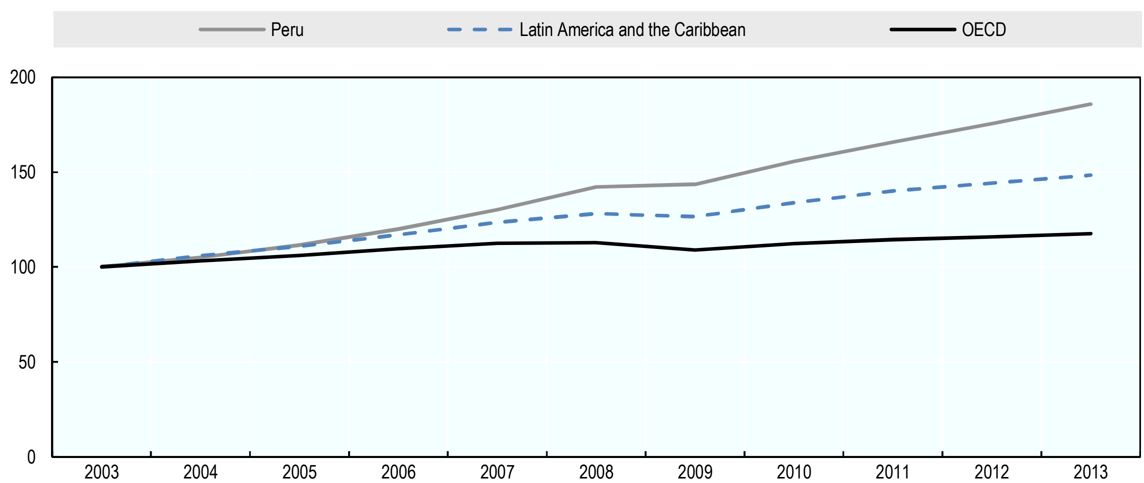
Energy production has evolved in line with economic growth. A comparison with OECD countries shows that the total primary energy supply per capita is low, and an analysis of energy intensity per unit of output suggests room for efficiency gains. The energy mix has shifted substantially over the last decade, due to the sharp increase in natural gas production. The renewable energy component of the mix is greater than that for the OECD, and the share of biofuels and solar energy together amounts to 9% of domestic supply. The transport sector accounts for the largest share of energy consumption and of emissions from combustion, and it has been growing apace with GDP.

While the country's contribution to global emissions of greenhouse gases is low, nationwide emissions caused by deforestation and changes in land use are significant. In recent years, carbon emissions per capita have risen slightly, but they remain below the OECD average, and emissions per unit of GDP have remained stable.

Aggregate estimates for the country show increases in emissions of particulate matter and nitrogen oxides, together with a slight reduction in emissions of sulphur dioxide. Air quality measurements in Lima-Callao point to a decrease in concentrations of polluting materials, explained primarily by the improved quality of fuels, something that also seems to be happening in other densely populated cities of the country. Sources of pressure on air quality include the growing size of the automotive fleet, the use of fossil fuels, and certain other large-scale productive activities.

Figure 1.1. Peru: GDP performance, 2003-2013

(Index: 2003=100)



Note: Index of relative change based on GDP valued in international dollars at constant 2011 prices at purchasing power parity.
Source: ECLAC calculations on the basis of World Bank, International Comparison Program.

The Atlantic (or Amazonian) watershed has an abundant availability of water, in contrast to the Pacific slope, which has a water shortage and which moreover contains a high percentage of the population. Over the last decade, the national water supply has remained steady, thanks to the increased extraction of water from subterranean sources. The heaviest demand for water consumption comes from agriculture, followed by the demand for drinking water. In terms of non-consumption uses, the energy sector is especially important. The proportion of the population using improved drinking water sources is estimated at 86%, and the proportion of those using improved sanitation facilities at 75%. These percentages are sharply lower in rural areas: water access coverage in many zones is only partial and water is delivered for only a few hours a day.

Although the last decade has seen significant progress in water monitoring, quality and treatment, there is still much room for improvement. As a result of various public policies and evolving environmental pressures, some types of illnesses have declined over time, such as acute respiratory diseases and acute diarrhoea in children. Nevertheless, the prevalence of diarrhoea among the population remains high. Isolated cases of heavy metal poisoning have also been reported.

The available data suggest an increase in the productivity of domestic material consumption per unit of output. In Peru, per capita waste production is lower than the average for the OECD: there are 11 sanitary landfills for the treatment and final disposal of solid waste, and nearly half of municipalities have developed comprehensive plans for the environmental management of solid waste.

Climatic conditions allow the cultivation of numerous and varied crops. Agricultural production for export is concentrated in the coastal zone and, despite the scarce availability of water, the zone is home to plantings of cotton, coffee, mangoes, lemons, asparagus, grapes, avocados and oranges, among other crops. The Sierra region is characterised by dry-land farming, where the typical crops are cereals, vegetables, garden produce and tubers. Agriculture in the Selva is dominated by plantations of coffee, cocoa, palms, fruits and timber-yielding species. The use of nitrogen- and phosphate-based fertilisers per hectare of arable land has risen apace with the volume of agricultural output. For the year 2012, this indicator is below that for the OECD and below the average for Latin America and the Caribbean.

The land area covered by forests amounts to more than half of the national territory, and is located for the most part in Amazonia. The greatest part of the forest is of the tropical type (54% of land area), followed by dry forest (3%) and Andean forest (0.2%). Peru has the second largest expanse of Amazonian forest, and the services provided by its ecosystems are of great economic, social and cultural importance. During the years 2003-2012, the land area covered by forest declined by just under 2%: the Amazonian region was most affected by the process of deforestation, reflecting the conversion of land to farming and livestock uses by small-scale producers. Clearing of the country's humid Amazonian forest exceeds 113 000 ha per year, and has occurred primarily in unclassified forests where there is no system of administration or protection.

Peru's marine resources are diverse, and there are many species of fish, molluscs, crustaceans and algae to be found all along the coast. The high productivity of the country's marine resources can be attributed to the Humboldt Current, which increases and distributes nutrients and food for fish and invertebrates. Peru has the world's largest fishery based on a single species, the anchovy, and it is one of the biggest producers in terms of catch, although this has been declining over the last decade. Among the greatest pressures on the marine ecosystem are the growing percentage of industries and of population along the coast, the introduction of exotic species, by-catch, and illegal fishing.

The country has abundant non-renewable resources that are an important source of foreign exchange. Exploitation of crude petroleum and natural gas reserves has given the country energy self-sufficiency. Domestic demand for oil and its derivatives is not fully covered by domestic production, and around 60% of oil processed in the country is imported. However, domestic output of natural gas has risen sharply over the last decade, bringing about important changes in the composition of the energy mix which has shifted from petroleum-intensive to a natural gas base. Peru also has large reserves of metallic ores, and is among the leading world producers of copper, gold, zinc, silver, lead and tin. Mining output has been growing steadily over time, and in 2013 mineral exports represented 61% (USD 25.5 billion) of the country's total exports.

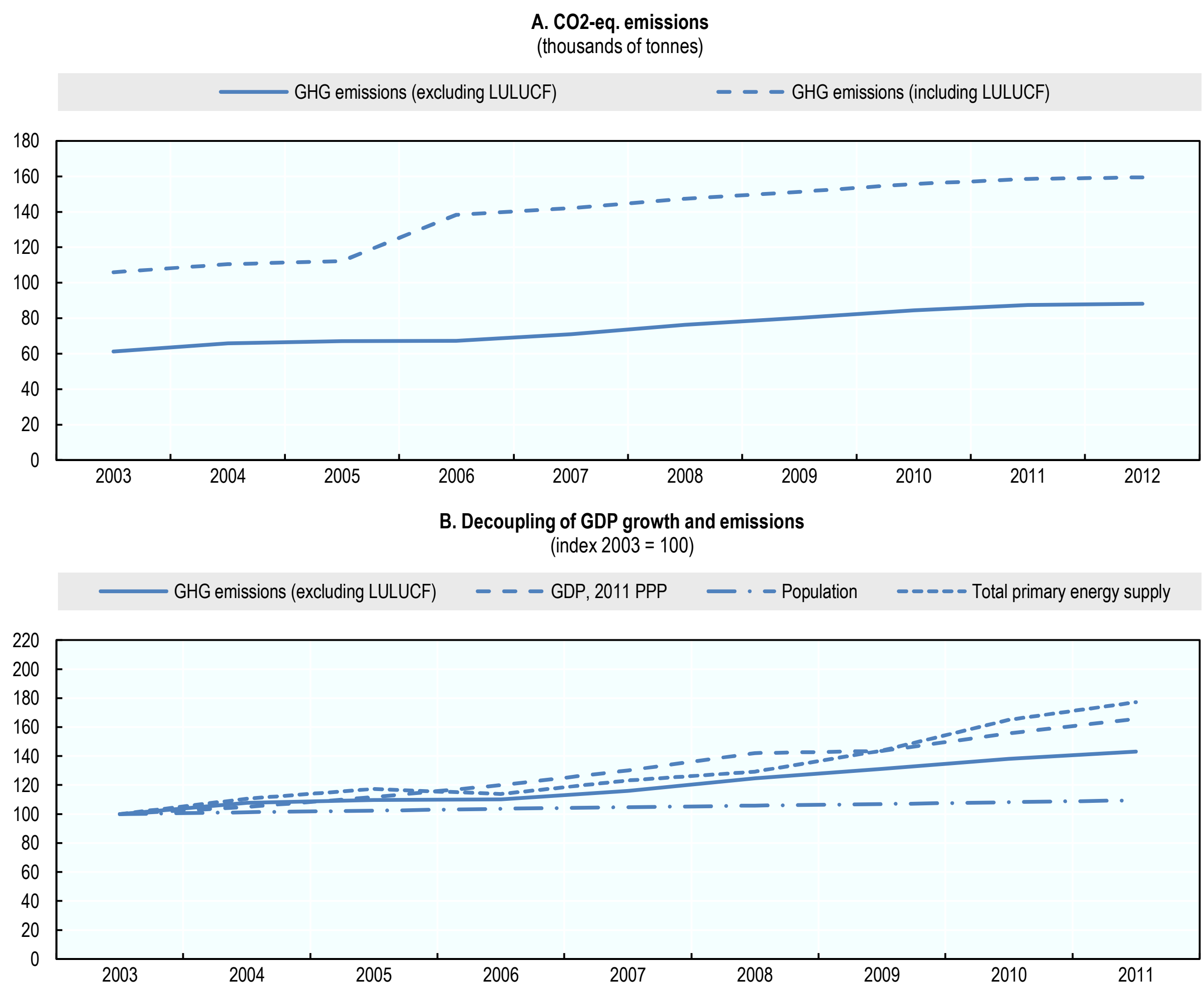
2. Progress towards sustainable development: moving towards a low-carbon economy and energy and resource efficiency

2.1. Carbon and energy intensities

Greenhouse gas emissions

According to figures from the World Resources Institute (WRI), total emissions of greenhouse gases (including changes in land use) in Peru amounted to 0.34% of global emissions, and 3.5% of emissions in Latin America and the Caribbean. If changes in land use and deforestation processes are excluded, greenhouse gas emissions would be in the order of 0.2% of worldwide emissions, and 2.5% of the region's emissions. During 2012, emissions from changes in land use and deforestation represented 46% of total greenhouse gas emissions in Peru, and over the period 2003-2012 these rose by 60%.

Figure 1.2. Peru: emissions of carbon dioxide equivalent (CO^2-eq) and decoupling GDP growth from emissions, 2003-2013



Note: LULUCF refers to emissions from the land use, land-use change and forestry sector.
Source: ECLAC calculations on the basis of Carbon Dioxide Information Analysis Center (CDIAC) and World Resources Institute (WRI), CAIT Climate Data Explorer, 2015 [online] http://cait.wri.org.

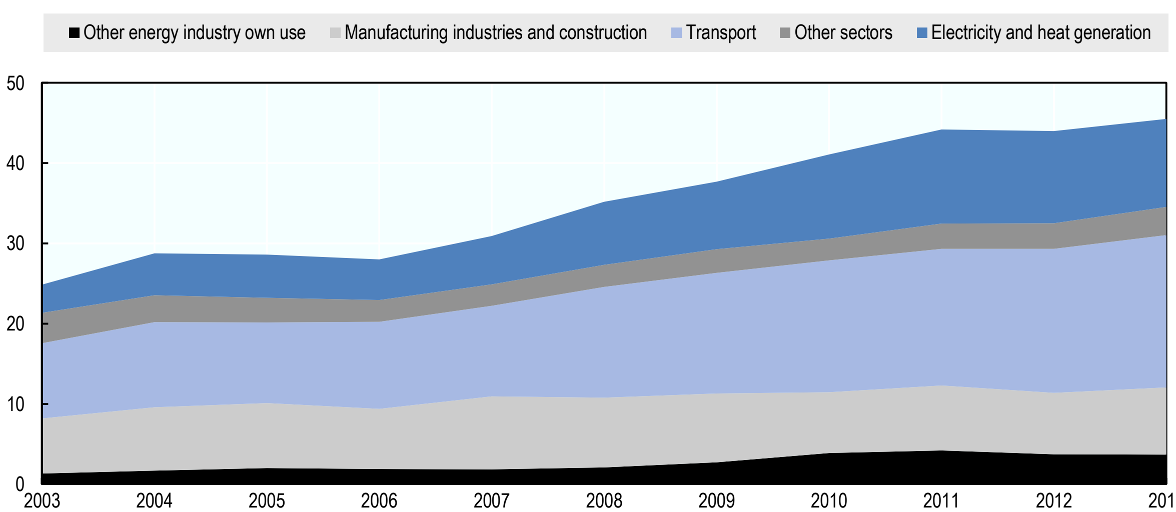
The International Energy Agency (IEA) reports that in 2012 Peru's CO_2 emissions from fossil fuel combustion—without including those from land use change—represented 0.14% of worldwide emissions, and they have increased by 82% since 2003.

A sector breakdown of emissions from fossil fuel consumption reveals that 39% derive from transportation, and 25% from electricity and heat generation. These proportions differ from the OECD average, where 28% of emissions are associated with transportation and 40% with power and heat generation (IEA/OECD, 2014). The lower proportion of emissions from electricity and heat generation reflects the fact that Peru's energy mix consists to a high degree of natural gas and hydropower.

The IEA also reports that, between 2003 and 2012, Peru's per capita emissions of CO_2 increased by 65%, while emissions per unit of GDP remained stable. The intensity of emissions in 2012 was 1.53 tonnes of CO_2 per capita, which is 16% of the average per capita intensity in the OECD. Currently, 0.15 tonnes of CO_2 is being emitted for every USD 1 000 of GDP (in terms of 2005 purchasing power parity), well below the average for the OECD (0.31 tonnes) and for Latin America and the Caribbean (0.23 tonnes).

The ratio between CO_2 emissions and primary energy supply has been declining over time. Over the period 2003-2013 this indicator fell by 1.6%, in line with the OECD trend, which dropped by 3.5%. Nevertheless, the ratio between CO_2 emissions and final energy consumption rose by 14%, while it declined across OECD countries by 3.6%.

Figure 1.3. Peru: energy-related carbon dioxide emissions by sector, 2003-13



Source: ECLAC calculations on the basis of IEA (2015b).

Total energy production grew by 128% during the period of analysis. At the beginning of this century, a third of the energy was imported, but this tendency reversed itself in recent years, and since 2011 Peru has become a net exporter of energy.

Primary energy production in Peru grew at a rate similar to that of GDP, measured in 2005 prices at purchasing power parity (PPP), and over the period 2003-2013 it recorded cumulative growth of 86%.

Energy intensity measured as the supply of primary energy with respect to real GDP showed no change between 2003 and 2013, and remains at 0.17 tonnes of oil equivalent (toe) per thousand dollars (2005 prices at PPP). This intensity is 31% greater than the average index for OECD countries (0.13 toe per thousand dollars at PPP), demonstrating that there is room for improvement in Peru's energy efficiency.

Primary energy supply per capita rose by 66% to 0.71 toe per capita in 2013, or 17% of the value recorded for the OECD (4.2 toe per capita).

The sector that consumes the most energy is transportation, with 42% of domestic energy consumption, followed by the manufacturing sector (29%). The sectors that have shown the greatest increase in consumption during the period are services (457%) and transportation (115%).

According to figures from the National Institute of Statistics and Informatics (INEI), Peru's production of electricity increased by 79% over the period 2003-2012, reaching 41 036 gigawatt hours (GWh). The number of power supply customers stands at 5.83 million, up by 56% over the same period.

The energy mix

The National Energy Balance prepared by the Ministry of Mines and Energy indicates that the domestic primary energy supply doubled in the period 2003-2013. Moreover, the energy mix has shifted significantly, with a growing share for natural gas, which jumped from 10% of domestic supply in 2004 to 57% in 2013 (MINEM, 2013).

Cumulative growth in the domestic supply of natural gas was 998%. This stands in contrast to the 9% fall in the oil supply over the same period, the share of which in domestic primary energy supply was 13% in 2013.

While there has been an increase in the provision of hydropower and coal, their share in the domestic primary energy supply fell to 8% and 3%, respectively, in 2013. Biofuels and solar energy have also lost domestic supply share, and together they now represent 9%.

It should be noted that in 2013 the supply of natural gas, liquefied natural gas and hydropower was domestically sourced. By contrast, 52% of oil and 84% of coal was imported from abroad.

By way of comparison, the IEA shows that the proportion of renewable energy within the total primary energy supply in Peru is 2.6 times greater than that for the OECD, owing primarily to the use of biofuels. At the same time, Peru consumes relatively less coal but relatively more oil and natural gas (including liquefied natural gas).

The sector with the greatest final energy consumption during 2013 was transportation, at 41%, followed by the residential, commercial and public sectors, and manufacturing and mining, both at 27%.

Growth in the transportation sector has tracked fluctuations in GDP, and since 2008 it has been growing continuously.

According to the Ministry of the Environment (MINAM, 2014a), the rate of automobile use has doubled, and the market for cheap used cars has grown. In addition, traffic flow has expanded by an annual average of 7% in the last five years. The number of vehicles per 1 000 inhabitants rose by 42% during the period 2003-2012, from 50 to 71, a figure that is still far below that for OECD countries.

Figure 1.4. Peru: energy intensity and primary energy supply by source, 2003-13

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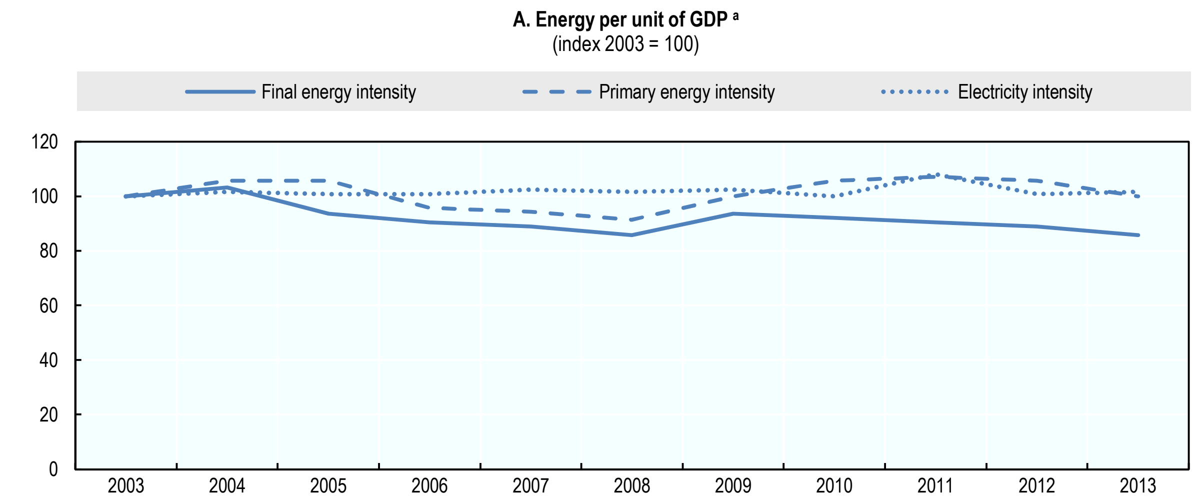
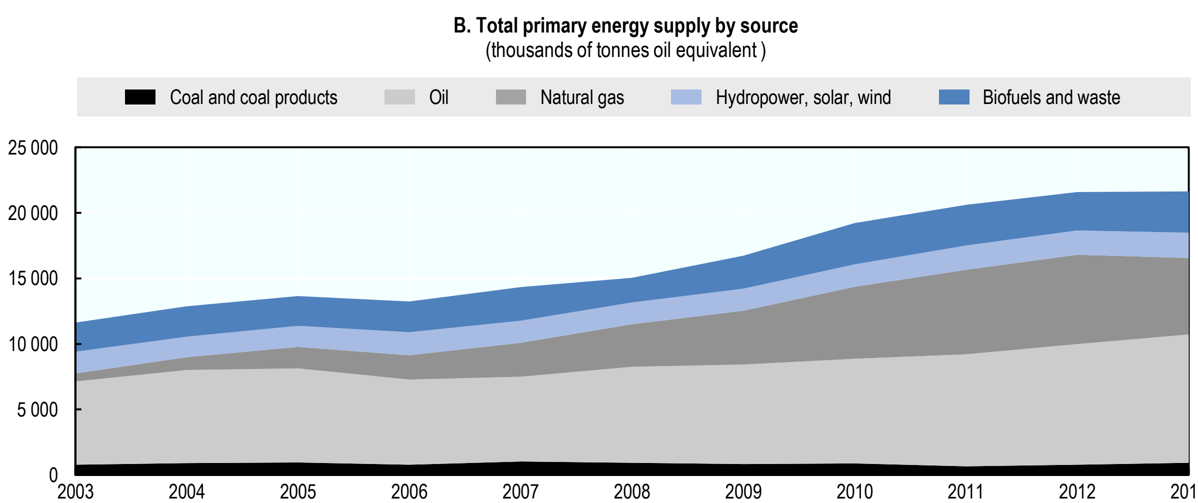




Note: a) GDP at constant 2005 prices and purchasing power parity.
Source: ECLAC calculations on the basis of IEA.

2.2. Efficiency in the use of inputs and in waste generation

Material productivity

According to a study by the United Nations Environment Programme (UNEP, 2013), Peru's domestic material consumption (DMC) increased by 37% over the period 2003-2008, and stood at 512 million tonnes in 2008.

The growth rate of domestic material consumption is lower than the rate of real GDP growth (at purchasing power parity and 2005 prices), denoting an increase in material productivity.

Domestic material consumption on a per capita basis in Peru rose by 29% in the period 2003-2008, and in the latter year stood at 17.8 tonnes per capita, slightly lower than the

OECD average of 18.1 tonnes per capita. Domestic consumption per capita is in fact 31% higher than the average for Latin America, and 74% above that for the rest of the world (UNEP, 2013).

Metallic ores and industrial minerals constitute the largest component of domestic material consumption, accounting for 37% of DMC in 2008, followed by construction minerals (7%), biomass (7%) and fossil fuels (1%).

In terms of growth by component, over the period 2003-2008, cumulative consumption of construction minerals rose by 93%, followed by fossil fuels (38%), metallic ores and industrial minerals (34%), and biomass (14%).

Waste generation and treatment

According to the Ministry of the Environment (MINAM, 2014b), 664 districts (24.5% of the total) reported data on waste in 2012. This figure represents a major increase from 2011, when 214 districts reported such information.

Based on various official extrapolations, it may be inferred that municipal solid waste in Peru amounted to 6.2 million tonnes in 2012, of which 4.6 million tonnes represented domestic waste and 1.6 million tonnes commercial and other waste, for a rate of 0.583 kg per person per day. A disaggregation by geographical zone reveals that the greatest generation of waste per capita occurs in the Selva (0.599 kg per person per day), followed by the Coast (0.597 kg) and the Sierra (0.527 kg).

Municipal solid wastes in Peru in 2012 consisted primarily of organic material (50.9%), plastics (10.1%) and hazardous waste (8.5%). In 2012, non-municipal solid waste amounted to 11.03 million tonnes nationwide, of which nearly 98% came from the agriculture sector, with smaller proportions from the housing and health sectors.

Hazardous solid waste in 2012 represented 8.5% of total waste reported at the municipal level. Beyond the municipal level, hazardous solid waste consists primarily of contaminated containers (41.4% of the sector's hazardous waste) in the manufacturing industry; oil residues in the fisheries sector (52.5%); waste contaminated with oil and water mixtures and emulsions in the communications sector (65.7%); oil residues in agriculture (57.4%); septic tank sludge, wastewater and run-off from cleaning equipment in the construction and sanitation sectors (99.7%); and metallic residues (38.05%) in the transportation sector.

The country currently has 11 sanitary landfills for the treatment and final disposal of solid waste. In 2011, 45% of provincial municipalities had developed comprehensive plans for the environmental management of solid waste, and there is a growing trend among municipalities to adopt such plans.

Fertiliser consumption

Over the period 2003-2012, the volume of agricultural output rose by 127%, while the equivalent figure for the livestock sector was 45% (INEI, n/d).

The use of nitrogen- and phosphate-based fertilisers per hectare of arable land rose by 27% over that period (World Bank, n/d).

In comparative terms, the indicator of fertiliser consumption per hectare of arable land stood at 104 kg in 2012. This figure is below that observed in the OECD (122 kg per hectare) and below the average for Latin America and the Caribbean (126 kg per hectare).

3. Improvement in environmental living conditions

3.1. Air quality

Peru has made significant progress in achieving the objectives of the Montreal Protocol, and substances that deplete the ozone layer are being eliminated at a significant and accelerating pace. Over the years 2003-2013, the release of such substances declined from 191 tonnes to 22 tonnes per year (UNEP, 2013).

The main source of pressure on air quality is associated with the growing size of the automotive fleet and the use of fossil fuels. Other sources of pressure identified for various zones of the country are brickworks, mineral extraction and smelting, the fishing industry and power generation (MINAM, 2014a).

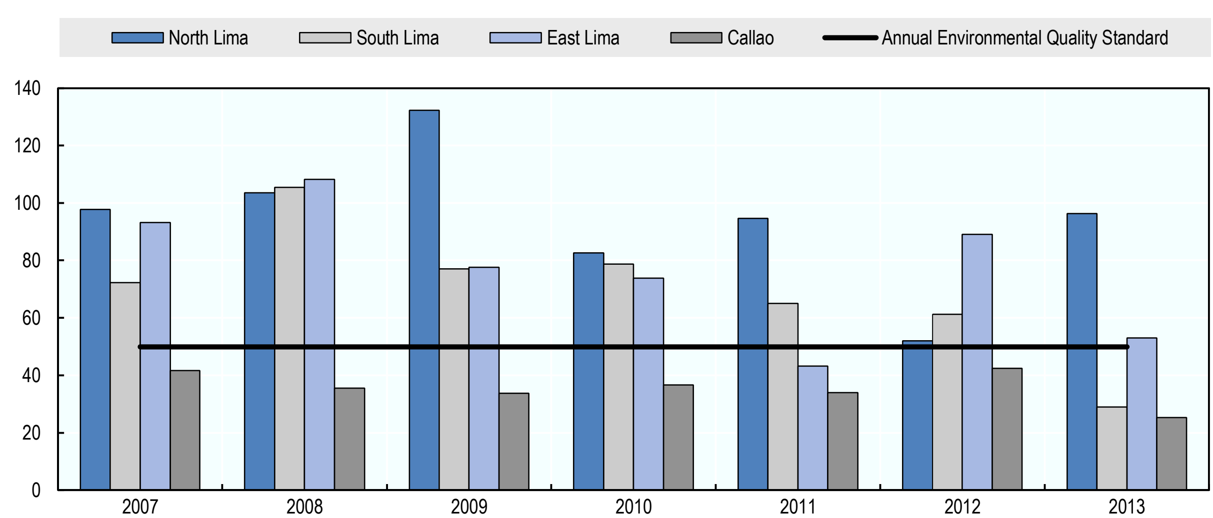
Over the years 2003-2012, the automotive fleet grew from 50 to 71 vehicles per 1 000 inhabitants. The departments of Lima-Callao and Tacna stand out in particular, with 135 vehicles per 1 000 inhabitants in 2012 (MINAM, 2014a).

Estimates for the country show that, over the period 2003-2012, particulate matter emissions rose by 14%, reaching 77 500 tonnes. Nitrogen oxide emissions were up as well, by 72% to 114 600 tonnes. By contrast, sulphur dioxide emissions declined by 11%, to 45 700 tonnes (INEI, 2015).

In 2012, sulphur dioxide (SO_2) and coarse particulate matter (PM_{10}) emissions were the subject of monitoring exercises in 13 cities of the country, and monitoring was conducted in 15 cities in 2013. Lima and Callao have been systematically measuring various air quality parameters since the beginning of 2000: during the period 2007-2013 there was a decline in concentrations of PM_{10}, fine particulate matter ($PM_{2.5}$), SO_2 and nitrogen dioxide (NO_2) (MINAM, 2014a).

Figure 1.5. Peru: average concentration of particulate matter (PM_{10}) in the Lima Metropolitan Area

(micrograms per cubic metre)



Note: Annual Environmental Quality Standard value of 50 micrograms per cubic metre (ug/m^3), established in D.S. Nº 074-2001-PCM. PM_{10} has been monitored since July 2007.
Source: ECLAC calculations on the basis of National Institute of Statistics and Informatics (INEI).

3.2. Water supply and sanitation

In 2013, the proportion of the population using improved sources of drinking water in Peru was estimated at 86%, up from 81% in 2003. The urban coverage rate was 91%, and in rural areas it was around 67%. The proportion of the population using improved sanitation facilities rose from 66% in 2003 to 75% currently (urban 81% and rural 50%).[2]

In terms of households with access to basic services, 83.2% had access to water via the public network and 77.8% had access to improved sanitation services in 2013 (INEI, 2013).

Although access to water has increased in Peru, in many cases the service is not continuous. Lack of access to water is primarily a problem in the central and north-eastern regions of the country. The regions with the greatest percentage of dwellings without water access are Huancavelica (59.9%) followed by Pasco (55.2%), Huánuco (52.5%), Amazonas (48.3%) and Loreto (42.4%). Intermittent service for less than six hours a day is frequent in coastal regions, such as Ica, La Libertad and Ancash.

It is important to note that the percentage of unbilled water exceeded 40% in 2008, due primarily to leaks and apparent losses explained by clandestine withdrawals, inactive connections and faulty metering (Rojas-Ortuste, 2010).

The Ministry of Environment (MINAM, 2014a) reports that in 2012, 32% of wastewater was being treated in the country as a whole, up from 21% in 2003. There is still significant room for improvement, as there is as yet no treatment of wastewater in the departments of Amazonas, Apurimac, Huancalevica, Huánuco, Loreto, Madre de Dios, Pasco, San Martín and Ucayali.

Water quality is monitored in 98 of the country's 159 hydrographic basins. However, more than 40% (41 of 98) of the basins monitored do not meet environmental quality standards (ANA, 2015). The main factors behind the decline in water quality are the lack of wastewater treatment, industrial and mining pollution, and the use of agrochemicals.

Available information shows that over the period 2003-2013 the environmental quality of coastal waters declined to varying degrees, depending on the zone. In particular, high concentrations of pollutants associated with industrial and domestic discharges have been detected in the bays of Huacho, Callao, Chancay and Chimbote, among others. Callao and Chimbote have total and thermotolerant coliform counts in excess of the country's quality standards.

3.3. Health impacts

During the period 2003-2013, the number of children aged under 5 years suffering from acute diarrhoeal disease dropped from 693 000 to 225 000. The departments that currently have the greatest numbers of affected children are Lima (13% of all cases), Cajamarca (11%), Cusco (8%) and Loreto (8%). In per capita terms, the incidences are highest in the departments of Amazonas, Loreto, Cajamarca, San Martín and Cusco (INEI, 2015).

There is still a persistent risk of contracting acute diarrhoeal diseases among the school-age population: in 2013, 13.7% of urban education institutions and 56.1% of rural schools were not connected to the public drinking water network (Ministry of Education, 2013).

The number of children aged under 5 years being treated for acute respiratory infections declined by 32% over the period of analysis, from 3.5 million to 2.4 million (INEI, 2015).

Available information shows that acute respiratory diseases in Lima and Callao declined during the years 2008-2012 from 142 to 102 cases for every 10 000 inhabitants, reflecting the reduction in the concentrations of particulate matter measuring less than 10 micrograms (µm). Nevertheless, there are episodes that exceed the environmental quality standards for PM_{10} and $PM_{2.5}$ (MINAM, 2014a).

During 2012, there were 1 252 cases of heavy-metal poisoning identified, the majority of them in the departments of Junin and Pasco. Such cases are associated for the most part with lead and its compounds (MINAM, 2014a).

Emissions and releases of mercury from artisanal and small-scale mining are a matter of great national concern.

Because of its geographical characteristics, Peru is particularly vulnerable to climate change and to the risk of natural disasters. According to information from the International Disaster Database (EM-DAT), the extreme natural events and disasters that have had the greatest impact on the Peruvian population are those associated with earthquakes, flash flooding and extreme temperatures. During the years 2003-2013, at least seven major earthquakes were recorded, affecting a total of more than 675 000 people. In climatological terms, more than 2.3 million people were affected by flooding (18 events) and nearly 5.2 million by extreme temperatures (9 events).

Among other natural phenomena there has been an increase in frost emergencies, which rose from 73 in 2003 to 413 in 2013 (INEI, 2015). The population affected by this phenomenon varied from 25 708 in 2003 to 280 930 in 2013. The people hit hardest were those living in the high Andes.

4. Use of the natural resources base

4.1. Biodiversity and ecosystems

Peru is ranked among the 17 mega-diverse countries. However, pressures on ecosystems are such that the country has 492 species of fauna and 777 species of flora that are listed as threatened, of which 64 and 194, respectively, are in critical danger (MINAM, 2014c). The registry of threatened species of fauna dates from the year 2014 (Supreme Decree 004-2014 of the Ministry of Agriculture), while that for threatened species of flora was initiated in 2006 (Supreme Decree 43-2006-AG).

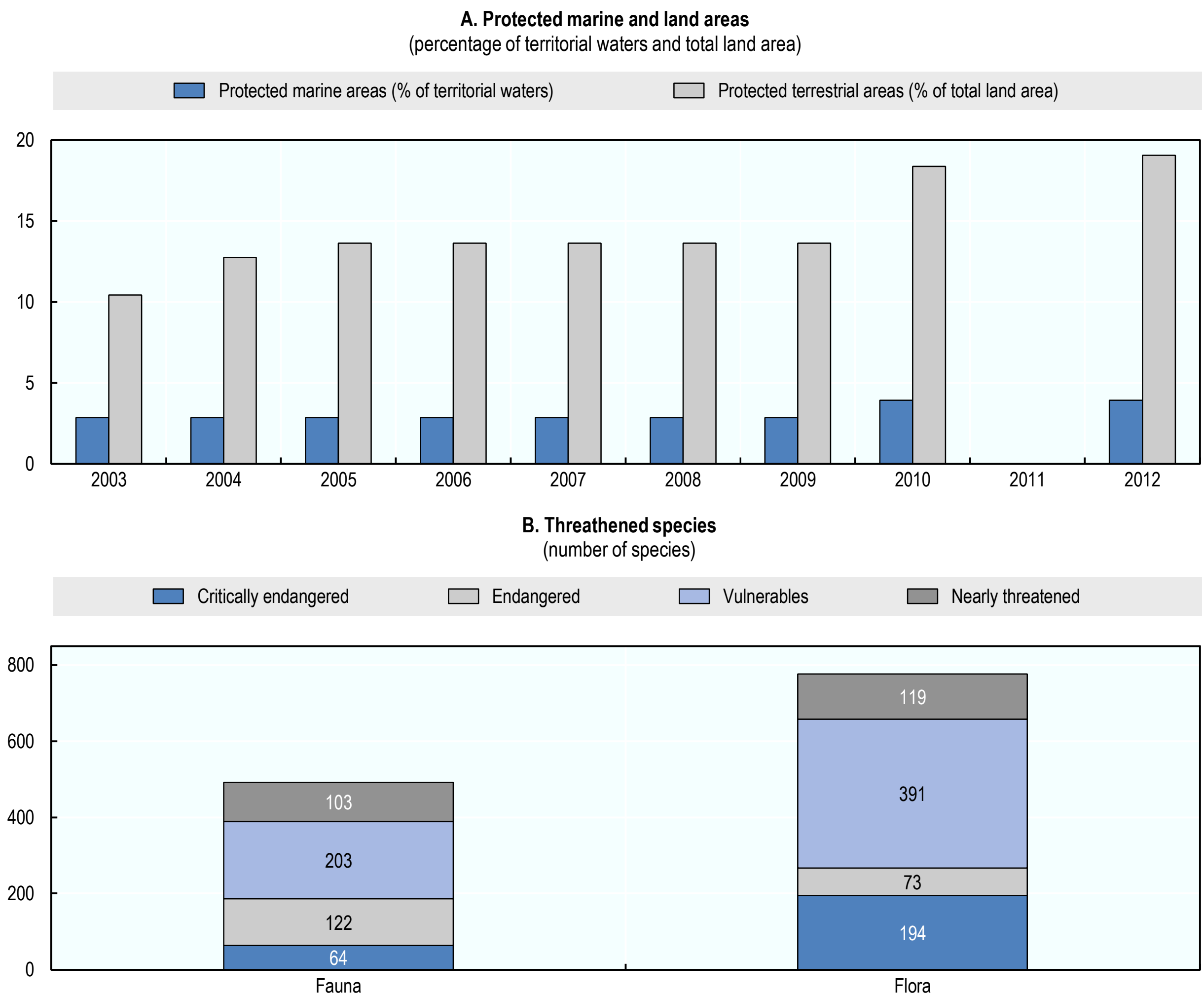
In 2012, protected land and marine areas represented 18.3% of the national territory, a figure slightly lower than the average for Latin America and the Caribbean (20.8%), but higher than the OECD average (13.6%). The period 2003-2012 saw these areas expand by 82%, a rate higher than that recorded for the region and for OECD countries (World Development Indicators based on United Nations Environment Programme and the World Conservation Monitoring Centre).

A disaggregation by type reveals that protected land areas currently constitute 19.1% of the national territory, while protected marine areas cover only 3.9% of territorial waters, far below the average for the region and for countries of the OECD (World Development Indicators based on United Nations Environment Programme and the World Conservation Monitoring Centre).

The National System of Protected Natural Areas (SINANPE) has experienced steady growth: the number of protected natural areas under national administration rose from 40 in 2003 to 64 in 2015.

Peru has demonstrated its commitment to achieving the Aichi Biodiversity Targets by establishing a correlation between its National Biological Diversity Strategy to 2021 (MINAM, 2014c) and the goals of the Convention on Biological Diversity, which it expects to meet by 2021.

Figure 1.6. Peru: protected areas and threatened species



Source: ECLAC calculations on the basis of the United Nations Environment Programme (UNEP); World Conservation Monitoring Centre (WCMC) and Ministry of the Environment (MINAM), *Estrategia Nacional de Diversidad Biológica al 2021. Plan de Acción 2014-2018*, Lima, 2014.

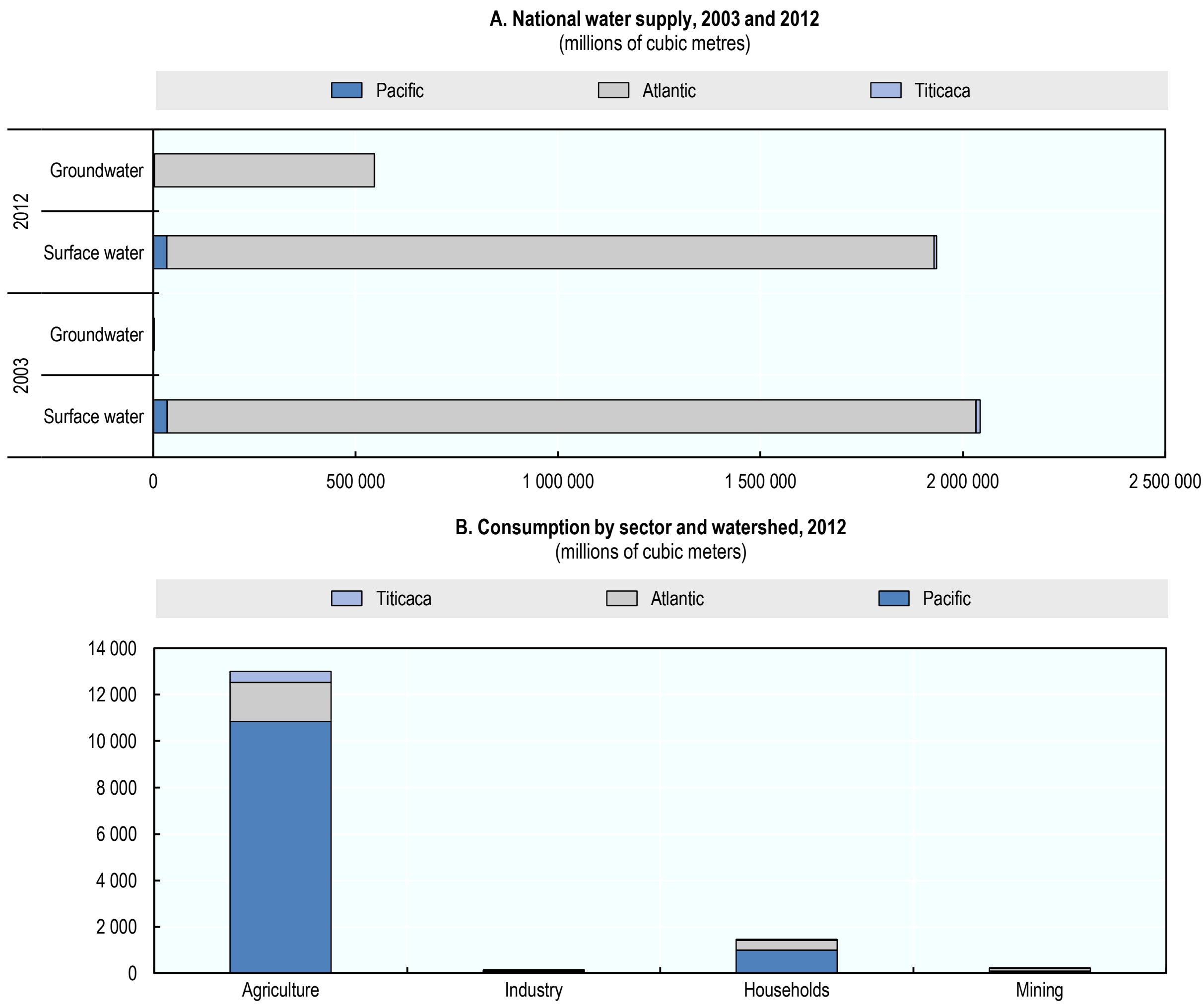
4.2. Renewable resources

Water resources

Peru's water supply amounted to 2 482.3 billion cubic metres (m^3) in 2012, placing it among the countries with the greatest water availability (INEI, 2015).

The water supply is distributed unevenly across the country: 98.2% of the volume corresponds to the Atlantic (or Amazonian) watershed, the Pacific watershed contains 1.5% and the Titicaca basin the remaining 0.3% (INEI, 2015). This distribution, together with seasonal variation, produces a high degree of aridity in the southern portion of the Pacific watershed, with moderate stress in the northern Pacific, and an abundance of water in the Atlantic watershed.

Figure 1.7. Peru: water resources



Source: ECLAC calculations on the basis of National Institute of Statistics and Informatics (INEI).

The three watersheds supply both surface water and groundwater. In 2012, more than 22% of the water supply from the Atlantic watershed was derived from underground sources, while the equivalent figures for the Titicaca and Pacific basins were 9% and 8%, respectively.

Over the period 2003-2012, the water supply expanded by 21%, from 2 046 billion m^3 to 2 482 billion m^3. During this time there was an appreciable increase in the groundwater supply, from 2 739 million m^3 to 546 730 million m^3.

An analysis of the hydric balance by watershed shows that: (i) the Pacific watershed presents a generalised water deficit, due primarily to the fact that most of the precipitation in the region takes place in the upper part of the catchment area; (ii) the Lake Titicaca watershed shows surface water availability, except during occasional dry years; and (iii) the Atlantic watershed shows a significant water surplus, owing primarily to the level of precipitation. Nevertheless, deforestation in this last zone could cause changes in the water cycle variables (UNESCO, 2006).

Because of the water deficit and the fact that 63% of the country's population lives in the Pacific watershed, this is the zone that is experiencing the greatest pressures on water availability.

According to information from the Food and Agriculture Organization of the United Nations (FAO, n/d), in 2013 the per capita domestic availability of fresh water amounted to 53 688 m^3. This figure far exceeds average water availability in Latin America and the Caribbean (22 615 m^3 per capita) and in the OECD (8 286 m^3 per capita).

In terms of water use, agriculture is the largest consumer, accounting for 87.7% of the total, followed by demand for human consumption (9.9%), the mining industry (1.5%) and manufacturing (0.9%). For uses other than consumption, the principal demand comes from the energy sector (99.1%) (MINAM, 2014a).

Forest resources

According to a 2009 map of Peru's vegetation cover, the forested area amounts to 74.2 million hectares. Of this total, 69.9 million hectares corresponds to humid Amazonian forests, 4.1 million hectares to dry forests, and 211 000 hectares to Andean forests (MINAM, 2014a).

According to FAO information, the land covered by forests represented 52.9% of the national territory in 2012. This figure is greater than the averages for Latin America and the Caribbean (46.9%) and the OECD (30.5%) (World Bank, n/d).

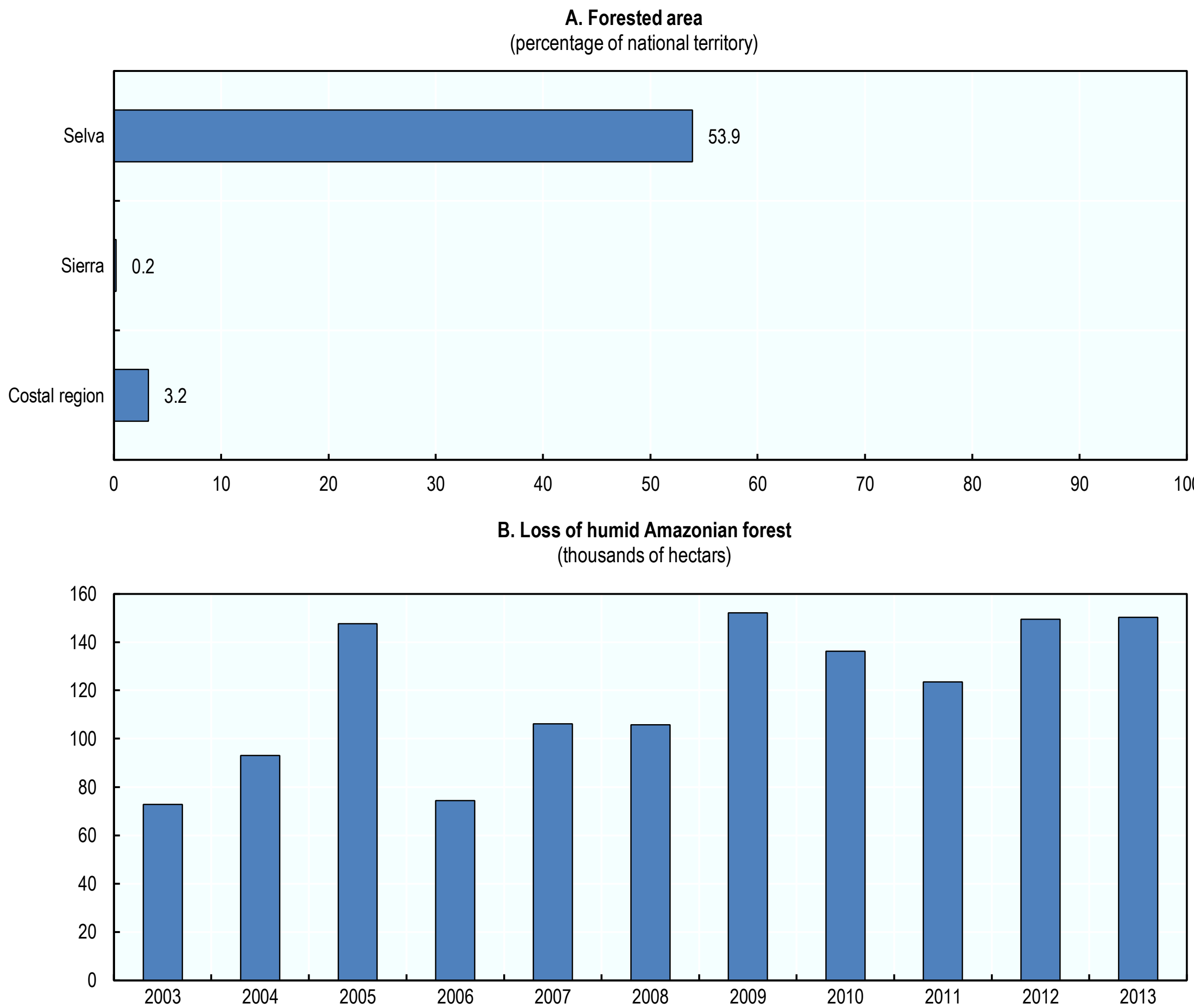
During the period 2003-2012, the forested area declined by 1.86%, according to the World Development Indicators (on the basis of FAO data). According to the National Forest Conservation Programme of the Ministry of the Environment, deforestation in the country's humid Amazonian forest amounted to an annual average of 113 056 hectares between 2000 and 2013.

The Amazonian region is the most affected by deforestation, caused by changes in land use brought about by small-scale farmers in search of larger areas for agriculture and livestock raising. The departments with the greatest cumulative loss of forest cover in the period 2000-2011 were San Martín (277 333 hectares), Loreto (219 671 hectares) and Ucayali (177 630 hectares) (MINAM, 2014a).

The activities that exert the greatest pressure on forest conservation are related to agro-industry, export agriculture, and livestock raising. There is also a significant impact, however, from illicit narcotics cultivation, deforestation due to the lumber industry (both legal and illegal), the opening or improvement of highways and various forms of exploitation of tropical forests (MINAM, 2014a).

The greatest level of deforestation has occurred in forests that do not correspond to any official category, and which therefore have no authority responsible for their administration or care (National Forest Conservation Programme). Unclassified zones in fact accounted for the majority of total cumulative losses of forest cover between 2000 and 2011 (MINAM, 2014a).

Figure 1.8. Peru: forested area and deforestation in the Amazonian zone, 2003-2013



Note: On the basis of the 2007 National Census.
Source: ECLAC calculations on the basis of MINAM (2015).

Fishery resources

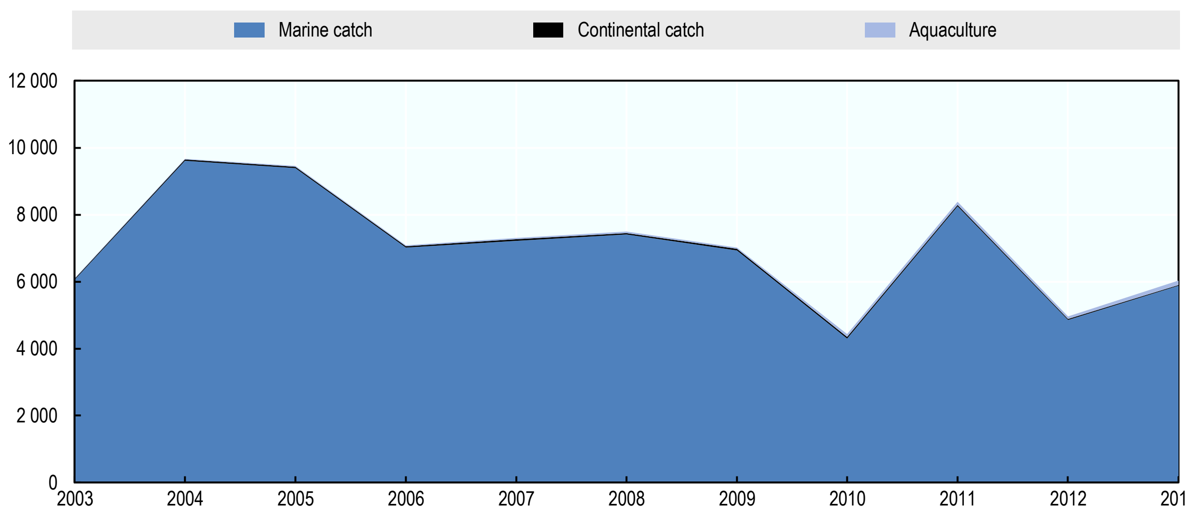
The seas off the Peruvian coast are highly productive, thanks to the complex set of currents that give rise to a recirculation system that cools the waters and boosts their nutrient content, thus increasing the availability of food for fish and invertebrates (Tam et al., 2008). However, this ecosystem is subject to major periodic disturbances caused by the El Niño phenomenon.

In 2003, Peru was the world's third-largest fish producer, accounting for 6.3% of the world catch, after China (17.6%) and Indonesia (6.6%). Its catches have since declined, with a cumulative reduction to 2013 of 3.5%, from 6 061 000 tonnes to 5 849 000 tonnes (FAO online statistics). Peru has the world's largest fishery based on a single species, the anchovy (FAO, 2007). The anchovy catch has been shrinking, however, leading to reduced exports of fish meal and fish oil. Peru is much less engaged in aquaculture, accounting for only 0.2% of global aquaculture production (FAO online statistics).

The greatest pressures on the coastal marine ecosystem have been identified as stemming from the growing percentage of industry and population concentrated along the Peruvian coast, which leads to over-exploitation of marine resources and changes in the quality and properties of marine and terrestrial waters. The situation is exacerbated by inadequate infrastructure for the unloading and preservation of catches, and a deficient marketing system that tends to pollute marine and coastal surface waters. Other sources of pressure on fishery resources include the introduction of exotic species, as well as by-catch and illegal fishing (undeclared and unregulated), where fishing methods are inappropriate and unsustainable (MINAM, 2014a).

Figure 1.9. Peru: fisheries production, 2003-2013

(Thousands of tonnes)



Source: ECLAC calculations on the basis of Food and Agriculture Organization of the United Nations (FAO).

4.3. Non-renewable resources

Fossil fuels

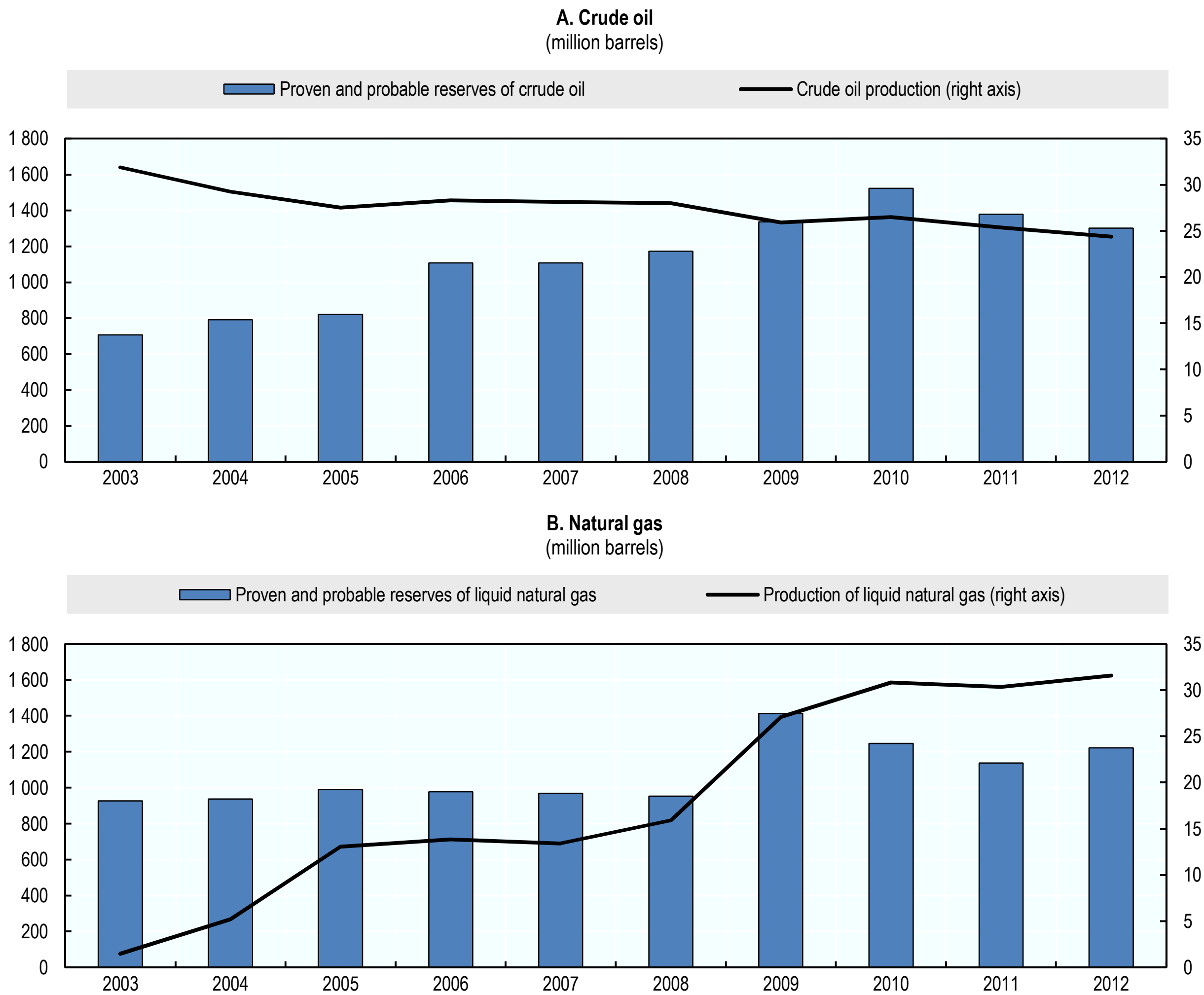
In 2012, proven reserves of crude oil amounted to 632.9 million barrels, distributed geographically among the Selva (43%), the Costa Norte (37%) and the Zócalo (21%). Liquid natural gas reserves were 789.8 million barrels, and were found almost exclusively in the Selva zone (98%) (INEI online statistics).

Production of liquid hydrocarbons reached 56 million barrels in 2012. There were some significant changes in the composition of production during the period 2003-2012. In 2003, 96% of hydrocarbon output corresponded to crude oil: this share fell to 44% in 2012, owing to the considerable increase in liquid natural gas.

During the period 2003-2012, hydrocarbon output recorded a cumulative increase of 68%, led by the sharp jump in the production of liquid natural gas (which went up by 2 049%), while oil production dropped by 23%.

During the period 2003-2011, the value of hydrocarbon exports rose by 658%, from USD 621 million to USD 4.704 billion. In 2011, exports of oil and derivatives represented 7.4%, and natural gas exports 2.8%, of the country's total exports by value.

Figure 1.10. Peru: hydrocarbon reserves and production, 2003-2012



Source: ECLAC calculations on the basis of Ministry of Energy and Mines (MINEM), 2015.

Metal mining

Peru has large reserves of numerous metallic ores. In 2011, proven and probable ore reserves included 69 890 000 metric fine tonnes (MFT) of copper; 60 362 000 fine ounces of gold; 24 103 000 MFT of zinc; 2 790 345 000 fine ounces of silver; 7 494 000 MFT of lead; 1 082 423 000 MFT of iron; and 91 000 MFT of tin (INEI online statistics).

In 2013, copper production was nearly 1.4 million MFT; zinc, 1.4 million MFT; gold, 5.0 million fine ounces; silver, 116 million fine ounces; lead, 266 000 MFT; iron, 6.7 million MFT; tin, 24 000 MFT; and the molybdenum, 18 000 MFT (MINEM, 2014).

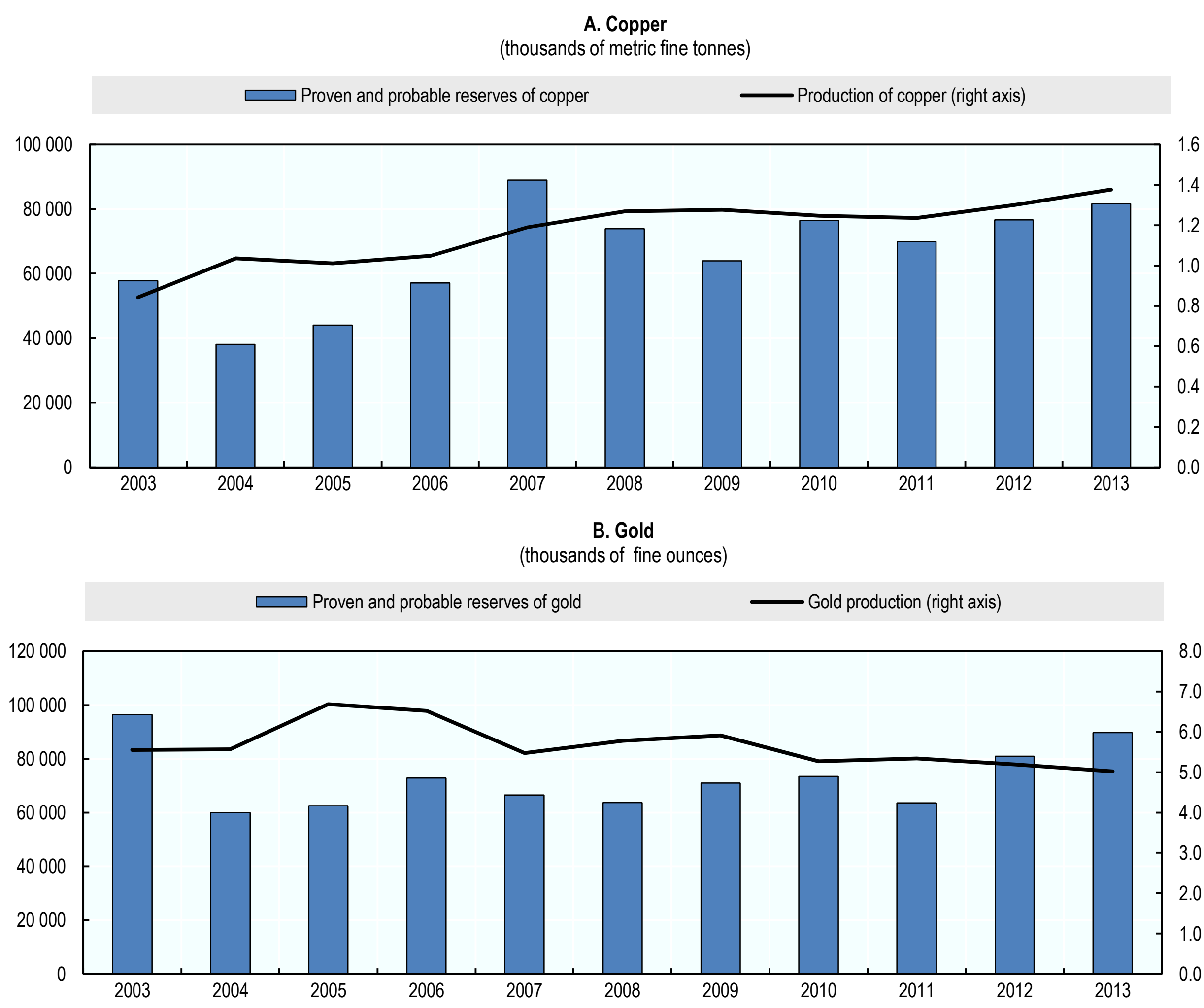
The volume of metallic ore production over the period 2003-2012 reveals significant cumulative growth for several metals: iron 92%, molybdenum 75%, copper 54%, and silver 19%. By contrast, there were declines in the volume of production of other metals: tin -35%, lead -19%, zinc -7%, and gold -6% (INEI online statistics).

The principal mining regions include Ancash (copper, silver and zinc), Arequipa (copper), Cajamarca (gold), La Libertad (gold) and Pasco (silver, lead and zinc) (MINEM, 2014).

In 2011, metallic ore exports accounted for more than 59% of the country's total export value. The main metallic exports are copper (23.2% of total export value), followed by gold (21.8%), lead (5.2%), zinc (3.3%) and iron (2.2%) (INEI online statistics).

Around 15% of the national territory is covered by mining rights, and 63.6% of the territory is in areas that are closed to mining activity (MINEM, 2014). Nevertheless, there is still a wide margin for further expansion of the area under mining concessions.

Figure 1.11. Peru: copper and gold reserves and production, 2003-2013



Source: ECLAC calculations on the basis of Ministry of Energy and Mines (MINEM), 2015.

Notes

1. See Economic Commission for Latin America and the Caribbean (ECLAC), CEPALSTAT database.
2. The statistics come from the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) Joint Monitoring Programme for Water Supply and Sanitation [online] http://www.wssinfo.org/.

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Chapter 2. Policy-making environment

This chapter assesses progress in environmental governance over the last decade. It provides an overview of the institutional framework for environmental management, touching upon horizontal and vertical co-ordination mechanisms. It discusses land use planning and examines Peru's innovative approach to environmental licensing. Finally, it discusses enforcement of environmental law and the provision of environmental information.

Key findings and recommendations

Significant progress has been made in the legal and institutional framework for environmental policy in Peru in the period under evaluation. That progress has occurred in two main directions: (i) the bulk of environmental responsibilities, which had been in the hands of sector authorities, were transferred to a new environmental institution, the Ministry of the Environment, created in 2008; and (ii) as part of the decentralisation process, environmental responsibilities were transferred from the national government to subnational and local authorities. The effect of these reforms has been to modernise environmental policy and bring about a better balance between Peru's sustainable development objectives and its sectoral and territorial aspirations.

As part of this process, Peru has created a number of new technical agencies specialised in environmental issues. These include the National Water Authority (ANA), the Agency for Supervision of Forest Resources and Wildlife (OSINFOR), the National Forestry and Wildlife Service (SERFOR), the National Service for State-Protected Natural Areas (SERNANP), the National Service of Environmental Certification for Sustainable Investments (SENACE), and the National Institute for Research on Glaciers and Mountain Ecosystems (INAIGEM). At the same time, the Ministry of the Environment has significantly strengthened its policies and institutional arrangements for coping with climate change.

In the framework of the decentralisation process, the sector authorities have transferred their environmental and land-use planning functions to the regional and local governments. The Ministry of the Environment co-ordinates with these bodies, primarily through the Regional and Municipal Environmental Commissions, which serve as a forum for dialogue and co-ordination among State entities and civil society for addressing environmental issues of regional or municipal concern. The assumption of responsibilities by subnational and local bodies has yielded uneven results, depending on regional and local capacities and resources. Some regional governments have been very pro-active in developing environmental and territorial governance tools, while others have achieved rather poor outcomes. For this reason, it is essential to foster a better territorial balance by supporting those regional governments most in need of strengthening in their technical and financing capacities.

In the context of transferring environmental responsibilities from sector authorities, two important institutions have been created in key areas of environmental management: SENACE is the environmental certification agency, combining the granting of environmental permits with environmental assessments, while the Environmental Assessment and Enforcement Agency (OEFA) conducts environmental audit and enforcement activities.

There are three types of environmental assessment, depending on the impact of investment projects: the Environmental Impact Statement (DIA), the Semi-detailed Environmental Impact Study (EIAsd), and the Detailed Environmental Impact Study (EIAd). In each case there are legally determined time limits for completing the assessment process. SENACE was created in December 2012 and, as an integral part of its mandate, it evaluates the environmental impact of larger-scale projects, i.e. those that require an EIAd. The transfer of assessment functions from the sector authorities is still a work in progress. In this transition stage it is very important to carry over technical know-how, good practices and lessons learned from the institutions previously responsible for this area.

This institutional change, as a result of which environmental certification is now handled at a single window, encourages intersectoral co-ordination. Nevertheless, the expedited processing of environmental certification to promote investment and economic growth must not be allowed to jeopardise the objective of environmental protection pursued by the environmental impact assessment system. Environmental certification time limits, participatory processes for environmental assessments, and amendments to environmental impact assessments should all be the subject of detailed examination, taking into account the objectives of green growth as well as the outcomes of the assessments under way.

In recent years, Peru has made a significant effort to strengthen environmental enforcement through OEFA, the lead agency in the National Environmental Assessment and Oversight System (SINEFA), whose purpose is to enforce environmental legislation. OEFA supervises compliance with environmental regulations directly in four sectors: (i) medium- and large-scale mining, (ii) hydrocarbons and electricity, (iii) commercial fisheries and large-scale aquaculture, and (iv) the brewery, papermaking, cement and tannery industries. It also supervises the 12 environmental enforcement entities of national scope, the 25 entities of the regional governments and the local entities (1 838 provincial and district municipalities). The environmental enforcement budget rose from USD 16 million in 2012 to USD 71 million in 2015. This has allowed OEFA to significantly increase direct auditing of firms in the four sectors under its responsibility, as well as supervision of the other environmental enforcement entities. The maximum level of fines for non-compliance has also been increased threefold.

Official government policies include a commitment to promote a strategic, integrated, effective and efficient process of land-use planning and management which will ensure human development and the sustainable use of the territory. Many references to territorial governance of a political, legal and technical nature are rooted in the Constitution itself and in the 2002 constitutional reform that paved the way for decentralisation.

Land-use planning makes use of tools such as Ecological and Economic Zoning (ZEE), a technical tool for characterising territories, in particular their physical and biological aspects, and Specialized Studies (EE), which can identify and analyse social and economic dynamics, changes in land use and population. The integration of ZEE with EE constitutes an Integrated Diagnostic Territorial Assessment (DIT). This chain of technical instruments has been planned with a view to preparing Land-use Plans (POT) that will identify the potentials and limitations of a territory and its natural resources.

Yet there are a great many legal provisions relating to land-use planning, which apply to different fields and overlap, making it difficult to understand their legal scope and force. Those legal rules include the Bases for Decentralisation Law, the Organic Laws for Regional Governments and Municipalities, the General Environment Act, the regulations to the framework law on the national environmental management system, as well as provisions governing domestic and foreign investments. With respect to policies, there is the National Environmental Policy, the Policy Guidelines for Land-use Planning and the Proposed National Strategy for Ecological-Economic Zoning. There are also guidelines of a technical nature.

Among the issues concerning effective application of land-use planning are: (i) legal dispersion, which creates uncertainty as to the true legal scope of the Land-use Plans, especially when they are seen as obstacles to investment projects; (ii) the leadership of the environmental authority has been key in driving the processes, but there needs to be closer articulation with other areas of the national government and with subnational and local bodies, as development planning processes go well beyond the environmental perspective; and (iii) problems with the delimitation of responsibilities and co-ordination between the national government and the subnational and local authorities. There has been significant progress: 13 of the 24 regions and the Province of Callao have already approved their ZEE. Nevertheless, there is a need to define clearly a national land-use planning strategy and to devise a law which will integrate many of the issues that today seem dispersed, which will clarify its legal force vis-à-vis other government policies, with broad institutional backing, and which will allow articulation both among sectors and with the subnational governments.

Some of the most pressing environmental problems, such as deforestation (between 2003 and 2013 some 1.3 million hectares were lost in Amazonia) and land degradation, are directly related to the lack of formalised ownership of the land. This lack of legal certainty increases the likelihood of predatory behaviour in search of immediate profits, eschewing long-term investments that would boost productivity while conserving natural capital. It is also a source of disputes and occasionally of violence.

According to the Peruvian Agricultural Census, in 2012 there were around 1 million farmers (45% of the total), 1 000 indigenous communities and 800 rural communities without land title. The Sierra and Selva regions are home to the majority of farmers in this situation.

The process of formalising land ownership has seen some important institutional changes since 1991, including the creation of an umbrella institution associating the Special Project for Land Title (PETT) and the National Superintendency of Public Registries (SUNARP). Responsibilities for issuing land titles were shifted to the Ministry of Housing (2007) and subsequently to the local governments (2010), prior to creation (in 2014) of the Directorate for Rationalization of Agrarian Property and Rural Land Registry (DSPACR) within the Ministry of Agriculture. At the present time the third stage of the project Cadastre, Titling and Registration of Rural Lands in Peru is under way, with the objective of enhancing rural landholding security in the Selva and in targeted zones of the Sierra.

The Ministry of the Environment is the body responsible for administering the National Environmental Information System (SINIA). SINIA embraces the regional and the local environmental information systems (SIAR and SIAL, respectively), administered by the respective government bodies at the regional and local levels. The legal standards provide that public institutions that generate information at the national, regional and local levels must provide the Ministry of the Environment with information that is relevant for SINIA. Other agencies also contribute to SINIA: these include the National Water Authority, which is responsible for the National System of Information on Water Resources (SNIRG) and the National Meteorology and Hydrology Service (SENAMHI), responsible for hydrometeorological information. The creation of the National Institute for Research on Glaciers and Mountain Ecosystems (IANIGEM) has been an important step, considering the strategic nature of these natural features in the context of climate change. Furthermore, data from OEFA are interoperable with SINIA. Peru has begun to implement the Pollutant Release and Transfer Register (PRTR) and is developing a national system, known as INFOCARBONO, to prepare greenhouse gas inventories. Information from SINIA is used to prepare an annual report on environmental figures, entitled *Cifras Ambientales*, covering a number of environmental variables, and the Peruvian government publishes a national report on the state of the environment every two years.

There are still however some major information gaps which hinder policy design and implementation. An example is the system for monitoring air quality in zones where there are atmospheric pollution problems. There is also plenty of room for greater collaboration with the sectoral spheres, which generate useful information from the environmental viewpoint and which could play a more active role in supplying information to SINIA.

Access to environmental information is guaranteed by the Law on Transparency and Access to Public Information, established in 2003 and binding on all public institutions. At the regional and local levels, with support from the Ministry of the Environment, efforts are under way to create and implement regional environmental information systems (SIARs) and local environmental information systems (SIALs). At the end of 2013, a total of 21 regional governments (out of 24 plus the Constitutional Province of Callao) had begun to implement regional environmental information systems, although only 25 local governments (out of around 2 000) had taken steps to implement their local environmental information systems. Despite the existence information transparency mechanisms, the district and provincial municipalities have implemented very few measures to ensure transparency and access to public information. According to a report published by the Office of the Ombudsman, more than half (55%) of complaints filed against municipalities refer to lack of transparency in information.

Recommendations

- On the basis of the existing mandates and legal obligations, implement the horizontal and vertical institutional co-ordination necessary to improve the country's environmental policy and management towards sustainable development, incorporating partial and sector-based perspectives. Strengthen the funding and technical capacities of subnational and local agencies with environmental responsibilities.
- Continue the process of strengthening and implementing the National Service of Environmental Certification for Sustainable Investments (SENACE) so it can facilitate efficient and independent environmental management through a one-stop window system and serve as a technical reference point for environmental impact assessment (EIA) studies. Ensure its financial sustainability (e.g. through licensing fees) and incorporate the technical know-how, best practices and lessons learned built up by the institutions that previously had responsibilities in that area.
- Consolidate and strengthen the oversight and control over activities that impact the environment and people's health and quality of life. Ensure the financial and operational sustainability of the Agency for Environmental Assessment and Enforcement (OEFA) and the National Environmental Assessment and Oversight Service (SINEFA), and improve their co-ordination with the public prosecution service and the judiciary.

- Continue with the Ministry of the Environment's efforts to pursue the processes of Ecological and Economic Zoning and Specialized Studies to direct them towards Integrated Diagnostic Territorial Assessments and Land-use Plans; enact a land-use planning law that consolidates the institutional framework and the existing instruments and integrate those processes to align the economic, sociocultural and environmental potential of territories with the use actually made of them. Complete the pending land-use planning processes and enforce the existing governance instruments. Ensure co-ordination with the watershed management plans of the National Water Authority.
- Step up efforts to rationalise the growth of cities through binding urban development master plans, preventing the illegal occupancy of areas of urban sprawl and ensuring co-ordination with transport planning at the local (urban traffic) and national (infrastructure) levels.
- Address the problems created by the informal sector, bearing in mind its impact on the ability to properly manage the conservation and protection of the environment and natural resources. Capitalise on the potential of activities related to the environment and the sustainable use of natural resources for job creation and increased formality.
- Continue strengthening the construction of the environmental information system and its use in public policy. Ensure the continuous, representative and mandatory reporting of basic environmental information with adequate and internationally standardised coverage (for example, records of pollutant emissions and transfers, levels of emissions and quality of media, biological indicators). Ensure the public's timely and transparent access to environmental information published in the public domain, in compliance with existing legislation.

1. Environmental management governance structure

Peru is a constitutional republic with a unitary and decentralised system of government (Box 2.1). The Ministry of the Environment is primarily responsible for drafting and implementing environmental policies, although other areas and levels of government are involved.

1.1. Background and environmental policy changes

The legal and institutional framework for Peru's environmental policy is rooted in the conservation and management of natural resources. The National Office for the Assessment of Natural Resources (ONERN) was created in the 1960s to foster agricultural development through investments in integrated watershed management, including erosion control and reforestation (World Bank, 2007). Major legal instruments of a sectoral nature were adopted in the 1970s, including the General Water Act and the Sanitary Code. In 1979, environmental considerations were included for the first time in the Constitution and the right to live in a healthy environment was recognised. The relevant provisions were ratified in the 1993 Constitution (Charpentier and Hidalgo, 1999), Chapter II (Title III, "The environment and natural resources") of which stipulates that natural resources, renewable and non-renewable, belong to the nation and that the State is sovereign in their exploitation and promotes their sustainable use. The Code on the Environment and Natural Resources entered into force in 1990, setting forth principles and criteria for environmental management, including the prevention and "polluter pays" principles. It also establishes the obligation to carry out environmental impact assessments.

The National Environment Council (CONAM) was set up in 1994, a decentralised body attached to the Office of the President of the Council of Ministers and the lead agency for environmental policy. CONAM is the product of the State's endeavours to create a body to co-ordinate environmental policymaking, although these policies were still the responsibility of sector institutions. The National Environmental Management System Framework Law (law No. 28 245 of 2004), adopted to ensure the effective achievement of the environmental goals of public entities, strengthened the institutional framework in this area and was consolidated in 2008 with the creation of the Ministry of the Environment. In the context of the decentralisation of environmental roles, this meant restructuring the relevant responsibilities without reducing those already assigned to regional and local governments.

During the period under consideration in this assessment, significant changes were made to the environmental legal and institutional framework. These changes had two main objectives: (i) to transfer the bulk of environmental responsibilities, including key sector audits and environmental assessments previously performed by sector authorities, to new environmental institutions; and (ii) to transfer environmental responsibilities from the central government to subnational and local authorities. The effect of these reforms has been to modernise environmental policy and to bring about a better balance between Peru's sustainable development objectives and its sectoral and territorial aspirations.

As part of this process, Peru has created a number of new technical agencies specialised in environmental issues. These include the National Service for State-Protected Natural Areas (SERNANP), the Environmental Assessment and Enforcement Agency (OEFA), the National Service of Environmental Certification for Sustainable Investments (SENACE) and the National Institute for Research on Glaciers and Mountain Ecosystems

(INAIGEM), all of which fall under the Ministry of the Environment. The Ministry of the Environment is also represented on the governing bodies of other new agencies under the Ministry of Agriculture and Irrigation, such as the National Water Authority (ANA) and the National Forest and Wildlife Management System (SINAFOR), which is overseen by the National Forestry and Wildlife Service (SERFOR). The Agency for Supervision of Forest Resources and Wildlife (OSINFOR), attached to the Office of the President of the Council of Ministers, also has important links with the Ministry of the Environment. Within the Ministry of the Environment, policymaking and efforts to develop institutions to tackle climate change have been strengthened considerably.

In addition, strategic environmental management instruments have been adopted at all three levels of government, including the State Policy on Environmental Management under the National Agreement (2002), the National Biological Diversity Strategy (2001), the National Climate Change Strategy (2003), the National Environmental Policy (2009) and the National Environmental Action Plan (PLANAA, 2011-2021) (2011).

In order to ensure the environmental and social sustainability of development, the Government of Peru adopted the strategic pillars of environmental management in 2012, which reflect national priorities and act as a framework to co-ordinate State involvement. The sector was strengthened by the adoption of the main guidelines of the 2013-2016 multi-year sectoral strategic plan (PESEM) and, in 2013, of the National Environmental Action Agenda, 2013-2014.

The decentralisation process, whereby sector authorities have transferred their environmental and land-use planning functions to regional and local governments, began in 2002 and has gone through different stages. The first stage, which ended in 2005, was to establish the institutional framework, but little progress was made on decentralisation. In the second phase, from 2006 to 2009, measures were taken to simplify procedures for transferring sectors' functions, but resource allocations for this phase were insufficient. Since 2010 and in a reversal of the process, there has been a growing trend towards centralisation, particularly in public spending and, within that, investment spending. The 2015 budget shows an 11% reduction in resources allocated to local governments for environmental activities, together with a 5% increase in resources for the central government (Peru, Congress, 2015).

In this context, the results of regional and local governments taking on environmental responsibilities have been very heterogeneous. Subnational authorities with greater technical and political capacities and greater resources, have developed environmental and land-use planning instruments. Meanwhile, the results of other regional and local governments are disappointing, so support should be given to those whose technical and financial capacities need to be strengthened. The Ministry of the Environment works with subnational authorities, primarily through the regional and municipal environmental commissions, which serve as a forum for dialogue and co-ordination among State entities and civil society for addressing environmental issues of regional and municipal concern. Important milestones in the policymaking process and the establishment of institutions responsible for managing various aspects of the environment are set out below (Table 2.1).

Table 2.1. Important milestones of environmental policy and institutions

Year	Milestone
1920*	Creation of the Geophysics Institute of Peru (IGP)
1969*	Creation of the National Meteorology and Hydrology Service (SENAMHI), responsible for several sectors (Ministries of Aeronautics, Agriculture, and Development and Public Works)
1981*	Creation of the Peruvian Amazon Research Institute (IIAP)
1990	Entry into force of the Code on the Environment and Natural Resources
1992	Signature of the United Nations Framework Convention on Climate Change (UNFCCC)
1993	Creation of the National Commission on Climate Change
1994	Ratification of International Labour Organization (ILO) Convention No. 169 concerning Indigenous and Tribal Peoples in Independent Countries, through legislative resolution No. 26253
	Creation of the National Environment Council (CONAM)
1996	Adoption of the first National Environmental Action Agenda (1997-1999)
2000	Adoption of the General Solid Waste Act
	Adoption of the law creating the National Environmental Impact Assessment System
2001	Submission of the first national communication on climate change
	Adoption of the first regulation on national air quality standards
	Creation of the National Commission for Environmental Land Management
	Adoption of the regulations to the Conservation and Sustainable Use of Biological Diversity Act
	Adoption of the first National Biological Diversity Strategy
2002	Adoption of the State Policy on Environmental Management under the National Agreement
	Entry into force of the Regional Governments Act
	Ratification of the Kyoto Protocol
Year	Milestone
2003	Adoption of the first National Climate Change Strategy
	Adoption of the regulations on ecological and economic zoning (ZEE)
	Adoption of environmental quality standards for noise
2004	Entry into force of law establishing the National Environmental Management System (law No. 28245)
	Adoption of the National Food Security Strategy 2004-2015.
2005	Entry into force of the General Environment Act (law No. 28611)
	Adoption of the environmental quality standards for non-ionising radiation
2007	Entry into force of the Energy Efficiency Act
2008*	Creation of the Ministry of the Environment (legislative decree No. 1013)
	Creation of the Environmental Assessment and Enforcement Agency (OEFA)
	Creation of the National Service for State-Protected Natural Areas (SERNANP), which prior to the creation of the Ministry of the Environment, fell under the jurisdiction of the Ministry of Agriculture through the National Institute for Natural Resources (INRENA)
	Adoption of the environmental quality standards for water
2009	Adoption of the agenda for scientific research on climate change
	Adoption of the National Environmental Policy
	Adoption of the Master Plan for Protected Natural Areas (ANP)
	Entry into force of the National Environmental Assessment and Oversight System Act (law No. 29325)
2010	Adoption of the Action Plan for Climate Change Adaptation and Mitigation (PAAMCC)
	Submission of the second national communication on climate change
2011	Adoption of the National Environment Action Plan, 2011-2021 (PLANAA)
	Entry into force of the Forestry and Wildlife Act (law No. 29763)
	Creation of the National System for Disaster Risk Management (SINAGERD) (law No. 29664)
2012*	Adoption of the strategic pillars of environmental management by the Council of Ministers, on the basis of the reportby the multisectoral committee created by supreme resolution No. 189-2012-PCM and responsible for

	preparing regulatory and policy proposals to improve the environmental and social conditions in which economic activities, particularly by extractive industries, are undertaken
	Creation of the National Service of Environmental Certification for Sustainable Investments (SENACE)
	Adoption of the National Environmental Education Policy
2013	Adoption of the 2013-2016 multi-year sectoral strategic plan (PESEM) for the environmental sector
	Adoption of rules formalising and prohibiting illegal mining
	Adoption of the regulations to the law establishing a 10-year ban on importing and producing living modified organisms in Peru
	Adoption of regulations for the management and handling of waste electrical and electronic equipment
	Adoption of the National Environmental Action Agenda 2013-2014
	Adoption of the first environmental quality standards for soil
	Entry into force of the Payment Mechanisms for Ecosystem Services Act (law No. 30215)
2014*	Creation of the National Institute for Research on Glaciers and Mountain Ecosystems (INAIGEM)
	Adoption of the National Environmental Action Agenda 2015-2016
	Adoption of the second National Biological Diversity Strategy
	Holding of the twentieth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change in Lima

Note: *Creation of bodies attached to the Ministry of the Environment.
Source: ECLAC's elaboration based on information provided by the Government of Peru.

Peru's legal and institutional systems are described below (Box 2.1).

Box 2.1. Peru's legal and institutional systems

The Government of Peru is unitary, representative and decentralised. It is rooted in the principle of the separation of powers and is composed of an executive, a legislative and a judicial branch, which are all autonomous and independent.

Executive power rests with the President, who acts as Head of State and symbolises and represents the country's permanent interests, and with the two Vice-Presidents. In his or her capacity as the Head of Government, the President is the driver of government policy and acts with the support of the representative of the political majority. The Council of Ministers and those Ministers whose portfolios cover certain areas are responsible for the oversight and management of public services.

Legislative power is exercised by Congress, composed of a single chamber that comprises 130 members elected by direct suffrage from multimember electoral districts, proportional to the population of each region. All congressional seats are contested every five years and the terms of office of the President and parliamentarians have the same duration.

The power to dispense justice emanates from the people and is administered by the judiciary through its constituent bodies, in accordance with the Constitution and laws. The Constitutional Court, responsible for overseeing compliance with the Constitution, is autonomous and independent, and is guided exclusively by its rulings and legislative provisions. This branch of the State is headed by the Supreme Court of Justice, which has jurisdiction over the whole country and is divided into judicial districts overseen by the Superior Courts of Justice. The justice system also comprises first instance courts, established in nearly all of the provinces. Justices of the peace are responsible for the administration of justice at the district level.

The National Judicial Council is an autonomous and independent body, responsible for the selection, appointment, confirmation and removal of judges and public prosecutors at all levels, except for those elected by popular vote, in which case the Council is only empowered to confer the title of judge upon them and remove them from office, when necessary, in accordance with the law. The Ombudsperson defends the constitutional and fundamental rights, of both individuals and communities, and ensures that public administration and public service officials perform their duties.

The Public Prosecutor's Office is an autonomous State body, whose main responsibilities are to defend the law, citizens' rights and the public interest, and to represent society at trial, by defending the family, minors and those declared to be incompetent, and the social interest, by safeguarding public decency, prosecuting crimes and obtaining civil redress. The Public Prosecutor's Office has created, inter alia, prosecutors' offices specialised in environmental matters, charged with preventing and investigating environmental crimes[1]. Their powers are largely preventive and refer in particular to the defence of the environment and natural resources, in accordance with the recognition that a healthy environment is a fundamental right. Their offices are at the headquarters of the judicial districts and are headed by a specialised provincial prosecutor. In 2016, there were 39 public prosecutors' offices specialised in environmental matters and 14 offices for the criminal prosecution of environmental crimes.

As specified in law No. 27 785, the Office of the Comptroller General is the technical body responsible for the National Oversight System, which has administrative, functional, economic and financial autonomy and is tasked with efficiently and effectively managing and supervising government oversight, by focusing efforts on promoting managerial transparency and institution-building; promoting the values and responsibilities of public officials and civil servants; supporting the branches of State in decision-making processes; and helping citizens to participate in a timely manner in social oversight.

The territory of Peru is divided into departments, provinces, districts and population centres. It is composed of 24 departments and two provinces with special status —the Constitutional Province of Callao and the Province of Lima— as well as 196 provinces, which as of mid 2016 were further divided into 1 874 districts. A process of regionalisation is currently underway supported by incentives, chiefly fiscal, with the aim of creating new regional entities by merging two or more departments, to be confirmed by binding referendums. Meanwhile, the administrative decentralisation process also affects the economic sphere, most notably in the transfer of mining tax revenues to regional and local governments, which has led to an increase in municipal and regional investments. The National Decentralization Council, established pursuant to the Decentralization Act, is an independent body attached to the Office of the President of the Council of Ministers, which is responsible for overseeing and guiding the process.

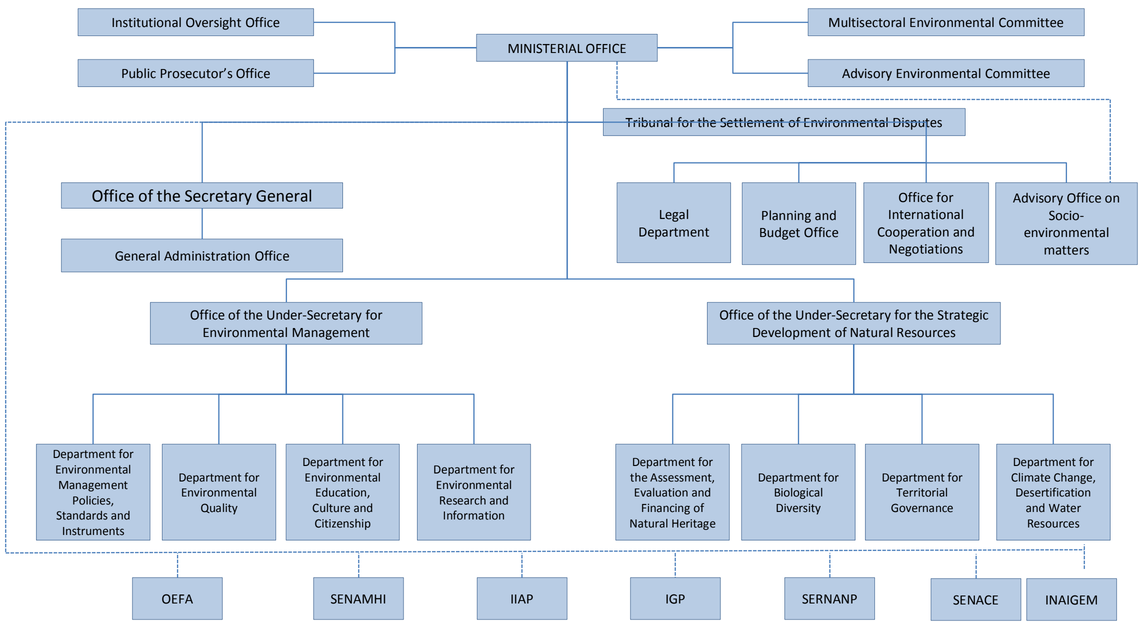
Note[1]*:* [Online] http://www.mpfn.gob.pe.
Source: Organization of American States (OAS), "Legal System of Peru", Hemispheric Information Exchange Network for Mutual Assistance in Criminal Matters and Extradition, 2009 [online] https://www.oas.org/juridico/mla/en/per/en_per-int-description.pdf.

1.2. Institutional framework

The Ministry of the Environment, created in 2008, is the lead agency for environmental management and, as such, is charged with formulating and implementing national policies on the environment and enforcing them. It also promotes the conservation and sustainable use of natural resources, biological diversity and protected natural areas, and carries out activities foreseen in national environmental regulations, which can be delegated to the relevant public bodies (Figure 2.1).

The national environmental policy (supreme decree No. 012-2009-MINAM) consists of four pillars. The first is the conservation and sustainable use of natural resources and biological diversity. The second (integrated environmental quality management) is linked to the "brown agenda", which includes objectives related to pollution, air quality, chemical substances and hazardous materials. The third pillar (environmental governance) provides policy guidelines on institutional frameworks and environmental culture, education and citizenship. Lastly, the fourth pillar (international environmental commitments and opportunities) addresses trade and competitiveness.

Figure 2.1. Organisation chart of the Ministry of the Environment, Peru



Source: Ministry of Environment (MINAM), "Organigrama y funcionarios", 2016 [online] http://www.minam.gob.pe/?el-ministerio=organigrama-equipo-funcionarios.

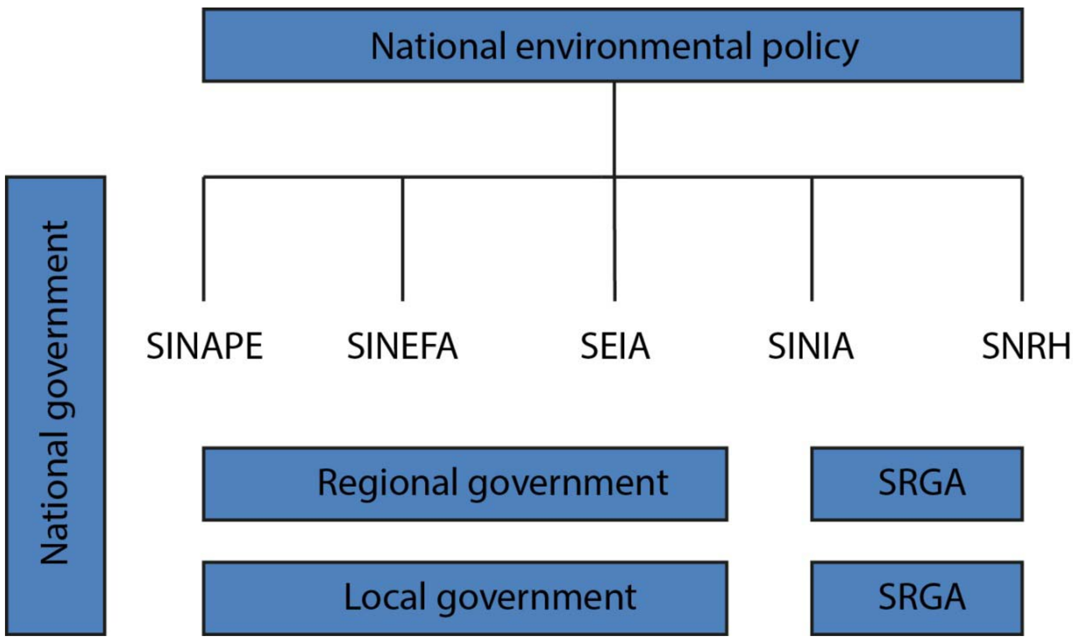
The National Environmental Management System (SNGA), headed by the Ministry of the Environment, brings together State institutions, bodies and offices of various ministries, decentralised public agencies and national, regional and local public entities responsible for matters related to the environment and natural resources, and regional and local environmental management systems. Both private sector and civil society entities can participate in the system (Figure 2.2).

The National Environmental Management System is composed of the National Environmental Impact Assessment System (SEIA), the National Environmental Information System (SINIA), the National System for State-Protected Natural Areas (SINANPE), the National Water Resources Management System (SNGRH) and the National Environmental Assessment and Oversight System (SINEFA). It is responsible for managing the natural resources in its area of specialisation, specifically biodiversity and climate change, and performs other environmental functions in accordance with the law.

The National Environmental Management System is made up of regional and local systems responsible for adapting environmental policy and standards to their jurisdictions. Related activities are carried out by the 25 regional governments of Peru and local governments, which are the environmental authority in their respective jurisdictions, and include the implementation of the regional government programme in the metropolitan area of Lima.

As part of the assessments of environmental policies and plans, a cost-benefit analysis is applied to regulations that have the force of law, general administrative regulations (supreme decrees), environmental management instruments (including, decontamination plans) and the methodology used to calculate environmental fines. When an economic value cannot be put on costs or benefits, they must be ranked in order of magnitude or importance.

Figure 2.2. National Mangement System



*Note:*SRGA stands for Regional Environmental Management System.
Source: Ministry of Environment (MINAM), Sistema Nacional de Gestión Ambiental, Lima, 2013.

Since 2005, plans and programmes have been the subject of strategic environmental assessments (EAE), considered to be policy instruments, at the development stage. A draft regulation on the matter is currently being processed for approval and some EAEs have been carried out in the areas of transport, energy, mining, tourism and other territorial-level sectors, but, at the time of writing, the Ministry of the Environment had not approved any of them.

In addition to the Ministry of the Environment, two important institutions have been created as part of the process of transferring environmental responsibilities from sector authorities: the National Service of Environmental Certification for Sustainable Investments (SENACE) and the Environmental Assessment and Enforcement Agency (OEFA).

Environmental assessments and oversight

Environmental impact assessments are one of the most important environmental policy instruments and are carried out for three types of projects. If the investment project is a category I project, the relevant authority must issue an environmental certification, by virtue of which the preliminary assessment is approved, which becomes an Environmental Impact Statement (DIA). This is the case for projects whose implementation would not cause significant negative environmental impacts. Other public investment projects may be classified as category II or III projects by the relevant authority, which then approves the terms of reference that will be considered when preparing a Semi-detailed or Detailed Environmental Impact Study (EIA). All assessments must be carried out within the legally determined time limits established for each category. Category II includes projects whose implementation may cause moderate environmental impacts and whose negative effects can be eliminated or minimised through easily applied measures. Category III refers to those projects that may cause significant quantitative or qualitative environmental damage. Between 2003 and 2014, 6 816 environmental studies were approved, 54% of which were environmental impact statements, 25% were detailed studies and the rest were semi-detailed studies (Table 2.2). Of those studies, 41% focused on the mining sector and 29% on the energy sector account. Assessments prior to 2003 were carried out by the relevant sector authorities.

Table 2.2. Number of environmental studies approved per year, 2003-2014

Type of study	Sector										Total
	Energy	Mining	Industry	Fishing	Housing	Defence	Tourism	Min. of Agriculture and Irrigation	Coast Guard Office	Min. of Transport and Communication	
Environmental impact statement	1 039	1 506	130	0	70	225	37	159	446	91	3 703
Semi-detailed environmental impact study	28	637	27	56	17	164	10	16	361	88	1 404
Detailed environmental impact study	911	682	0	0	0	0	0	85	0	31	1 709
Total	1 978	2 825	157	56	87	389	47	260	807	210	6 816

Source: MINAM (2015).

The National Service of Environmental Certification for Sustainable Investments (SENACE) is responsible for examining and approving the environmental impact studies for public, private and mixed capital investment projects that, due to their larger scale, must be the subject of a detailed environmental impact study. Before SENACE was created, sector authorities were responsible for carrying out these project assessments, which gave rise to conflicts of interest. That role is now being transferred following a predetermined timetable. As SENACE was set up in 2012, its performance cannot be assessed yet, although some observations on its operations are set out below.

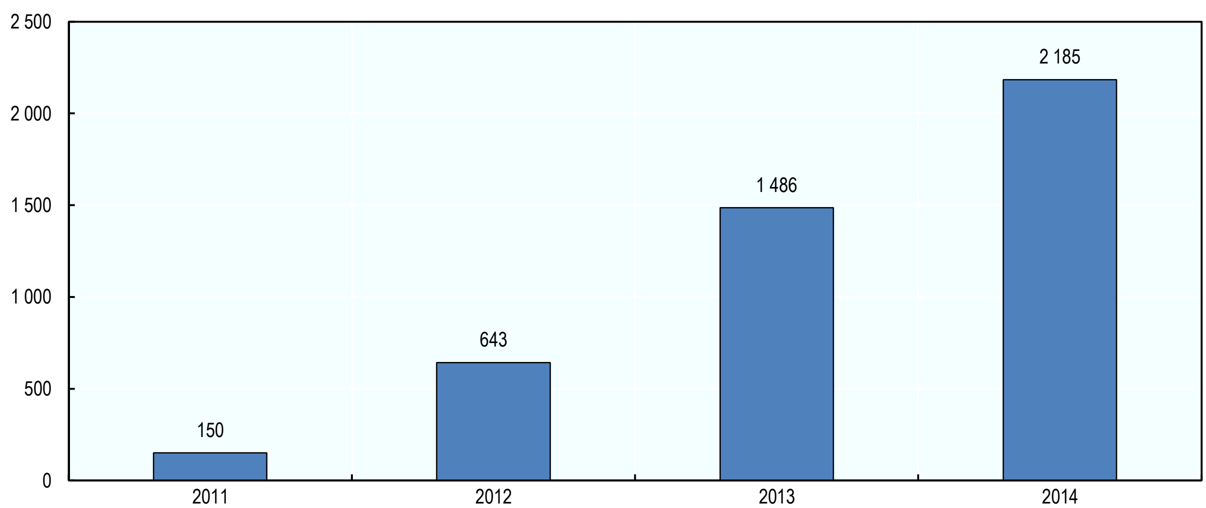
The environmental impact assessment system must provide technical and independent assessments of investment projects; it must be agile, equipped with the necessary means for making decisions in a reasonable time and must encourage active social participation. The environmental certification one-stop window service provided by SENACE complies with these requirements and boosts intersectoral co-ordination through its governing body, comprising the relevant ministries. In order for the system to work properly, it must have technical capacities and financial resources to meet the legal deadlines. As part of the transition process, it is crucial to incorporate the technical know-how, best practices and lessons learned built up by the institutions that previously had responsibilities in that area. The institutional changes made, according to which the responsibility for defending stakeholders' interests is spread more equitably, should help to reduce socio-environmental conflicts.

The Environmental Assessment and Enforcement Agency (OEFA), which ensures compliance with sector legislation, is the governing body of the National Environmental

Assessment and Oversight System (SINEFA). In addition, it directly oversees the application of environmental regulations in four sectors: (i) medium- and large-scale mining; (ii) hydrocarbons and electricity; (iii) commercial fisheries and large-scale aquaculture; and (iv) the brewery, papermaking, cement and tannery industries. It also supervises the 12 environmental enforcement entities of national scope, the 25 entities of the regional governments and the local entities (1 838 provincial and district municipalities). The environmental enforcement budget rose from US$ 16.3 million in 2012 to USD 71.3 million in 2015, which has allowed OEFA to significantly increase direct auditing of firms in the four sectors under its responsibility—up from 1 042 in 2011 to 2 834 in 2014. The number of firms audited by other oversight bodies in the same period rose from 249 to 980.

Direct audits can identify alleged infractions, classified as moderate, critical or major. In the case of critical or major infractions, an administrative procedure must be carried out to impose sanctions. Figure 2.3 sets out the cases resolved by OEFA. In 2014 and 2015, most of the resolved cases involved the mining and hydrocarbon sectors (a total of 84% in 2014 and 73% in 2015) (OEFA, 2016).

Figure 2.3. Number of cases resolved by OEFA, 2011- 2014

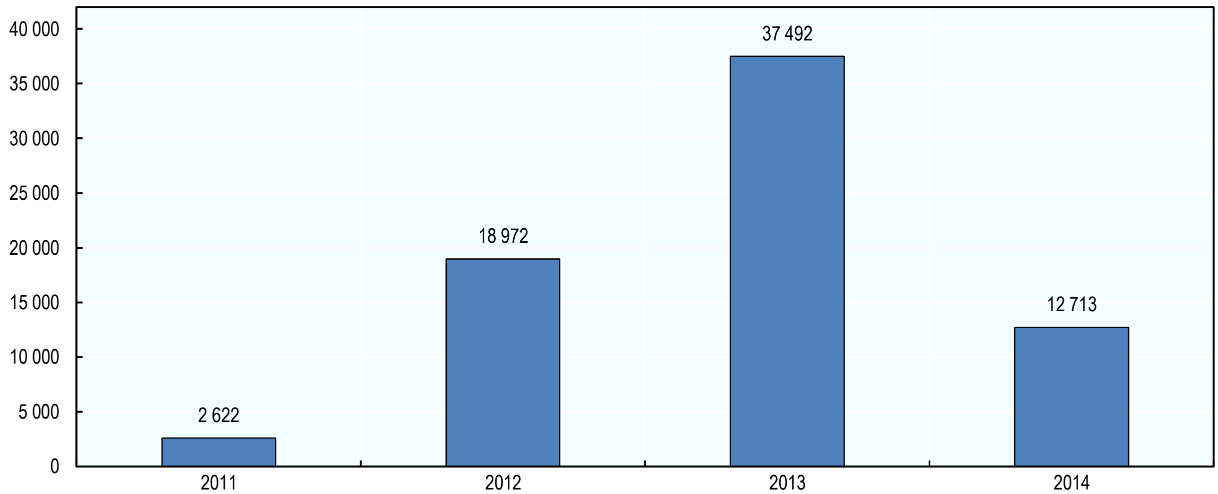


Source: Environmental Assessment and Enforcement Agency (OEFA), Memoria Anual, 2011, 2012, 2013 and 2014.

OEFA is authorised to impose fines and corrective measures. When calculating the fines, a specific methodology is used, taking into account aggravating and mitigating factors, so that the process can be adapted to objective criteria and limits the discretion with which fines are imposed. Some of the mitigating and aggravating factors considered are the severity of the damage, determined inter alia by whether they can be reversed, their geographic extent and the effect on protected areas; the economic impact, which depends on the level of poverty in the area and the number of sources of pollution or elements of the environment involved; and the offender's behaviour (repeat offender, voluntary remediation and intent). Figure 2.4 presents quantitative information on fines imposed by OEFA in 2011-2014.

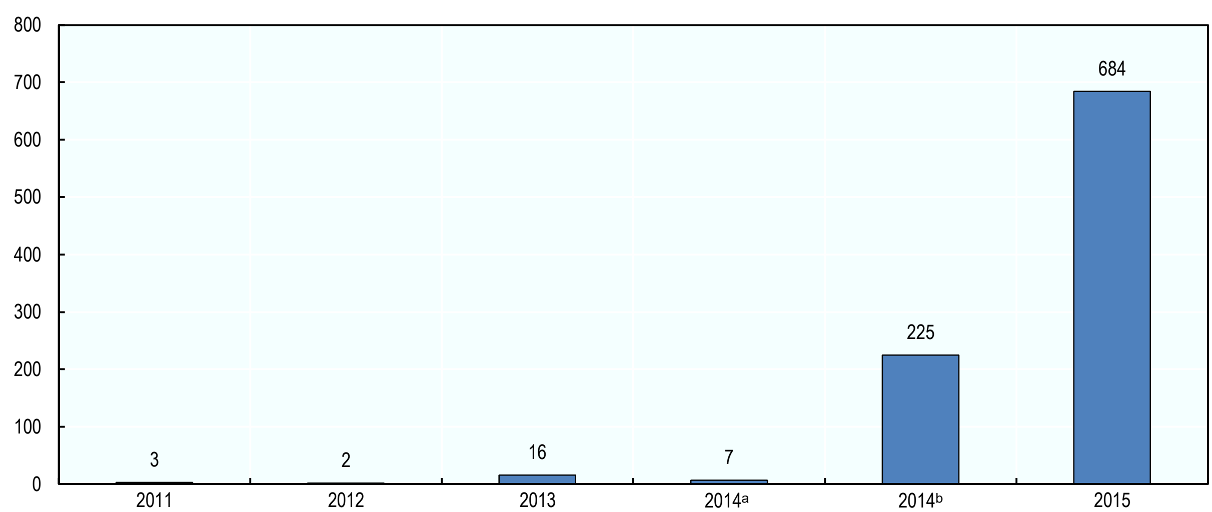
Figure 2.4. Number of fines imposed by OEFA, 2011-2014

(Tax units)



Note: In 2014, a tax unit (TU) was equivalent to 3 800 Peruvian sol. The value is updated every year on 31 December.
Source: MINAM (2015).

Figure 2.5. Number of corrective measures imposed by OEFA, 2011–2015



Note: Measures as of 31 August 2015. *a)* Prior to the entry into force of law No. 30/230. *b)* After the entry into force of law No. 30/230
Source: MINAM (2015).

Corrective measures require those responsible for an infraction to contribute economically to the rehabilitation of the environment, so that, as far as possible, it is returned to its original state. Failure to comply with a corrective measure leads to a fine being imposed on the offender. Law No. 30230, enacted in 2014, prioritises the adoption of corrective measures and states that fines shall only be imposed in the event that offenders fail to comply with those measures. Since the law entered into force, the number of corrective measures imposed has increased considerably (Figure 2.5), while the number of fines has decreased.

Horizontal and vertical co-ordination

There are institutional mechanisms for co-ordination, consultation and decision-making in environmental matters at all levels of government. Both public and private entities participate in those mechanisms. The main horizontal co-ordination mechanisms between the Ministry of the Environment and other national institutions are described below.

- The Council of Ministers: responsible for making decisions related to the national environmental policy, establishing protected areas and drafting environmental legislation.
- The Co-ordinating Committee of Deputy Ministers: responsible for approving draft multisectoral legislation, linked to the portfolios of at least two ministries or that must have the consent of the Council of Ministers.
- The Multisectoral Environmental Committee: responsible for technical co-ordination and consultation on environmental issues among different sectors and levels of government.
- The Advisory Environmental Committee: a standing body that reports to the Ministry of the Environment and promotes dialogue and co-ordination on environmental matters between the State and society. It is also responsible for providing advice and opinions on the policies, strategies and plans submitted by the Ministry of the Environment for the Committee's consideration, and for reviewing and responding to the Ministry's queries. This Committee is composed of professionals or experts from the sectors involved in implementing environmental policies and achieving their objectives.
- Multisectoral committees: responsible for monitoring, co-ordinating and assessing multisectoral matters. In the past, committees of this type were set up to examine, in a concerted and co-ordinated manner, matters linked, inter alia, to the development of strategic guidelines and socio-environmental conflicts. In early 2016, the Ministry of the Environment was represented on 119 multisectoral committees on environmental issues, most of which were standing committees.

With regard to vertical co-ordination, the main inter-institutional mechanisms in which subnational entities participate are the following:

- Regional and municipal environmental commissions: forums for dialogue and co-ordination among the State and civil society for addressing environmental issues of regional or municipal concern. Currently, all regional governments have such a commission.
- Technical groups on environmental matters: technical co-ordination bodies, such as the groups for carrying out technical environmental studies on air quality (GT-GESTA Zonal de Aire) and water resources councils, among others.

As is the case at the regional level, local environmental institutions are in the process of being strengthened. Before 2013, 342 municipal environmental commissions were created through municipal ordinances, covering around 19% of the country's provincial and district municipalities.

In connection with horizontal and vertical co-ordination, the National Climate Change Committee is composed of several ministries and agencies, representatives of non-governmental organisations, universities, the National Assembly of Regional

Governments and the National Council of Chairs of Professional Associations, among others.

Environmental information

The National Environmental Information System (SINIA) is a mechanism to support the implementation of the National Environmental Management System. It is composed of networks and databases that can be grouped into two broad categories: (i) thematic information, which includes aggregated data on certain aspects of the environment; and (ii) territorial information, which includes aggregated data on the environmental situation in specific geographical units. The Ministry of the Environment is responsible for managing SINIA, which includes regional and local environmental information systems, administered by regional and local governments.

SINIA compiles environmental information produced by the following bodies: the National Water Authority (ANA); the National System of Information on Water Resources (SNIRG); the National Meteorology and Hydrology Service (SENAMHI), responsible for compiling hydrometeorological data, and the Geological, Mining and Metallurgical Institute (INGEMMET). It also has links with international services, including that of the United States' National Aeronautics and Space Administration (NASA) to monitor heavy rains and forest fires. The National Institute for Research on Glaciers and Mountain Ecosystems (INAIGEM) was created recently, in view of the vital importance of those natural features. The Ministry of the Environment is developing a national system to prepare greenhouse gas inventories, called INFOCARBONO, which complements the database on the volume of emissions. The Pollutant Release and Transfer Register (RETC) was launched in 2014, which contains information on both aspects, especially pollutants from economic activities, particularly the most dangerous one, and the associated risks. In Peru, all companies not listed as small or micro-businesses must report on this matter. This standard is being gradually introduced, as new economic sectors are constantly being added.

The SINIA webpage provides information on elements of the environment, biodiversity, solid waste and mining activities, among other things. The information consists of environmental indicators, thematic maps, entire documents, reports on the state of the environment, reviews of environmental legislation and related material. SINIA also publishes an annual report on environmental figures, entitled *Cifras ambientales*, and the government produces the national report on the state of the environment every two years. As part of the process of transferring sector authorities' responsibilities to the Ministry of the Environment, there is room for greater collaboration between SINIA and sector authorities, which generate useful environmental information. Meanwhile, although noteworthy advances have been made in providing information, there are still gaps that hinder policy design and implementation. A good example of this is the limitations of the air quality monitoring system in areas affected by air pollution.

In accordance with the provisions of the Law on Transparency and Access to Public Information of 2003, all public institutions shall guarantee access to environmental information. Regional and local environmental information systems are being established with the support of the Ministry of the Environment. In 2016, 24 regional governments and 65 local governments had such systems, authorised by and interconnected with SINIA. Despite the existence of information transparency mechanisms, the district and provincial municipalities have implemented few measures to ensure transparency and access to information. According to a report published by the Office of the

Ombudsperson, more than half (54.6%) of complaints filed against municipalities refer to the lack of in information. Of all complaints filed, 17.4% referred to education entities, 6.2% to healthcare providers and 4.8% to regional governments.

Land-use planning

Land-use planning is mentioned in the constitution, in documents related to the 2002 constitutional reform that paved the way for decentralisation, and in multiple political, legal and technical texts. It is a process led, in most cases, by an environmental authority and that, in addition to the unquestionable progress made, shows political and legal problems, related mainly to its applicability and to the uncertainty surrounding the hierarchy between the process and other legal instruments.

Land-use planning in Peru is overseen by the ecological and economic zoning processes (ZEE), which identifies the potential and limitations of a territory and its natural resources. The following categories are established on the basis of various criteria (productive, bioecologial and cultural value; vulnerability; conflicts over land use; and suitability for urban and industrial use): (i) zones most suitable for productive use; (ii) ecological protection and conservation zones; (iii) special treatment zones; (iv) rehabilitation zones; and (v) urban or industrial zones. There are three categories in geographical terms: (i) macrozoning (national, macroregional and regional); (ii) mesozoning (regional spaces, river basins or specific areas); and (iii) microzoning (local areas). ZEE is the basis for developing territorial governance policies and plans which, in turn, become national, regional and local development plans.

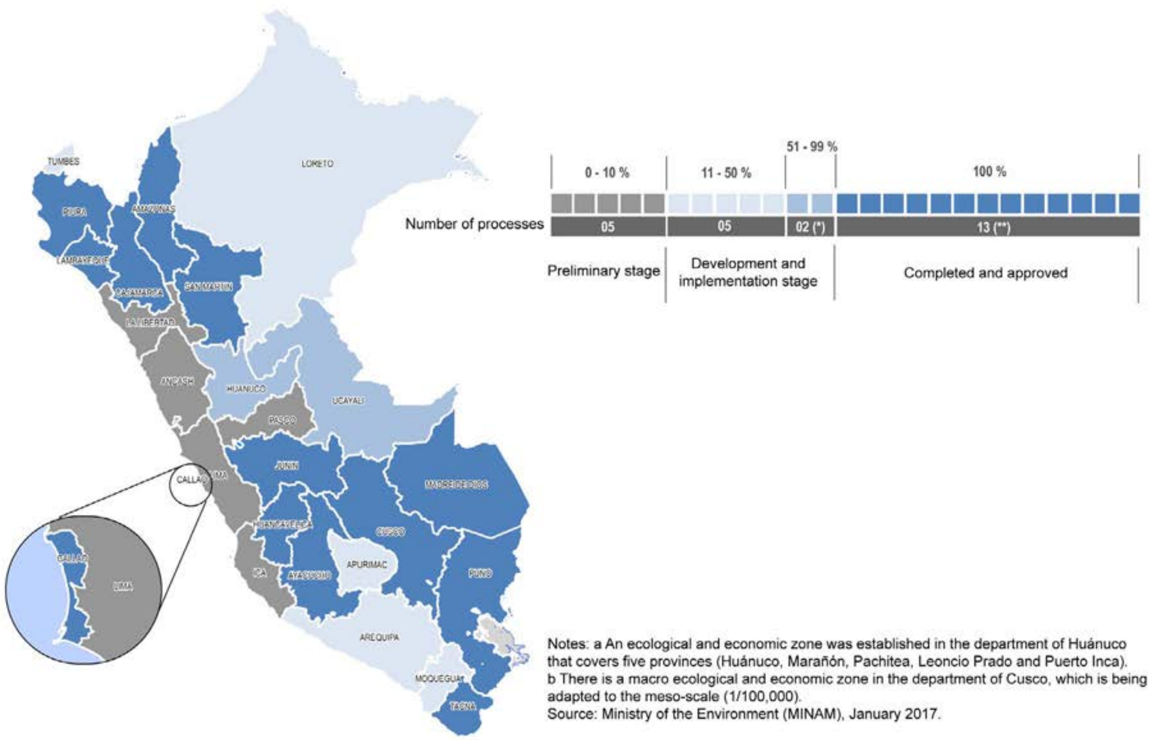
There are a great many legal provisions relating to land-use planning, which apply to different areas and overlap, making it difficult to understand their legal scope and force. These provisions range from laws on decentralisation and the environment to regulations on regional and municipal governments' powers and on domestic and foreign investments. In this context, law No. 30230 is of particular interest, as it made it possible to adopt tax measures and to simplify the mechanisms for granting permits in order to give a greater impetus to investments, but which limits land-use planning. On the normative front, the National Environmental Policy, the Policy Guidelines for Land-use Planning and the proposed National Strategy for Ecological-Economic Zoning are notable. There are also technical guidelines, such as those in the *Guía Metodológica para la elaboración de los instrumentos técnicos sustentatorios para el ordenamiento territorial* (MINAM, 2010) and in the "Directiva guía metodológica de la zonificación ecológica y económica" (MINAM, n/d).

Important questions have been raised with regard to the effective contribution of land-use planning to sustainable development, which allude to the following issues, among others:

- legal dispersion and uncertainty about the true legal scope of land-use plans, especially when they are seen as obstacles to investment projects;
- environmental bias in land-use planning, as it is the responsibility of environmental authorities. This must be corrected by strengthening co-ordination with other areas (economic and social, among others) of the national government and with subnational and local bodies;
- problems with the delimitation of responsibilities and co-ordination between the national government and subnational and local authorities.

As shown in Figure 2.6, significant progress has been made in the ecological and economic zoning process in several departments. Nevertheless, a national land-use planning strategy must be clearly defined, to integrate many of the issues that today seem dispersed and to clarify its legal force in relation to other government policies. It should also have broad institutional backing and facilitate co-ordination both among sectors and with subnational governments.

Figure 2.6. Progress of ecological zoning



Notes: a An ecological and economic zone was established in the department of Huánuco that covers five provinces (Huánuco, Marañón, Pachitea, Leoncio Prado and Puerto Inca).
b There is a macro ecological and economic zone in the department of Cusco, which is being adapted to the meso-scale (1/100,000).
Source: Ministry of the Environment (MINAM), January 2017.

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Chapter 3. Economy and the environment

Peru's economy has performed well over the last decade thanks to macroeconomic stability, open trade, and inflows of foreign direct investment. However, much remains to be done to green the economy, as evidenced by poor performance on a number of environmental indicators. Growing awareness of the economic implications of environmental degradation has prompted action to endorse the OECD Declaration on Green Growth. This chapter reviews Peru's achievements in the areas of environmentally related taxation, public expenditure, public-private partnerships and eco-innovation.

Key findings and recommendations

During the period of analysis, the Peruvian economy has grown at an average rate exceeding 6%, thanks to macroeconomic stability, open trade, and inflows of foreign investment attracted by the potential for natural resource exploitation. Together with establishing measures to ensure the conditions necessary for private investment in various productive sectors, the country has strengthened its environmental institutional framework as well as its legislation governing environmental management and conservation of natural resources, although it has not succeeded in decoupling environmental degradation, with its associated costs, from economic growth.

The estimated costs of environmental damage at the beginning of the analysis period amounted to some 4% of GDP. Seventy per cent of those costs were associated with the effects on health from waterborne diseases, atmospheric pollution in cities, exposure to lead, and contamination in the home. There are also estimates of water pollution from mining activities, which varied between 0.4% and 0.7% of GDP in the middle of the first decade of this century. Although the information is very sketchy, there are signs of a reduction in some environmental costs post-2006, especially those associated with atmospheric pollution. On the other hand, the amounts required to offset mining liabilities, which amounted to nearly 2% of GDP at the beginning of the period, have been growing along with the number of contaminated sites identified by the Ministry of Energy and Mines (MINEM), of which there were more than 8 600 in 2015.

Peru ranks third in Latin America and the Caribbean and first in South America in terms of the costs associated with natural disasters, as estimated over the period 1970-2010 by ECLAC. The combined costs of the El Niño/La Niña phenomena of 1982-1983 and 1997-1998 represent nearly half of GDP for the year 2000 —hence the fear of the effects that the current season's event could have. During the period 2000-2005, the annual costs of natural disasters exceeded half a percentage point of GDP, and were associated primarily with losses in the agriculture sector. In the future, the additional GDP losses caused by climate change could amount to 15% for the period 2010-2100, and would likely be concentrated in the farming, high-Andean livestock and fisheries sectors.

Peru is well aware of its economic dependence on natural resources and the welfare effects of environmental costs. The country has been laying the basis for adhering to the OECD Declaration on Green Growth, through discussion of a national strategy for green growth and adoption of the intended nationally determined contributions (INDC) relating to the reduction of greenhouse gas emissions, among other things. Yet there is still a lack of consistency between development policies, plans and strategies, on one hand, and environmental targets, on the other; there are failures of co-ordination, both horizontal and vertical, among the various government institutions; and there are problems in reconciling investment promotion measures with efficiency and effectiveness in environmental policies.

Moreover, although Peru has abundant legislation for effective protection of the environment, and although the General Environment Law recognises the principle of internalising costs, the enforcement of legislation has relied essentially on command and control measures, with limited use of economic instruments and no specific provisions in the area of environmental taxation. In the absence of effective enforcement and penalties concomitant with damage, this strategy may be of limited effectiveness in achieving a better environmental performance. In practice, the fines levied bear no relation to the economic costs of the associated environmental damage, even though, with the creation of the Agency for Environmental Assessment and Enforcement (OEFA), there was a rise in the number and amount of fines levied toward the end of the period under analysis. Peru also allows for discounts on fines as an incentive to invest in compliance with environmental regulations.

Government expenditure on the environment, while growing, amounted to barely 0.4% of GDP at the end of the period under analysis (slightly more than 2% of total government spending), and of this amount only 27% was funded from general tax revenues. The majority of resources earmarked for environmental issues originated in utility rates and fees and taxes at the municipal level, which accounts for 75% of public environmental spending.

Generally speaking, the user pays principle has been applied to natural resource development and ecosystem services in the form of charges levied by the State (Law No. 26821 on sustainable use of natural resources, among others) for the use of water and the dumping of waste water, royalties on the exploitation of forest resources, entry fees to natural areas, and various taxes on the mining industry. The fees paid directly to the State as well as the rates charged for outsourced water and solid waste services do not typically cover the costs of their provision, and tend to lose value in real terms. Nevertheless, the contributions associated with mining and hydrocarbons exploitation (in their various forms: taxes and special levies, royalties, and so on) have been growing, averaging 1.5% of GDP, although they have fluctuated widely under the impact of the international economic cycle. These proceeds are allocated primarily to the regions where they originate, with no relationship to regional development indicators or environmental protection needs. It must also be recognised that tax evasion associated with illegal and informal mining amounts to USD 305 million a year: various estimates for the period under analysis indicate that cumulative evasion in the gold mining industry may have reached one percentage point of GDP at 2014 prices. Recent years have seen the development of systems of payment for ecosystem services, although the effectiveness and incentive value of these have yet to be evaluated.

When it comes to applying the polluter pays principle, the situation is less encouraging. Legislation to promote private investment and tax stability is making it difficult to undertake a green tax reform. Nevertheless, Peru's low level of tax pressure, at around 16% of GDP, offers an opportunity to align environmental incentives with the need to raise greater revenues. Taxes associated with the generation of externalities (imposed on energy products and automobiles) represented about 0.6% of GDP in 2010, below the level in all OECD countries with the exception of Mexico. Revenues from the fuel tax (part of the consumer excise tax) remained relatively stable during the period under analysis until, in 2014, gasoline taxes were cut by 30%. In addition, the municipalities apply taxes on vehicle ownership and road use (levied on fuel importers and refiners, who pass them on to consumers). There is no clear relationship with the harmfulness of combustion-produced emissions, fuel quality, or the vehicle's environmental characteristics. Moreover, there are exemptions from the fuel excise tax in 350 districts of eastern Peru, located for the most part in the departments of Amazonas, Loreto, Ucayali, San Martín and Madre de Dios. In addition, there is substantial fuel smuggling along the northern border.

Although no information is available on private spending on environmental protection activities, Peru has developed some meaningful public-private partnerships to foster investments in the public interest, including investments in water and sanitation and in the treatment and processing of wastes. However, there are no indicators that would make it possible to encourage environmentally friendly investments or to discriminate among proposals for the same project. The tax-funded works law, which provides incentives for regional and local public investment with private sector participation, allows firms to finance and implement public projects as a deducible from their tax liability, and allows subnational authorities to obtain financing in exchange for royalties and fees. The mechanism, which has financed investment in solid waste treatment, sanitation and other areas, will demand a great deal of transparency and ongoing reassessment, as local and regional institutions are progressively strengthened. Peru has no system for green public procurement, and public incentives for clean production and technologies are scarce and dependent on international co-operation. There are some incipient initiatives on extended producer responsibility (Supreme Decree No. 001-2012-MINAM).

Peru's great natural heritage offers an opportunity for eco-innovation and the development of new productive sectors and internationally competitive niches. Nevertheless, R&D investment falls short of the average for Latin America and the Caribbean, and is far below the level in OECD countries. The intention is to boost such investment fivefold, from its 0.15% of GDP at the end of the period under analysis, and tax benefits are being awarded for innovation. The National Strategy for the Development of Science, Technology and Innovation gives priority to programmes for biotechnology and for environmental science and technology with an emphasis on climate change, among other things. But much more remains to be done to support a green growth strategy. The National Programme to Promote Bio-Trade was launched in 2003. Estimates suggest that exports of bio-trade products rose over the 2000 decade, amounting to more than USD 300 million by 2010, and that Peru is becoming one of the leading exporters of such products.

Recommendations

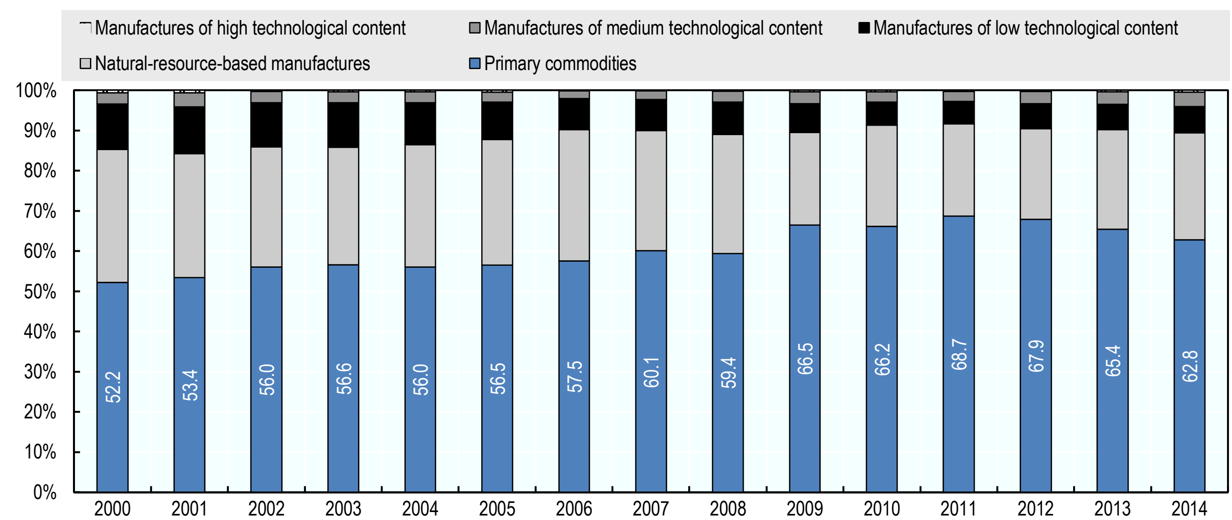
- Complete the Green Growth Strategy in Peru, taking into account the role of environmental policies as a driver of economic growth. Include environmental policy goals in plans for national development and productive diversification, in the framework for budget planning and in sectoral policies and plans. Strengthen co-ordination between the National Centre for Strategic Planning, the Ministry of the Economy and Finance, the Ministry of Production, the Ministry of the Environment and other competent agencies to ensure the effective achievement of low-carbon green growth by defining specific, measurable and consistent environmental objectives.
- Incorporate environmental considerations into the tax system by encouraging the introduction of environmental taxes, as applicable, and gradually eliminating environmentally harmful systems of exemptions and subsidies. Further the full enforcement of environmental criteria in taxes on fuel and vehicles, in light of their contribution to emissions and their impact on health. Replace public financial support with systems of payment for environmental services, as applicable, thereby ensuring efficient use of tax revenues and effective environmental protection.
- Include environmental impact assessments in economic policies, in particular spending and public investment policies. Expand the strategic environmental assessments (SEA) of energy policy and transport plans, in particular for the Lima-Callao metropolitan area and other mid-sized cities, as a tool for long-term planning.
- Develop a green public procurement system and include environmental considerations in the programme of incentives for improving municipal management.
- Bolster regular budget funding for the environmental institutional framework in order to streamline the formulation of environmental policy and the oversight of compliance with its objectives. Promote the economic evaluation of environmental policies, plans and programmes, using tools such as cost-benefit and cost-effectiveness analyses and the establishment of objectives and goals with timetables and compliance indicators. Strengthen the use of management oversight tools to ensure compliance with those objectives.
- Enhance the role of the private sector in the development of eco-innovation, energy efficiency, non-conventional renewable energy sources, the waste recycling, reuse and treatment sectors and other environmental policy objectives, through economic incentives, credit supports and soft loans, public-private partnerships and clean production agreements, among others. Build the eco-innovation component into R+D policy and ensure that funds from royalties foster the development of knowledge hubs in environmental protection, the sustainable use of natural resources and the creation of new environmentally friendly competitive niches. Leverage extended producer responsibility to encourage formalisation processes and strengthen eco-labelling systems in order to increase consumer awareness and encourage good private sector behaviour on the basis of the benefits of reputation.
- Expand and deepen economic information related to the implementation of environmental policy instruments (integrated economic and environmental accounting systems, environmental spending, public financial support, direct regulation, environmental taxes, market creation mechanisms, service fees, voluntary systems, information systems) using cost-effectiveness analyses and following international methodologies and standards.

1. Links between the economy and environmental pressures

Over the past 20 years, Peru has opened up its economy to the world, achieving vigorous growth based on sound economic policies in a benign international context characterised by high prices for the raw materials that form the core of its exports. In the decade of 2003-2013, commodity exports increased by 547%, compared to an average export growth of 473%, and reached a peak in 2011-2012. The country's reliance on a development model based on natural resources is reflected in the growing export share of minerals and hydrocarbons, along with agricultural, fishery and forestry products. Exports of commodities and natural-resource-based manufactures, which in 1990 represented 82% of the total, currently account for over 91%, as their relative weight increased during the period under analysis (Figure 3.1).

Figure 3.1. Export structure by technology intensity, 2000-2014

(Percentage)

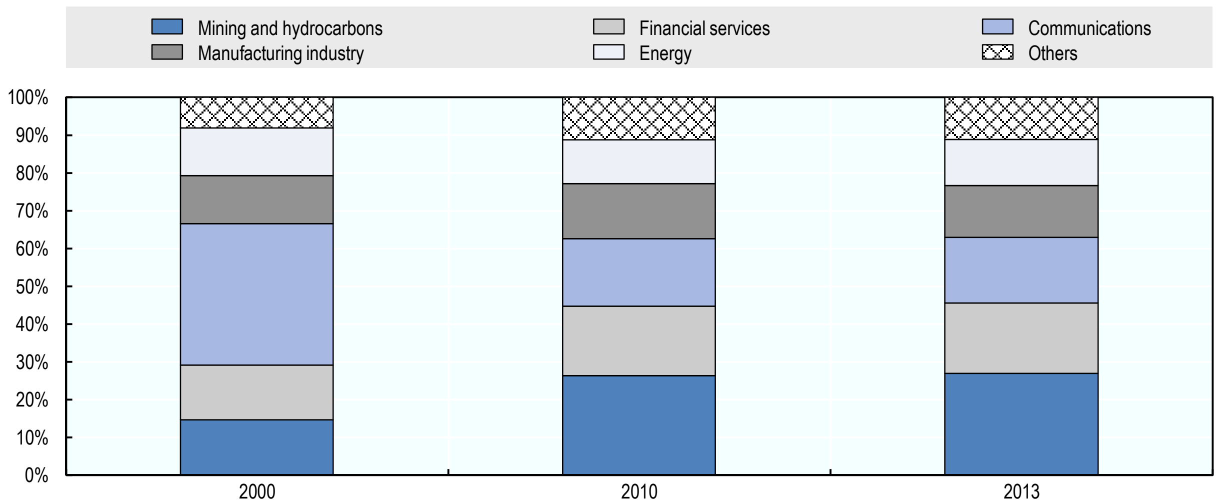


Source: ECLAC calculations on the basis of United Nations Commodity Trade Statistics Database (COMTRADE).

Inflows of foreign direct investment (FDI) increased from 2.3% of GDP in 2003 to 4.6% in 2013, thereby reinforcing the natural resource-dependent structure of production, since the investment was mainly absorbed by the mining and hydrocarbon sectors, which doubled their FDI share by the end of the period (Figure 3.2).

Figure 3.2. Sectoral structure of foreign direct investment, 2003-2013

(Percentage of GDP)



Source: Private Investment Promotion Agency (ProInversión), General statistics, 2015 [online] http://www.proinversion.gob.pe

This production structure, in which mining contributed 12% of GDP in 2013 while the forestry-agriculture and fisheries sectors accounted for 6%, generated increasing pressure on the environment and ecosystems. Economic expansion and current patterns of consumption have contributed to increased environmental degradation, which continues to be linked to economic growth and displays a worrying trend, despite the strengthening of environmental institutions and legislation (Chapter 2). Nonetheless, environmental quality indicators in Peru are similar to those in countries with the same level of development and industrialisation, and in some cases they are better than the OECD average. Examples are carbon dioxide emissions, both per capita and relative to GDP, energy intensity, the vehicle fleet, forest cover and fresh water per capita, among others (Annex I.B).

2. Economic effects of environmental degradation and climate change

Economic development in Peru is increasingly hampered by the costs imposed by extreme natural events and climate change, which compound the economic consequences of environmental degradation. Extreme events, exemplified by episodes of the El Niño and La Niña phenomena, in 1982-1983 and 1997-1998, respectively, had catastrophic effects in terms of both human lives lost and people made homeless. They also had a major economic impact on the fishery and agriculture sectors and on infrastructure, which makes Peru one of the countries most exposed to environmental risks (Bello, Ortiz, and Samaniego, 2014). Various estimates see climate change reducing GDP by 4.3 percentage points by 2025 (CAN, 2008) and by 6 points by 2050 (CAN, 2008). The Inter-American Development Bank and ECLAC (IDB/ECLAC, 2014) are projecting GDP losses of around 15% in the present century.

The World Bank estimated an environmental cost equivalent to 4% of GDP in 2003, mainly due to increased mortality and morbidity, declining productivity and the degradation of soils and infrastructure (Giugale, Fretes-Cibils and Newman, 2006). This mostly involves health effects, due to diseases caused by inadequate water supply and improper sanitation, atmospheric and indoor air pollution, as well as lead exposure. At the start of the period under review, the monetary cost of the high mortality and morbidity associated with environmental degradation in Peru, which affects the most vulnerable population groups disproportionately, was higher than in other countries of similar income level (World Bank, 2007). The cost of air pollution in metropolitan Lima was estimated at 0.5% of GDP at its peak in 2006. Since then it has abated thanks to a change in the energy matrix to prioritise gas consumption; the conversion of vehicles to run on gas; and, since 2010, restrictions on imports of used vehicles (Orihuela and Rivera, 2013). The contamination of water resources caused by mining activity has been costed at between 0.4% and 0.7% of GDP in 2008-2009 (Herrera and Millones, 2012). The resource cost of cleaning up mining liabilities represented nearly 2% of GDP at the start of the period analysed, a percentage that has been rising along with number of polluted sites identified by the Ministry of Energy and Mines (MINEM), which numbered 7 000 at the end of the period (Glave and Kuramoto, 2002, MINEM, 2011). Although few cost studies have been conducted, the negative effects of environmental degradation attributable to production processes, particularly water and air pollution, are known to be high (MINAM, 2008, OECD, 2015).

3. Environmental policy in Peru, competitiveness and economic activity

The need to harmonise sustainable natural resource use and reduce the environmental degradation associated with human activities has become increasingly important in Peru. Nonetheless, ever since environmental regulations were first developed, contradictions have arisen owing to a realisation that they could hamper economic activity. This led to the promulgation of the Private Investment Growth Framework Act (Legislative Decree 757) and the Mining Sector Investment Promotion Act (Legislative Decree 708), which modified the 1990 Environment and Natural Resources Code and rendered ineffective several of its provisions. To eliminate obstacles to economic activities, the first of these laws formalised the administrative sectoralisation of environmental management. Since the creation of the National Environment Council (CONAM) in 1994, and particularly the Ministry of the Environment in 2008, environmental policy has been strengthened with a view to establishing a more consistent relationship between environmental protection and economic activity. With the same objective, the environmental impact assessment system and the single window facility for large-scale investment projects were established, operating within the framework of the National Service of Environmental Certification for Sustainable Investments (SENACE) —created in 2012 and attached to MINAM— a body that will progressively take over the functions of the sectoral authorities as from 2015 (Chapter 2). In 2012, the Multisectoral Commission was created to draft legislative proposals and policies aimed at improving the environmental and social conditions in which economic activities are carried on, particularly in the extractive industries (Supreme Resolution 189-2012-PCM). The Commission is attached to the Office of the President of the Council of Ministers and has representatives from the Ministries of Development and Social Inclusion, Agriculture, Economic Affairs and Finance, Energy and Mines, Culture, Health and Production. Its work is complemented by the Multisectoral Commission for Marine-Coastal Environmental Management, among other entities (Supreme Decree 096-2013-PCM).

Concern about the economic consequences of environmental laws has also been reflected in legislative amendments to foster investment. Supreme Decree 054-2013-PCM specifies two circumstances in which the environmental management instrument does not need to be altered, and only a technical report is required from the owner of an investment project confirming that the required conditions are met. These circumstances are: (i) when it is necessary to modify ancillary components or to extend the scope of a project that already has environmental certification, and provided its execution would not have a significant environmental impact; and (ii) when technological improvements are to be made in the operations in question. The competent authority must notify its agreement within 15 days. The aforementioned decree was supplemented by Supreme Decree 054-2013-PCM, which aimed to reduce the cost and time to complete the procedures needed to implement investment projects. Law No. 30230 of 2014 provides for the adoption of tax measures and the simplification of procedures and permits, to encourage and invigorate investments; and priority is given to actions that prevent and correct conducts that infringe environmental regulations and are subject to sanctions by the inspection body, the Agency for Environmental Assessment and Enforcement (OEFA) (Figure 3.3). Under this law, fines are also reduced by up to 50% for up to three years, except in very serious circumstances. The effects of the application of the Investment Promotion for Economic Growth and Sustainable Development Act (Law No. 30327, of 2015), which aims to rationalise the granting of environmental permits requiring global environmental certification, facilitate expropriations for the execution of large-scale investment projects in infrastructure works and simplify procedures for assigning rights of way, still require thorough evaluation to ensure that this law makes it possible to harmonise environmental protection and economic development (Box 3.1). The legislation also provides for a cost-benefit analysis of regulations with the status of law, supreme decrees, environmental management instruments (including plans) and the methodology for calculating environmental fines.

Box 3.1. National Environmental Impact Assessment System and the Investment Promotion for Economic Growth and Sustainable Development Act

The National Environmental Impact Assessment System Act of 2001 was substantially amended in 2008, as per Legislative Decree 1078; and the regulations to the Act were issued in 2009.

The single window facility, designed to optimise the environmental impact assessment of large-scale investment projects, was set up in 2015, under the Investment Promotion for Economic Growth and Sustainable Development Act (Law No. 30327). This legislation instituted the Global Environmental Certification, an administrative instrument issued by SENACE through which this entity approves category III environmental studies, for which it has 150 working days as from the date of presentation. To this end, information on the corresponding qualifying titles or opinions (14 in total),[1] according to the nature of the project, is included in the Detailed Environmental Impact Study. Global Environmental Certification allows for environmental certification qualifications to be included in a single administrative procedure. The relevant public consultations should also be carried out within the aforementioned period.

The system responds to the need to speed up the approval of projects of economic and social importance for the country; but this improvement is controversial. Some civil society organisations have raised objections, arguing that the system makes it harder to protect indigenous territories, it could be detrimental to the autonomy and functions of regional governments, and it could increase social conflicts. These organisations also consider that the deadlines are very tight and that the system assigns excessive responsibilities to public officials in charge of procedures, who are exposed to sanctions.

As this legislation has only recently been passed, it is too early to assess its results; and these will largely depend on the human and financial resources available to SENACE and its effective co-ordination with the sectoral authorities. Accordingly, implementation of the law will need to be monitored to determine whether it contributes to creating a balance between the economic, social and environmental development of Peru.

Note[1]*:* Article 2 states that the law covers public entities involved in the granting of licences, permits, authorisations and the like, as well as entities related to the activities of environmental certification, tax collection, investment promotion, approval of rights of way, land valuation, protection of security areas and land purchase for large-scale infrastructure works. The scope of this rule is applicable to public, private, public-private or mixed-capital investment projects.

4. Mainstreaming green growth and sustainable development in public policies

Peru has many planning instruments, most of them aimed at fostering the country's growth, competitiveness and development. The most far-reaching is the Bicentenary Plan: Peru towards 2021 (CEPLAN, 2011), which specifies the objectives, targets and activities needed to implement the State policies defined in the 2002 National Agreement. The policies are grouped around four thematic pillars. Sustainable development and environmental management form part of the "Country competitiveness" pillar, one of the objectives of which is to boost exports of organic products; while the "Conservation and sustainable use of natural resources and biodiversity" pillar contains guidelines on the valuation of natural heritage, promotion of corporate environmental responsibility, clean production, bio-trade, renewable energies, eco-efficiency and the use of economic instruments in environmental management. Indicators are also defined with baselines and targets for 2021, including the percentages of forest areas with permanent production and under forestry management (38% in 2009 and 75% in 2021); the number of marine species subject to sustainability measures (8% in 2008 and 15% in 2021); the share of renewable energies in gross domestic energy supply (49% in 2009 and 56% in 2021); the number of environmental variables included in the national accounts (none in 2010 and 85% in 2021); and the proportion of agricultural land under mechanised irrigation (2% in 2008 and 27% in 2021). The Plan envisages strategic programmes, for which it estimates necessary financial resources.

The National Competitiveness and Formalization Council of the Ministry of Economic Affairs and Finance (MEF) co-ordinates pro-competitiveness policies. The strategic pillars of the Competitiveness Agenda for 2012-2013 and 2014-2018 include the environment, and natural resources and energy, respectively. The first of these seeks to design activities to promote environmental sustainability aimed at increasing competitiveness, and emphasises the need to promote exports of goods and services derived from biodiversity. The Ministry of the Environment is tasked with attaining specific targets for eco-efficiency and forest conservation to mitigate climate change. The current agenda prioritises evaluation of the effects of applying environmental standards; the implementation of national land-use planning policy (including the review of economic-ecological zoning procedures); and the strengthening of management capabilities in relation to environmental quality and natural resource use (eco-efficiency, eco-labelling, renewable energies and mechanised irrigation, among others).

The National Productive Diversification Plan, developed by the Ministry of Production, aims to improve the country's production structure, partly by reducing excess costs arising from over-zealous or ill-conceived regulations on safety, health and the environment. The objectives of the Plan include fostering productive innovation, the development of production clusters and the registration of patents; but it does not delve deeper into the productive potential of environmental protection or the competitive advantages associated with the sustainable use of ecosystemic goods and services.

The Ministry of the Environment is implementing the National Environmental Action Plan (PLANAA), Peru 2011-2021 (Supreme Decree 014-2011-MINAM), which, among other things, targets the sustainable use of natural heritage and the competitive and eco-efficient functioning of the public and private sectors. MINAM also prepares the National Environmental Action Agenda, which specifies objectives, along with the results expected during the agenda's lifetime and follow-up indicators. The increased commercialisation of bio-trade products and investments in eco-businesses, together with the inclusion of environmental criteria in the regulatory framework of economic activity, are some of the expected results. These instruments are complemented by national strategies, either currently in force or in the process of being formulated, on issues such as climate change, desertification, biodiversity, water resources, trade and the environment.

In 2015, the Peruvian Government took initial steps towards endorsing the OECD Declaration on Green Growth, which recognises that environmental protection and economic growth can be compatible. To this end, a debate was launched on a green-growth strategy; and nationally determined contributions were adopted for the reduction of greenhouse gas (GHG) emissions, among other things. Since 2013, Peru has also been involved in the Partnership for Action on Green Economy (PAGE), sponsored jointly by the United Nations Environment Programme (UNEP), the United Nations Development

Programme (UNDP), the United Nations Industrial Development Organization (UNIDO), the International Labour Organization (ILO) and the United Nations Institute for Training and Research (UNITAR). The aim of the project for Peru is to contribute to a form of development planning that embraces the concept of green growth, while also promoting efficient resource use, environmental quality and sustainability, the creation of green jobs and adoption of the instruments needed to implement them. The development of a green-growth strategy offers possibilities for harmonising, and creating synergies between, the Bicentenary Plan; the National Environmental Action Plan; the National Competitiveness Plan; the National Plan for Productive Diversification; the National Strategic Plan for Science, Technology and Innovation for Competitiveness and Human Development (PNCTI) 2006-2021; and the current strategies for the various aspects of sustainable development. The strategy's linkage with multi-annual budget programming and the strict monitoring of results and fulfilment of targets and indicators will help to fully mainstream green growth in public policies.

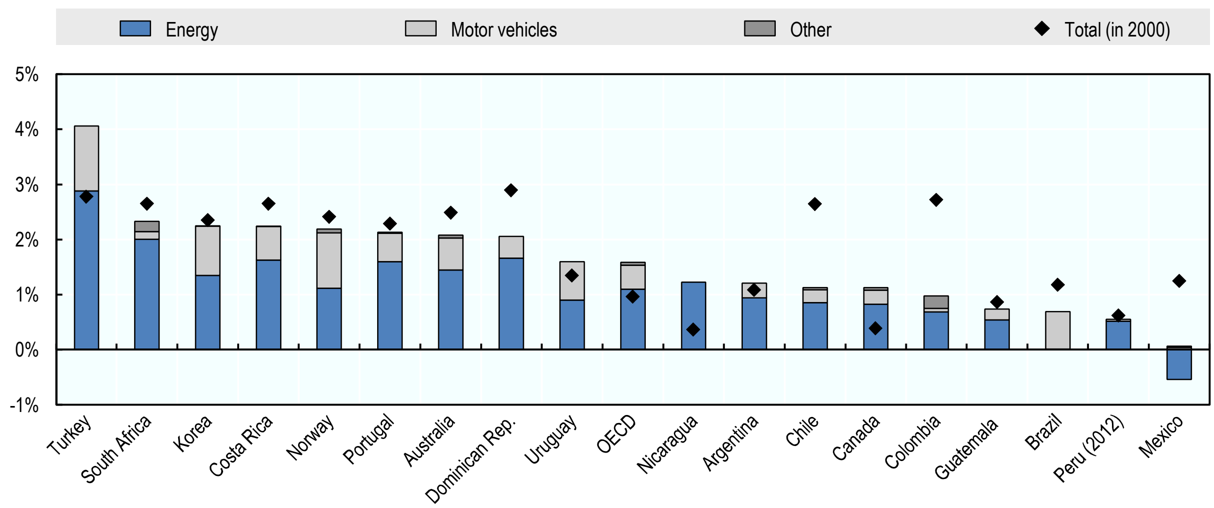
5. Environmental taxes

Although tax revenues in Peru grew from 14.5% of GDP in 2000 to 18.3% in 2013 (OECD/ECLAC/CIAT/IDB, 2015), they are still relatively low compared to those of OECD members and other Latin American and Caribbean countries, which averaged 34.1% and 21.3% of GDP, respectively, in 2013. In that context, environmental taxes would boost revenue and provide incentives for implementing a green-growth strategy under the polluter-pays and user-pays principles.

Nonetheless, the current tax system is not aligned with a green-growth strategy, and in 2012, environmental tax revenues were barely 0.6% of GDP, well below the OECD average, and also lower than other countries in the region. Furthermore, there has been no increase in the period under review (Figure 3.3). Virtually all of these taxes are levied on fuels and gasolines, although some also apply to automobiles.

Figure 3.3. Revenues from environment-related taxes, 2000-2013

(Percentage of GDP)



Source: OECD, OECD database on policy instruments for the environment [online] http://www2.oecd.org/ecoinst/queries.

The consumer excise tax (ISC) is a specific duty levied on the sale in Peru, by producers or importers, of motor gasoline, kerosene and kerosene-type fuels used in jet engines and turbines, also covering diesel fuels and coal. Revenue from this tax, which goes directly to the national government and is the most important environment-related tax, fell both in absolute terms and as a proportion of total tax revenue in 2013-2014, owing to the reduction in the rates applicable to gasoline and diesel fuels (Supreme Decree 316-2014-EF).

Development of the Fuel Toxicity Index (INC) by CONAM in 2005 (Board of Directors Decree 018-2005-CONAM-CD), initially for pedagogic purposes, was the first step towards relating the tax to the impact on the population of the pollutants contained in fuels. Law No. 28694 of 2006, regulating the sulphur content of diesel fuel, stipulates that, as from 1 January 2008, ISC rates on fuels should be "proportional to the degree of toxicity of the pollutants they contain for the health of the population". To this end, MEF, in co-ordination with CONAM, is required to approve annual indices of relative toxicity. This change was set to occur gradually over a maximum period of eight years, ending on 1 January 2016, when the toxicity criterion should fully govern the setting of fuel taxes. The index applies exclusively to fuels used for energy purposes, but not to mixtures with other elements to produce intermediate or final products.

In 2007 (Supreme Decree 211-2007-EF and amendments), fixed amounts were established for taxes (per gallon or tonne), applying the criterion of proportionality to the degree of toxicity. In the annual table, the flat taxes on gasoline were gradually reduced, to a greater extent in cases where they had a higher octane value, to a lower level than those applicable to kerosene and jet fuels (*gasoil*). A substantial increase was also anticipated in the ISC on the latter two fuels and other types of fuel oil. However, at the end of the period the higher-octane gasolines were still subject to a relatively higher ISC. Preparation of the annual table was suspended in 2013, pending recalculation of the toxicity index (Supreme Decree 348-2013-EF). The new index, approved by Supreme Decree 006-2014-MINAM, will allow MEF to adjust ISC to penalise the most polluting fuels (Table 3.1).

Table 3.1. Fuel toxicity index, 2014-2015

(Natural gas=1)

Natural gas	1	Diesel 2-S5000-B5	5.46
Liquefied petroleum gas (GLP)	1.25	Anthracite coal	7.64
Gasohol 90/95/97	1.31	Bituminous coal	9.03
Gasohol 84	1.45	Industrial petroleum 500	12.98
Diesel 2 S5- B5	2.52	Industrial petroleum 6	22.22
Turbo	4.38		

Source: MINAM, Supreme Decree No. 006-2014-MINAM, El Peruano, Lima, 1 May, 2014.

The Amazon Investment Promotion Act (Law No. 27037 of 1998 superseded by Law No. 29742 of 2011) granted exemption from General Sales Tax (IGV) and ISC for firms located in the departments of Loreto, Ucayali and Madre de Dios, in respect of sales for domestic consumption of oil and natural gas and their derivatives in these areas. Similarly, firms in the department of Madre de Dios will be entitled to a refund of any ISC paid on the purchase of petroleum-based fuels. Nonetheless, these measures have not yielded the expected results, and they have generated a high fiscal cost and resulted in a misalignment of environmental incentives (APEC, 2015). The National Merchant Marine Reactivation and Promotion Act of 2015 also provides IGV and ISC exemption for a 10-year period on the sale of fuels and lubricants to cargo vessels flying the national flag. Public transport services, except rail and air, are also exempt from IGV. Other provisions grant a 30% refund of ISC on diesel oils, with the aim of encouraging the formalisation of interprovincial public passenger and freight transport services. Electric utilities using this type of fuel are totally exempt from the tax.

One of the direct sources of revenue for local governments is the road use tax (*impuesto al rodaje*), levied through the Municipal Compensation Fund at a rate of 8% on the sale of vehicle fuels (gasolines). The tax is applied at the manufacturing (refinery) stage, or when it is imported; and it is incorporated into the selling price of the fuel, which motorists pay as users of the local road infrastructure. It thus serves to remunerate the municipalities for road construction and maintenance (Municipal Tax Law, Legislative Decree 776).

In addition to general taxes (tariffs, IGV and VAT), vehicles are subject to a municipal promotion tax of 2% (national tax with revenue assigned to the municipalities). In contrast, the municipal Vehicle Ownership Tax, which is paid once a year and applies to the ownership of automobiles, vans, SUVs, trucks and buses, is equivalent to 1% of the value of vehicles in the first three years after registration. Lastly, in the case of used vehicles, an ISC rate of 30% is payable, in addition to the imposition of technical restrictions and age limits for importation purposes, while new vehicles are subject to a 10% ISC. Recreational boats, including jet skis, pay an annual rate of 5% of the original value, with the revenue thus received being assigned to the Municipal Compensation Fund.

6. Solid waste management charges

Pursuant to the General Law on Solid Wastes (Law No. 27314-2000) and its amendments, provincial municipalities are responsible for the management of solid wastes of household or commercial origin, and similar waste generated by other activities. In contrast, the district municipalities are tasked with the provision of solid waste collection and removal services and for the cleaning of public roads, spaces and monuments in the areas under their jurisdiction; and they charge fees (or rates) for providing these services. In 2013, the national per capita revenue obtained from public cleaning services averaged USD 3.50, with a maximum rate of about USD 12 in Lima and Callao. Nonetheless, the deficit reported in that year was almost 53%, and it has been trending upwards in the present decade (MINAM, 2014). Low collection and high arrears rates are very common problems among municipalities, which make it difficult to provide these services adequately (Chapter 7). To promote recycling and broaden the scope of extended responsibility among producers, so that it is not limited to electrical and electronic equipment, Supreme Decree 001-2012-MINAM creates new economic opportunities and fosters shared responsibility for solid waste management.

7. Fees for the provision of ecosystemic goods and services

The Organic Law on the Sustainable Use of Natural Resources (Law No. 26821 of 1997) was enacted to promote and regulate the sustainable use of renewable and non-renewable natural resources, by establishing a suitable framework for promoting investment and striking a balance between the economy, conservation and social development. The granting of natural resource use rights is governed by specific laws for each resource; and the rights in question give rise to economic benefits. The Ecosystem Service Payment Mechanisms Act of 2014 provides for the establishment of a system of payment for ecosystem services, under which measures that contribute to the conservation, recovery and sustainable use of such services would be paid for by their beneficiaries.

7.1. Water

In Peru, fees, referred to as "*retribuciones*", are levied for water use (both consumptive and non-consumptive) and for waste-water discharge. In the first case, all users must pay the State an amount per cubic meter of water used, irrespective of right of use or origin (Water Resources Law, No. 29338 of 2009), since this natural resource is national property. The fees set by the National Water Authority (ANA), which vary by type of use (agricultural and non-agricultural), respond to economic criteria applicable to the productive sector and to social criteria applicable to the population and agrarian sector. The rate-setting process takes account of water availability in river basins and aquifers, along with the demand from, and effect of, the first of those sectors. The operating companies collect the fees, and the revenues are used by ANA to formulate watershed management plans; for water management in natural sources; the financing of quality control and monitoring measures; and to enhance availability and conservation. The payment for authorised discharge of waste water treated in a recipient body is an economic payment, and not a tax, which users have to pay annually. The Water Authority assesses its amount according to the quality of the water, the volume discharged and the cost of recovery at the affected source. The rate charged for discharges of domestic-municipal waste water is lower, and that applied to industrial waste varies according to the level of danger. The revenue obtained finances the monitoring, prevention, control and repair of environmental damage. In 2009-2014, annual revenue amounted to about 50 million Peruvian sol (PEN 50 million), or roughly USD 18 million; and it has since been rising, although it is still very low in per capita terms. Most of the payments for discharges correspond to the mining sector, followed by the sanitation sector with a much smaller volume.

In all cases, economic incentives are given for efficient use and the adoption of measures for the recovery or restoration of water bodies, including the application of treatment techniques to reduce the pollutant load. Incentives, in the form of certificates, give discounts on the fee payment and preferential treatment for obtaining water rights in respect of surpluses generated through efficiency and other measures.

In addition to the fees, users, where appropriate, are charged for the following: (i) use of the water infrastructure (charges to cover construction, operation and maintenance costs, and the recovery of investments); (ii) the distribution of water to the various sectors, and (iii) monitoring and control of the use of groundwater when the service is outsourced to third parties. In addition to the informality that characterises water use by the population and the agricultural sector, there are cross-subsidies from industrial users to domestic ones, and from higher-income households to those with lower incomes. Moreover, a large percentage of water consumption is not invoiced, which makes it difficult to recover costs (Chapter 8).

7.2. Forestry and hydrobiological resources and natural areas

The use of forest resources for commercial and industrial purposes must be governed by management plans and is subject to a system of concessions, authorisations and permits and the payment of an adjustable duty that depends on the usable volume, the value of the products in their natural state, their location and ease of access, environmental and landscape resources, and public services. Forestry legislation recognises deforestation duties, which vary according to the area to be cleared. These duties are paid to the National Forestry and Wildlife Service (SERFOR); and the resources they provide are used for forestry development, the application of control and monitoring mechanisms, and the promotion of afforestation, reforestation and recovery of degraded systems. Half of the revenue is distributed among the regional governments involved. According to the Food and Agriculture Organization of the United Nations (FAO) and the World Bank (2012), the revenue collected by the forestry authorities is insufficient for them to carry out their functions. In 2009, USD 3.2 million was obtained from forest exploitation duties, which, together with payments for administrative services, covered less than 50% of expenses. The same is true at the regional level, with Ucayali being the only department able to cover its expenses. The aforementioned study recommends reclassifying the timber species on the basis of their real market value, and increasing the amount charged for each category; or else for the Government to cover the budgetary needs of the forestry authorities. The possibility of reducing or eliminating the charges for exploitation rights as an incentive to sustainable management is ruled out, owing to the impact this would have on the budget of the forestry authority. The granting of incentives for the provision of environmental services is consistent with the existing mechanisms of payment for ecosystemic services. Several studies have found that the resources currently available, amounting to USD 0.5 per hectare per year, are insufficient for effective monitoring and control (Suárez de Freitas, 2009). The costs associated with illegal logging have also been documented (Chapter 9).

The exploitation of hydro-biological resources requires a time-limited right, granted by the Government through concessions, authorisations, permits or licenses and subject to an annual payment that is set according to the commercial value of the species to be extracted, their use and destination, and their degree of exploitation, among other considerations. In this context, emphasis is placed on non-transferable quota systems (Chapter 11). Aquaculture enjoys some exemptions from the payment for water use; and, in the case of deprived social conditions, from the payment of duties.

Rights in respect of tourism and recreational use of protected natural areas (ANP) for commercial purposes are granted through concessions, contracts, authorisations and permits. As in the previous cases, the granting of these rights (validity or exploitation) entails a payment to the State (SERNANP, 2014). Such payments are not considered taxes, and the sums collected must be reinvested in the management of the ANPs, although SERNANP can use up to 30% of the total revenue for the management of the National System of Protected Natural Areas. The collection of an ANP entrance fee, which is the system's main direct revenue source, has trended positively since 2003. The funds received increased from PEN 5.5 million, which was then equivalent to just over USD 1.5 million, to almost PEN 9.3 million in 2013. While this represents a real increase of over 30%, it is much less than the proportionate increase in the number of visitors during the same period.

Several studies place a high value on the contribution made by ANPs to the country's development, given the benefits they provide: water supply, hydroelectric power generation, non-timber forest products, food security for the local population, protection of watersheds against erosion and sedimentation, carbon capture, tourism and biotrade possibilities. They also note the relative lack of investment in the maintenance of these areas and possible additional sources of income (León Morales, 2007, Sanclemente, Ruiz and Pedraza, 2014). Although the financial resources available to the system do not allow the necessary expenses to be incurred, the allocation of regular public funds to the ANPs has increased significantly since 2009; and directly collected funds (duties, remuneration and entrance fees), have also increased since 2011, albeit offset by a stagnation or reduction in grants (Chapter 9).

8. Fiscal revenue obtained from non-renewable natural resources

The importance of natural resources, particularly non-renewables, to the Peruvian economy is also reflected in their contribution to fiscal revenues generated through special taxes and levies on mining, along with mining royalties and income taxes. In 2011, the Mining Solidarity with the People Programme was terminated, under which the mining companies committed to making a voluntary contribution equal to a percentage of their net profits. At the moment, steps are being taken to link taxation of the sector more closely to profitability, although the effects of its activities on the environment and the country's natural heritage are not taken into account. The new royalties are not defined on the basis of sales (value of the concentrate calculated according to the international market price), but on operating profit; and they vary between 1% and 12%, on a cumulative progressive scale. The funds thus raised are distributed between local and regional governments (80% and 15% respectively), and national universities in the producing regions (5%).

The special mining duty is charged on the operating profits of firms that enter into agreements with the Government in respect of projects for which guarantee contracts and investment promotion measures are in force; so they are not taxes, but contractual obligations. In the absence of such agreements, known as "tax stability contracts", a special mining duty is levied, which is also based on operating profits, although subject to other progressive rates (Laws No. 29789 and No. 29790). Both the duty and the tax are applied to the activities of exploitation of metallic mineral resources, and the companies deduct the amounts paid as an expense for income-tax purposes. Small-scale producers and artisanal miners are not covered (General Mining Law). Government revenues from this sector, which represented 0.9% of GDP in 2013, are mainly obtained from income tax, which in that year accounted for 78% of the total, compared to less than 7% in the case of royalties, and 15% for special taxes and charges. Under the mining industry revenue sharing arrangement (*canon minero*), 50% of these funds are channelled to the areas where mining activities are carried on.[1] Thus, government income from this source is volatile and depends both on the profitability of the sector and on international prices (Chapter 12). There is also considerable evasion owing to illegal and informal mining activities (Torres, 2015).

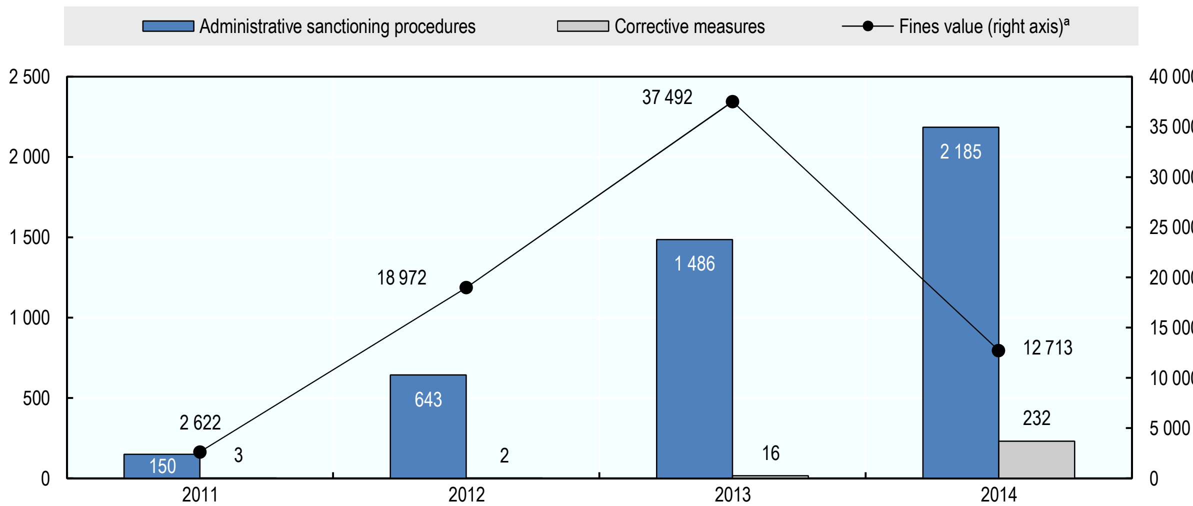
Taxation in the hydrocarbons sector (oil and gas) consists of royalties and income tax. The royalty is calculated as a percentage of the value of the resource extracted; it is fixed for each contract and is deductible as an expense for income-tax purposes. The revenue in question has grown steadily in the period analysed, in proportion to the value and volume of the resources extracted. The Camisea Consortium makes the largest contribution in both taxes. In 2013, revenues from this sector were similar to those of mining, with royalties accounting for over 70% of the total. The *canon minero* is the mechanism for transferring a large proportion of the funds raised to subnational governments.

9. Fines

Given the importance of command and control measures relative to economic instruments to protect the environment and internalise externalities, effective enforcement and the imposition of sanctions in accordance with the damage caused are essential. Although, in practice, the fines paid cover far less than the economic cost of the environmental damage they aim to prevent, the creation of OEFA resulted in an increase in the fines imposed and their amount, although in 2014 and under the new legislation on the subject, the amounts were temporarily halved (Figure 3.3). Pursuant to provisions of Law No. 30230, OEFA cannot use income obtained from fines to finance environmental inspection activities, which must be funded from the regulatory contribution of the entities and companies it supervises. This contribution was established in 2000 under the Framework Act on Supervisors of Private Investment in Public Services (Law No. 27332); and, since 2013, it has had to finance the performance of OEFA environmental inspection activities in the mining and energy sectors (OEFA, 2014). Moreover, the agency grants ad honorem and economic incentives, in the form of discounts on fines, to recognise the application of good environmental practices over and above what is required by the regulations.

Figure 3.4. Number of administrative sanctioning procedures and corrective measures, and value of fines, 2011-2014

(Tax units)[a]



Note: a) In 2014, the value of one Tax Unit was PEN 3 800 (about USD 1 300).
Source: OEFA and MINAM.

10. Environmental expenditure and investment

The system of tax-funded works (Act to Promote Regional and Local Public Investment with Private Sector Participation, Law No. 29230), which entails forgoing tax revenue, makes it possible to channel part of the income tax payment by private firms into the formulation and implementation of priority public investment projects at all three levels of government and also at public universities. The firms recover the investment made through a certificate that allows them to deduct it from their income tax assessment. In 2009-2014, projects implemented under this modality increased exponentially, more than doubling each year; 20% of the projects (accounting for 28% of the funding) were in the sanitation sector, 33% in transport and 22% in education; the transport sector accounted for just under half of the investments. In addition, the Public-Private Partnerships Framework Act has strengthened this private investment promotion mechanism. Although not directly related to the environment, it nonetheless has environmental components in which private investment has increased considerably. Projects implemented through public-private partnerships include the construction of waste-water treatment plants in Taboada and La Chira, the provision of sanitation services in the districts of southern Lima, and the construction of some sections of the Lima and Callao metro network.

A large proportion of non-governmental and international co-operation funds is earmarked for the environment, with 17.5 per cent of co-operation funds allocated on a non-reimbursable basis between 2010 and 2014. The United States, Spain, Switzerland and Germany are the main donors. Environmental management is the preferred target of official assistance, while philanthropic grants focus on conservation. As Peru is a middle-income country, dependence on these resources can become problematic. Most of them, whether allocated on a reimbursable or on a non-reimbursable basis, are channelled through funds. The MIVIVIENDA Fund of the Ministry of Housing, Construction and

Sanitation provides a grant for environmental protection in real estate projects, specifically for the adoption of water- and energy-saving measures and solid-waste management according to a plan. In this area, the National Fund for Natural Areas Protected by the State (PROFONANPE) and the National Environment Fund (FONAM) are leading players, with participation by officials from MINAM, MEF and other institutions of the business world and civil society.

11. Eco-efficiency and eco-innovation

In Peru, a national environmental-efficiency programme, known as *Peru Ecoeficiente*, is being implemented to promote savings in energy, paper and water in the public sector (Supreme Decree 009-2009-MINAM). In addition, as a means of encouraging green public procurement, the use of biodegradable and recycled products has been made mandatory (Supreme Decree 011-2010-MINAM). The General Law on the National Budget System provides for measures targeting the same objective; and in 2008, the Business Eco-efficiency Award was instituted.

Although the State Procurement Act recognises the principle of environmental sustainability and requires criteria to be applied to guarantee this in all procurement processes, "seeking to avoid negative environmental impacts in accordance with the rules on the subject", the implementation of a green-growth strategy requires a comprehensive system of green public procurement and incentives for eco-efficiency and the use of clean technologies. The Law Promoting the Development of Techno-ecological Industrial Parks (Law No. 30078, of 2013), created to "ensure the growth and orderly development of industries at the national level with a cluster approach, in accordance with environmental stewardship, efficient energy use, social responsibility and water care", constitutes an innovative initiative on the subject. The creation of the National Quality System in 2014 strengthened measures adopted to standardise environmental management, including labelling; and the energy efficiency standards and labeling project is currently executing.

12. Investment in research and development

Investment in research, innovation and development is at a very low level in Peru, compared to other OECD countries. Expenditure on R&D barely represents 0.1% of sales (CONCYTEC, 2014), although the development of science, technology and innovation has been prioritised since 2012 by strengthening the National Science, Technology and Technological Innovation System. In addition, a national strategy has been formulated and various funds created; and tax benefits have been granted to innovative enterprises. The five programmes approved by the National Council for Science, Technology and Innovation (CONCYTEC) include the National Transversal Programme on Biotechnology and the National Transversal Programme on Environmental Science and Technology. The latter has components related to climate change, the conservation and sustainable use of natural resources, and environmental quality. Patent registration is an indicator used to measure the effects of investment in science and technology, a field in which Peru displays poor results. Among other things, the number of Peruvian patents registered in the United States is below the regional average; and countries with a similar level of development, such as Chile and Colombia, have nearly three times and twice the number registered by Peru, respectively. Since 2010, the National Institute for the Defense of Competition and Intellectual Property Protection (INDECOPI) has registered a very small number of biotechnology patents; 97% of which were granted to foreign nationals.

13. Trade opportunities

Peru has an open economy and has signed trade agreements with the countries and blocs to which it exports. The treaties in force with Canada, the United States, the Republic of Korea and the European Union contain environmental chapters, which facilitated the creation of specialised councils and committees for monitoring and implementing their provisions. One of the titles of the agreement with the European Union is devoted to trade and sustainable development, and there is also a subcommittee dealing with the latter. Side agreements on environmental co-operation have been signed with Canada and the United States (Chapter 5). Under the agreement with Japan, two joint declarations were issued, on trade and the environment and on biodiversity, access to genetic resources and traditional knowledge. In general, bilateral agreements allow the parties to adopt measures to ensure that the environmental consequences of investments are taken into account; and several of them offer opportunities for trade in biodiversity products. Peru participates in several bio-trade programmes, as it is one of the leading exporters of products in that category (Box 9.2). A moratorium was also imposed on the entry into national territory and the production of living modified organisms for a ten-year period (Law No. 29811, of 2011); a regime was established on the subject; Law No. 27811 of 2002 was enacted; the National Commission against Bio-piracy was created, and numerous measures have been adopted to combat this activity.

In addition, as with imported capital goods, a zero tariff is applied to environmental goods recognised by the Asia-Pacific Economic Cooperation (APEC) Forum. The export sector needs to adapt to the demands of global markets, which are expressed both through regulations in the countries in which it sells its products and through greater environmental awareness among consumers, who make increasing demands as to the sustainability of production processes.

Note

[1] See National Superintendency of Customs and Tax Administration (SUNAT), "Memoria institucional" [online] http://www.sunat.gob.pe/cuentassunat/planestrategico/memoraInstitucional.html.

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Chapter 4. Society and environment

Peru has reduced poverty, inequality, malnutrition and environmental health impacts over the past decade while improving access to water and energy services, although there is still room for improvement in all these areas. This chapter reviews Peru's efforts and achievements in the field of environmental democracy, in terms of public participation in decision-making and access to environmental justice and information. Finally, it discusses measures to improve environmental education and raise public awareness of environmental issues.

Key findings and recommendations

The geographical conditions prevailing in Peru, along with the country's socioeconomic structure and activities and its population distribution, underpin a strong relation between environmental health and conditions and quality of life. Environmental variations and changes affect living conditions and economic and production activities of all kinds. Environmental pollution is having a major impact on the prevalence of acute diarrhoeal diseases and acute respiratory infections. There has been a heightened frequency of emergencies caused by natural phenomena, which increased by 54.6% between 2003 and 2013 related to climatic variability.

While the poverty rate has dropped sharply (from 52.5% in 2003 to 23.9% in 2013), inequality measured by the Gini coefficient has improved much more slowly (edging down from 0.49 in 2004 to 0.44 in 2013). The poverty rate in rural areas is three times its urban counterpart. Moreover, in rural areas, basic utilities are in short supply, and water is consumed from unsafe sources and under inappropriate conditions. This persistent inequality is accentuated among the rural population; and it is even worse among vulnerable social groups, such as indigenous peoples (primarily the Quechua and Aymara groups and those of Amazonian origin), who are also the most exposed and vulnerable to environmental conditions, especially those stemming from natural events. Peru displays severe social and living-standard disparities, caused particularly by geographical isolation. These, together with Peru's investment dynamics and a growth model that relies heavily on natural resource exploration and extraction, have driven rural and semi-urban dwellers to migrate to the coastal cities, which offer better prospects in terms of living conditions and infrastructure.

On the education front, the Ministry of the Environment (MINAM) has been working with the Ministry of Education (MINEDU) to promote the environmental-culture, education and citizenship component of the National Environmental Policy. Education in eco-efficiency has been encouraged since 2011 through the Environmental Education Project, whose purpose is to ensure that schools foster knowledge, values and practices that are in harmony with the environment. Efforts in this area are supplemented by the National Prize for Environmental Citizenship, introduced in 2009, and by other initiatives at the university level. Nonetheless, there are still major hurdles to be overcome before the country has an education policy that incorporates environmental contents in a programmatic and permanent way into school systems. Practical actions are also needed in the domain of non-formal education, with a view to building an environmentally more responsible citizenry that is aware of the importance of the environment for the quality of life. This is particularly true for social groups that are vulnerable to climate change or to the externalities generated by works or projects. Information and communication technologies can play a key role in raising social awareness on this issue.

Peru has made major efforts to improve access to information held by the Government and to ensure its transparency; and, in particular, to generate and systemise environmental information and make it more widely available. The Transparency and Access to Public Information Act (Law 27806 of 2003), which is binding on public institutions of the Peruvian State, has expanded conditions for citizen oversight and accountability, while also laying the foundations for transparency in public affairs. With specific reference to the environment, the National Environmental Management System (SNGA), created by law in 2004, together with the National Environmental Information System (SINIA), has provided the basis to facilitate free and open access to environmental information, through a primarily Internet-based service. The number of visits to the system has been growing steadily since its creation; however it is still not widely known or used by the public at large. At the regional and local levels, steps have also been taken to create and implement environmental information systems with MINAM support. However, these efforts have been insufficient.

Environmental understanding, awareness and involvement among the general public is hindered in some cases by a lack of information, and the fact that what is available is provided only irregularly and in a non-standard and non-comparable format, and has to be sought from scattered sources. Problems of access to environmental information, especially for people affected by projects and construction work, and those vulnerable to climatic impacts, can be blamed on many factors: lack of technology, the communication language used in a multilingual country, the capacity of the public to assimilate technical information, and territorial isolation, among others. The system therefore needs to be strengthened at all three levels of government administration —national, regional or departmental and local— to promote citizen participation and raise awareness on the prevention of pollution, environmental degradation, and natural disasters. District and local government capabilities also need to be strengthened, as these entities are the targets of most complaints about lack of information and transparency.

Peru has also adopted legislative and administrative measures to enhance citizen participation in decisions that have environmental implications. Of particular note is the Prior Consultation Act (Law 29785) of 2011, which regulates the process of consulting indigenous communities on activities in their territories, reflecting the provisions of the Indigenous and Tribal Peoples Convention of the International Labour Organization (ILO Convention No. 169). To date, 22 prior consultations have been held or are under way — most of them relating to the energy sector and the environment. At the government level, recognising the sharp increase in socio-environmental conflicts (up by 300% over the period 2010-2015, according to the Office of the Ombudsman), the Ministry of the Environment created the Advisory Office on Socio-environmental Matters in 2011, with a view to managing, preventing and transforming socio-environmental conflicts by creating mechanisms for dialogue between the disputing parties and by proposing strategies for resolving them. The Advisory Office is supplemented by the National Office for Dialogue of the President of the Council of Ministers, which fosters co-ordination and dialogue between sectors and across government levels in dealing with various social conflicts.

Despite these efforts, citizens still have few opportunities to influence environmental decisions. The mechanisms that exist for participation in traditional instruments, such as the environmental impact assessment and territorial governance processes, need to be strengthened and broadened to ensure that the opinions of potentially affected social groups are heard before a project or activity is launched. The quantity, frequency and intensity of socio-environmental conflicts, the diversity of stakeholders involved in them, and the resulting economic and social effects (which increased sharply during the period under analysis) are also a reflection of a set of unmet needs that go beyond the strictly environmental and are rooted in the country's egregious inequalities.

With regard to the application of environmental justice in Peru, Law 29263 of 2008 amended the list of environmental offences, increased the penalties for each offence and aligned the legal terminology with modern definitions of environmental protection. To apply this legislation, the Peruvian Government created a Specialized Prosecution Office for Environmental Offences. Since 2010, this office has been defending the interests of the State in investigations and proceedings involving environmental offences. This move has served to overcome a piecemeal, sector-based approach to environmental protection that impeded proper and effective enforcement of environmental justice. The environmental justice system has been further enhanced by the establishment of Specialized Environmental Prosecutors within the Attorney General's Office; and the creation, in 2013, of two Preliminary Investigation Courts for environmental offences, although their remit covers only two of the country's districts (Piura and Cusco). It is also noteworthy that the entities that make up the National System of Environmental Assessment and Oversight have played a positive role in promoting the enforcement of environmental legislation.

Despite changes in the country's institutions and legal framework, several major loopholes in environmental justice and enforcement persist. The lack of social licences for many projects and construction work, coupled with societal empowerment in defending and protecting the environment and natural resources, has fuelled a growing number of legal challenges, through both administrative mechanisms and the courts, with the consequent need to improve the capabilities of those responsible for applying and enforcing environmental legislation in both instances. Issues such as the burden of proof in court proceedings, or the inadequate level of technical expertise, continue to pose challenges for justice administration.

Recommendations

- Draft a national action plan on environmental health, targeting: (i) enhanced basic sanitation, particularly in rural areas and municipalities; (ii) improved health and safety in the workplace; and (iii) reduced exposure to poor sanitary conditions (air, drinking water, wastewater, solid waste, dangerous substances and all types of pollution and environmental liabilities).
- Bolster and deepen formal and informal education and awareness on environmental issues among the public and the business sector, prioritising the most polluting industries and the communities that are most exposed and vulnerable to risks associated with externalities arising from economic activities and climatological conditions, in order to: (i) improve awareness and fulfilment of rights and duties; (ii) contribute to behavioural changes and the adoption of environment-friendly practices; and (iii) facilitate active and constructive participation in the design and implementation of policies, programmes, strategies and projects that have an impact on the environment.
- Enhance the effectiveness of citizen participation mechanisms in the environmental impact assessment system, and also in plans, standards and programmes and in other forums for social interaction; continue to promote and improve conditions for implementation of the prior consultation mechanism provided for in ILO Convention No. 169, particularly in major investment projects in the mining and energy sectors.
- Improve the capabilities of the judiciary, the Attorney General's Office and other agencies of the justice system with responsibility for law enforcement, in addressing environmental issues; and consider setting up specialised environmental courts. Scale up mechanisms to provide environmental education and training to the judicial branch, within the Judiciary School and other training facilities for judges; improve technical and scientific support for justice administration and law enforcement tasks, and strengthen police agencies that specialise in environmental offences.

1. Current situation

As revealed in the indices of access to basic goods and services, the quality of life of the Peruvian people has improved. Socioeconomic progress in the last few decades has brought with it an over-60%, increase in per capita income and a reduction in the poverty rate from roughly 52% in 2003 to 24% in 2013 (ECLAC, 2016). Nonetheless, the challenge remains to overcome the glaring inequality and environmental degradation generated by economic development. Moreover, increased consumption by a growing middle class is fuelling greater demand for public services and is harming the quality of the environment.

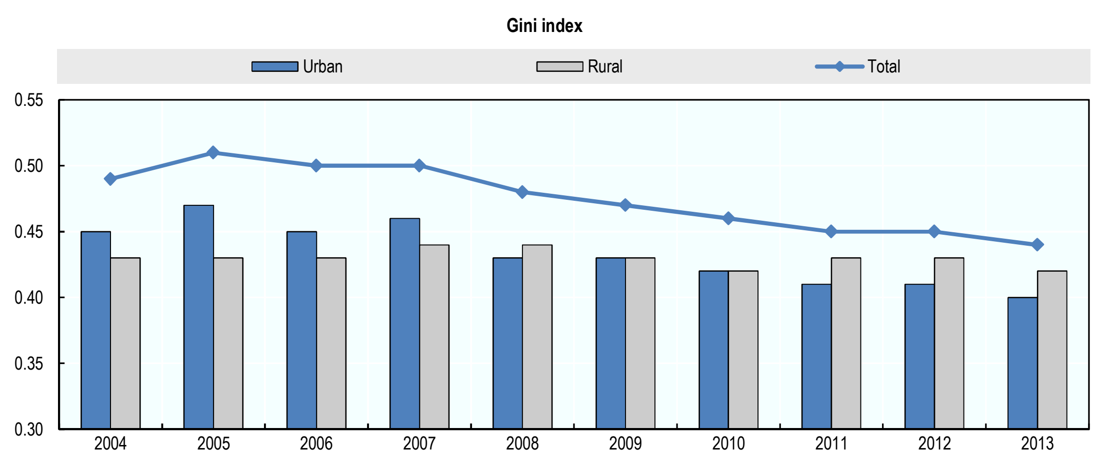
Inequality is reflected in differentiated access to basic goods and services, both between urban and rural areas and between the different geographical regions of the country (coast, highlands —*sierra*— and forest —*selva*— regions), and social disparities including gender, ethnic and age group gaps, among others.

Population growth, the current development model and consumption patterns, compounded by the haphazard expansion of urban areas, lack of land use management and unequal income distribution, contribute to the overexploitation and degradation of environmental services and natural resources (MINAM, 2014a). This situation complicates the relation between society and the environment. On the one hand, pollution and climate change have affected specific population groups differently in terms of health and well-being, and have given rise to serious socio-environmental conflicts; on the other hand, economic growth has stimulated expansion in certain sectors of production, thus contributing to the country's general development.

1.1. Inequality and vulnerability

Although Peru is one of the countries of Latin America and the Caribbean with the lowest inequality index, this remains above that of the vast majority of OECD member states (Chapter 1). Nationwide income inequality, measured by the Gini coefficient, declined from 0.49 in 2004 to 0.44 in 2013. The sharpest reduction occurred in urban zones, where the index shed five percentage points between 2004 and 2013 to reach a level of 0.40; in contrast, inequality decreased by less in rural areas, edging down from 0.43 to 0.42 in the same period (Figure 4.1). In 2013, the highest inequality was recorded in the highland and forest regions, each with a Gini coefficient of 0.47 (INEI, 2013).

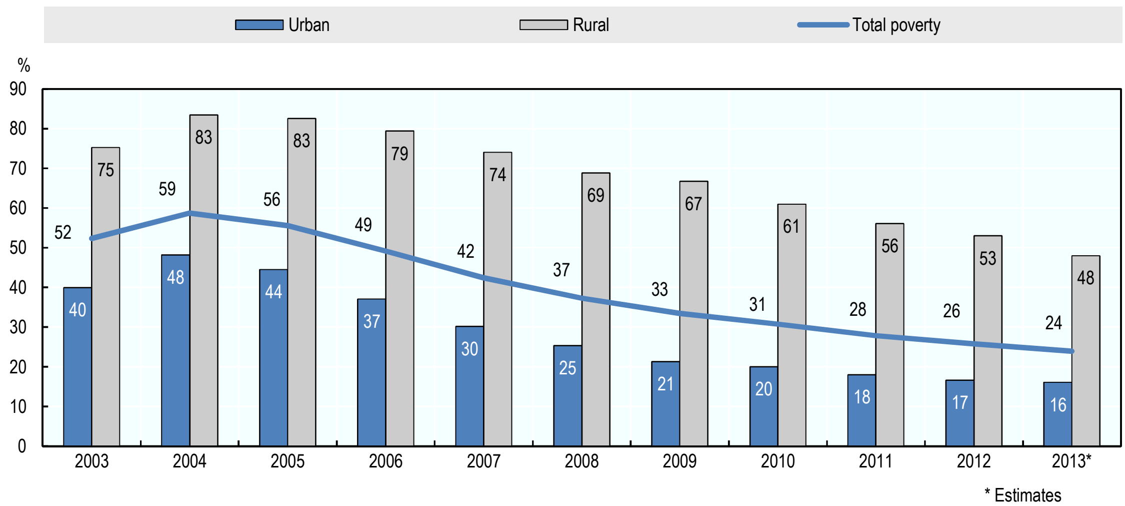
Figure 4.1. Income inequality, 2004-2013



Source: INEI, *National Household Survey* (ENAHO), 2004-2013.

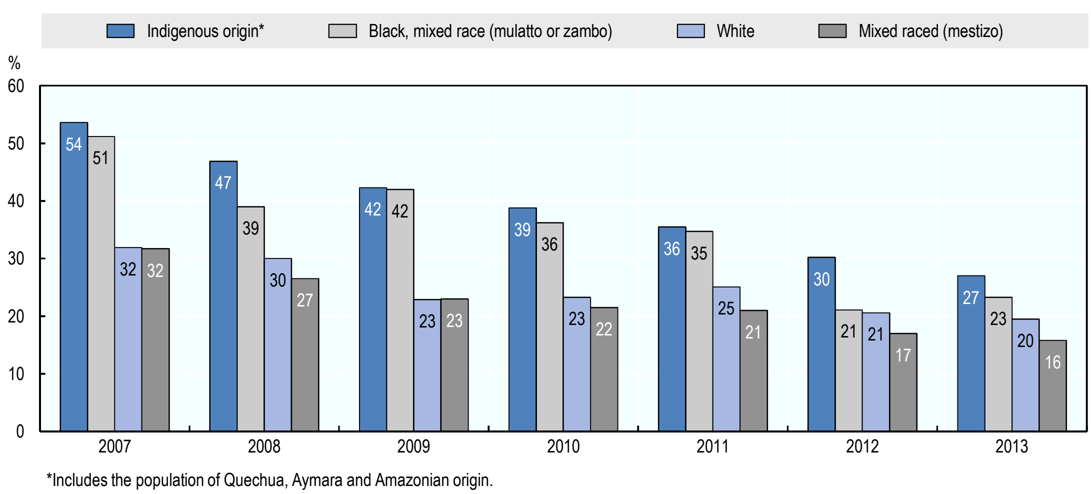
Poverty particularly affects peoples of Quechua, Aymara and Amazonian origin, who are concentrated in the highland and forest regions. In 2007, over half of Peru's indigenous population was living in poverty; but by 2013 the proportion had shrunk considerably to less than one third (Figure 4.3). Nonetheless, in rural areas, poverty remains very high among the indigenous population, with rates of over 40%.

Figure 4.2. Total, urban and rural poverty, 2003-2013



Source: INEI, National Household Survey (ENAHO), 2003-2013.

Figure 4.3. Incidence of poverty by ethnic origin, 2007-2013



Source: INEI, *National Household Survey* (ENAHO), 2003-2013.

Poverty rates expressed in terms of the coverage of public utilities have also decreased, thanks to expanded access to services. The population segment that suffers from at least one unmet basic need[1] decreased from 30.3% in 2007 to 20.3% in 2013 (INEI, 2015b). In the latter year, however, there were sharp differences between departments. For example, in Loreto and Ucayali over half of the population had at least one unmeasured basic need, compared to less than 10% of the population in Lima-Callao and Tacna.

Given the social inequality and territorial segregation that still exist in Peru, the poorest population and those without access to public services are most vulnerable to environmental changes, particularly natural disasters. The risk is compounded by the precarious and informal nature of most homes, built in areas that are prone to such phenomena, including hillsides, riverbanks, coastal strips, unstable land or areas that are remote from assistance centres.

1.2. Access to basic services

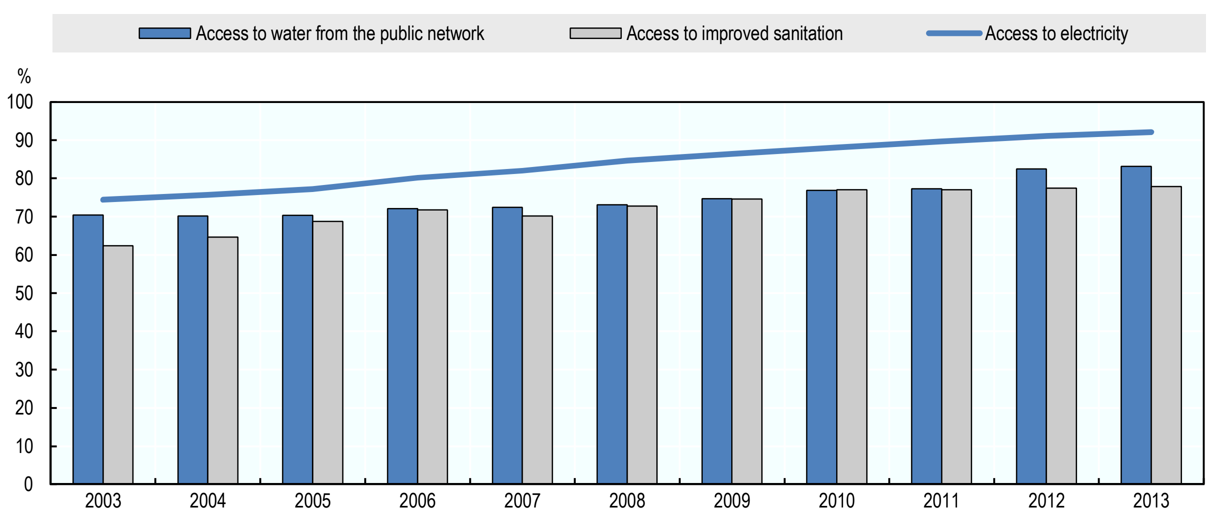
Peru's population growth and economic buoyancy have fuelled a significant increase in energy consumption. In response to this, electric power generation grew by about 7% per year in 2004-2013 (MINAM, 2014b).

In 2003, just 70.4% of households were connected to the public electricity grid. By 2013, coverage had grown to 92.1%. The expansion was much greater in rural areas, where there was also a steeper reduction in poverty, although there are still differences with urban zones in this respect. Between 2003 and 2013, the percentage of households with access to the public drinking water network[2] increased from 70.4% to 83.2%, while the proportion of users with access to improved sanitation services increased from 62.4% to 77.8% (Figure 4.4) (INEI, 2015b).

Access to electricity, water supply and sanitation services is greater in urban zones and in the coastal region. Nonetheless, over 30% of the population in half of Peru's departments lacked access to drinking water in 2011, while in the regions of Amazonas, Loreto and Pasco the figure was about 50%. Moreover, many households that do have drinking water supply suffer from poor water quality and an irregular service (Chapter 8).

Figure 4.4. Access to water, sanitation and electricity services, 2003-2013

(Percentage)



Source: INEI, *National Household Survey* (ENAHO), 2003-2013.

1.3. Pollution

The deterioration in air quality is mainly due to the sustained increase in the vehicle fleet and the use of fossil fuels. The number of vehicles grew by about 70% from 1.3 million to over 2.3 million in 2003-2013 (Chapter 6) (INEI, 2015b). In the same period, vehicle density grew from 50 to 75 vehicles per 1 000 inhabitants.[3] Air quality has deteriorated, particularly in the largest cities, owing to the expansion of the vehicle fleet and its age, particularly in the case of urban transport vehicles. Other sources of atmospheric pollution identified in various zones of the country include brick production, mineral extraction and smelting, industrial fishing activities and electric power generation.

The estimated volume of air pollutant emissions grew sharply in 2003-2012. Particulate materials increased by 14% to a level of 77.5 million tonnes, whereas emissions of nitrogen oxide grew by 72% to 114 600 tonnes and carbon monoxide (CO) emissions increased by 22% to 696 000 tonnes (INEI, 2015a).

Peru has adopted measures to reduce and reverse this trend. Sulphur oxide emissions declined by 11% between 2003 and 2012, from 51 500 to 45 700 tonnes (INEI, 2015a). Over the same period, the consumption of substances that contribute to ozone layer depletion decreased by 76.8% (INEI, 2015a).

According to the World Health Organization (WHO) the use of solid fuels in homes is associated with a rise in mortality from pneumonia and other respiratory diseases in children, together with higher mortality from pulmonary diseases and cerebrovascular accidents among adults.

According to WHO estimates, Peru is one of the Latin American countries with the highest percentage of the population using solid fuels in their homes —around 34% in 2013, and much higher in rural areas.[4] The Millennium Development Goal indicators show that this rate has remained relatively stable.

Moreover, estimates made by the National Institute of Statistics and Informatics (INEI) based on the National Household Survey show a sharp reduction in the number of people who cook exclusively with fire wood or coal: from 29.3% to 8.3% between 2001 and 2011. The steepest fall occurred in the highland region (from 46% to 9%), followed by the forest region (from 59.4% to 26.8%) and the coastal region (from 10.8% to 3.4%) (United Nations, 2013).

A document describing the country's sociodemographic profile, *Perfil Sociodemográfico del Perú*, published in 2008 by INEI, ranks firewood second among the fuels used most frequently for cooking, with 30.2% of households using this form of fuel. The leading fuel was gas, which was used in 55.6% of households. In contrast, in rural areas firewood was the most common cooking fuel, used in 77.4% of households. Those areas often also used animal dung (14.5% of households), particularly in the highland area, where firewood is scarce and the deforestation rate is high.

The 2007 National Population Census found that 83% of households that cooked with fire wood, coal, animal dung or kerosene did not have a chimney in the kitchen; so conditions inside the homes could be highly toxic. In some places, mainly in the Amazon region, the cooker was outside the home, which considerably reduces the problem. To overcome this, since the 1980s, the use of improved cookers has been encouraged, initially to reduce deforestation but subsequently to avoid diseases. The general objective was to address the problem through an integrated approach that recognised its multiple causes and the factors —including poverty, level of education and isolation— that prevented the affected population from using other fuels.

In 2007, the Institute of Work and Family (ITYF) started to implement the "*Sembrando*" project, through which over 90 000 cookers have been distributed. The programmereceived carbon credits, and since 2009 it has been complemented with a campaign titled "*Medio millón de cocinas mejoradas por un Perú sin humo"* [Half a million improved cookers for a smoke-free Peru], which aims to raise the profile of the problem of pollution in the poorest homes and its impact on health. Both were framed by broader poverty-reduction and child malnutrition policies, which facilitates the co-ordination of different actors. In this context, Urgent Decrees 069-2009 and 025-2010 were issued, which authorise local and regional governments to earmark up to 2.5% of their income and mining royalties for the manufacture of upgraded cookers, drinking water supply, and waste management in the highland and forest zones. Thanks to these campaigns, over 155 000 households have certified improved cookers. In addition, under the "Nina" project (2009-2011) of the Ministry of Energy and Mines, over 40 000 cookers that operate with liquefied petroleum gas (LPG) and 64 000 improved wood-burning cookers were distributed to rural communities.

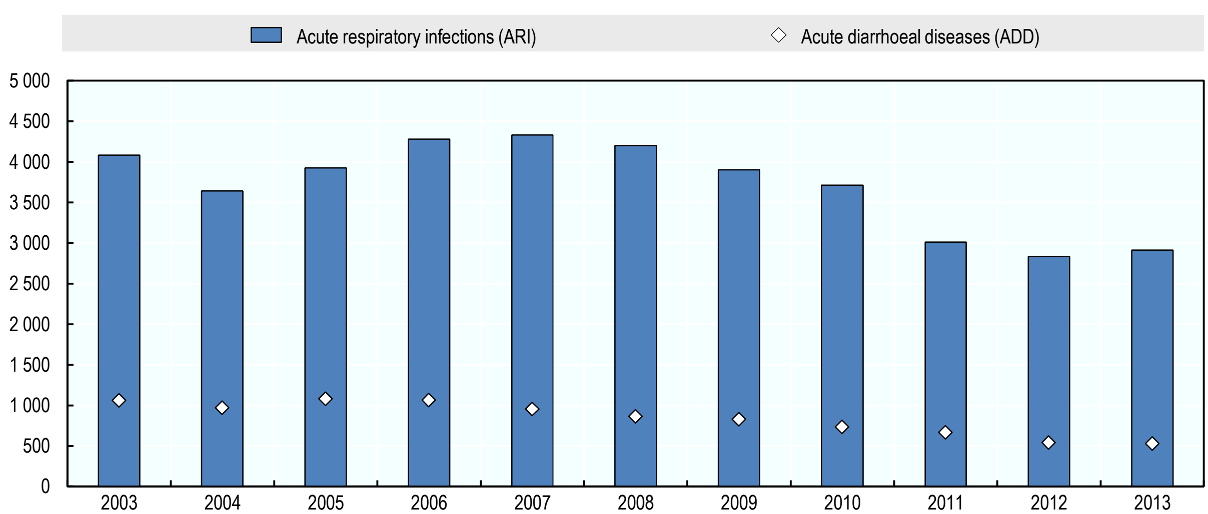
In urban areas, gas is the most widely used fuel (71.4% of households), whereas firewood is used by 15.2% (roughly 780 000 households). This situation undoubtedly contributes to local pollution, but there is no further information in this regard.

1.4. Human health effects of environmental degradation and pollution

There is a direct relation between environmental pollution, on the one hand, and acute diarrhoeal diseases (ADD) and acute respiratory infections (ARI), on the other. Although these illnesses can affect the entire population, they are more common and intense among children under five years of age. In 2003-2013, there was a significant reduction in the incidence of diarrhoeal diseases in this age group, from over 1 million to 529 000 cases diagnosed (Figure 4.5). In addition, ARI cases dropped from 4 million to nearly 3 million. The reduction has been smaller among the population at large, 28.7% for ADD and 2.0% in the case of ARI.

Figure 4.5. Incidence of acute diarrhoeal diseases and acute respiratory infections among the under-fives, 2003-2013.

(Thousands of cases)



Source: Ministry of Health (MINSA), General Office of Statistics and Informatics (OGEI).

Malnutrition also declined sharply, particularly in urbanised areas. Between 1991-1992 and 2010-2011, chronic malnutrition among the under-fives dropped from 62% to 10% in urban areas; and it fell by 32% to 37% in rural zones (United Nations, 2013).

As with environmental pollution, the atmospheric changes caused by climate change are affecting the population's health. Emergencies caused by extreme natural events increased by 55% between 2003 and 2013. Specifically, the number of frosts increased from 73 to 340; intense rainstorms from 388 to 1 177; snowstorms from 16 to 296; and hailstorms from 50 to 157 (INEI, 2016).

1.5. Social and cultural effects of environmental changes

Urban and rural areas display different patterns of economic growth, and differences in terms of the availability of infrastructure and services, income and opportunities. This triggers migration to the cities, land-use change and the loss of ancestral practices.

While migrations may be driven by economic and social factors, they can also respond to anthropic pollution and to the process of climate change. Among other things, these phenomena affect the inhabitants of rural zones with rainfed land and impoverished and eroded soils, and those living in fragile ecosystems.

Urbanisation in Peru has been a rapid process. While rural dwellers accounted for over 50% of the total population in the 1970s, they represent just 23% today. Migration is more common in the highland region, where rural and semi-urban populations move to the smaller coastal cities (INEI, 2011), mainly owing to the exhaustion of soils resulting from over-cropping and grazing, and the abandonment of autochthonous techniques.

2. Relevant actors

The fact that the Transparency and Access to Public Information Act, of 2003 (Law 27806) is binding on government institutions has enabled citizens to inform themselves of the measures adopted by governments, strengthen the link between the State and the population, and promote citizen oversight. The response to information requests and the creation of standardised transparency portals fosters the relation between public entities and the citizenry, in the framework of a modern state at the service of individuals.

Nonetheless, there is unfinished business in this area, since 54.6% of complaints filed against municipalities stem from a lack of information transparency (Office of the Ombudsman, 2013a). These are followed, in order of frequency, by complaints lodged against the education sector (17.4%) and health sector (6.2%), and against regional governments (4.8%). It would therefore be advisable to strengthen the capabilities of district and local governments in this domain.

Law 28245, of 2004, established the National Environmental Management System (SNGA), which provides for mechanisms to facilitate access to information on the environment, and the dissemination of that information nationally, regionally and locally. To that end, the National Environmental Information System (SINIA) was created. The system has been managed since 2009 by MINAM and has been defined as a "network of technological, institutional and human integration that facilitates the systemisation, access and distribution of environmental information: relevant for decision-making and environmental management.

To consolidate the SINIA network, MINAM is encouraging the application of protocols that have been developed to systemise the exchange and flow of environmental information. It is promoting the creation and implementation of regional environmental information systems (SIAR) and local environmental information systems (SIAL). By late 2013, 21 regional governments (84%) had started processes to implement the former, and 45 were starting to apply local environmental information systems (SINIA, 2016).

The Ministry of the Environment, acting through the Department of Environmental Information and Research (DGIIA), is integrating the digital environmental information repositories of libraries and research centres throughout the country. Since the creation of MINAM, two reports have been produced on the status of the environment in Peru, covering 2009-2011 and 2012-2013.

The environmental information system is used by researchers, students and consultants; but it is not yet known nor being used *en masse*. The main constraint is the lack of Internet access for large sectors of the population, particularly those who are directly affected by projects and works, and those most vulnerable to weather phenomena. In addition, easily understandable material needs to be offered, including in indigenous languages. It would also be advisable to strengthen the system at the three levels of government —national, regional or departmental and local— to facilitate participation of the population likely to be affected by pollution, environmental deterioration and natural disasters when adopting preventive measures.

2.1. Citizen participation in environmental decision-making

The Prior Consultation with Indigenous or Originating Peoples Act, recognised in ILO Convention 169 (Law 29785 of 2011) and its respective regulations (Supreme Decree 001-2012-MC) contain provisions on citizen participation in environmental decision-making. The law specifies seven consecutive and mandatory stages in any consultation process related to the adoption of legislative or administrative measures: (i) identification of the measure; (ii) identification of the indigenous or originating peoples that need to be consulted; (iii) dissemination of the measure; (iv) provision of information on the measure; (v) internal evaluation in the institutions and organisations of the indigenous or originating peoples; (iv) dialogue between government representatives and those of the indigenous or originating peoples; and (vii) decision-making.

The relevant functions of the Ministry of Culture, which acts through the Vice Ministry of Inter-culturalism, consist in providing technical assistance to the entities that promote the measures and to the indigenous or originating peoples, throughout the participatory prior consultation process.

As of 2015, 22 national, regional and local consultation processes had been held, 54.5% of which were related to the energy sector, specifically oil drilling, whereas 36.4% concerned protected natural areas. In the agriculture sector, there was a consultation on the regulations to the Forestry and Wildlife Act; and in the health sector, a consultation on the inter-cultural health sector policy.

In recent years, social conflicts have proliferated, mainly owing to territorial segregation and the unequal use and exploitation of environmental services. The Office of the Ombudsman is responsible for monitoring these conflicts, on which it must issue a monthly report. In 2008, the Directorate of the Social Conflicts Unit was created; and three years later the Office of the Deputy Ombudsman for Social Conflict Prevention and Governance was established (Office of the Ombudsman, 2012).

In just under five years, the number of social conflict cases increased by over 300%, most of which involved socio-environmental issues. Whereas disputes of this type were concentrated in four of the country's regions in 2004, they had spread to a further 20 by

2010. The expansion also manifested itself in terms of percentages: in 2011, active or latent socio-environmental conflicts represented 41.7% of the total.

In 2013, a total of 139 disputes were registered, of which 74.8% related to mining activity, and 12.2% to drilling for oil and gas. The departments registering the largest number of socio-environmental disputes are Áncash (22), Apurímac (17), Cajamarca (11), and Ayacucho, Puno and Cusco (9 cases each) (Office of the Ombudsman, 2013b).

The National Office for Dialogue and Sustainability (ONDS), which is a government agency and a technical body of the Office of the President of the Council of Ministers (PCM), is responsible for setting up mechanisms for co-ordination with the different government levels, and with stakeholders and leaders from the public and private sectors. These mechanisms represent an instance of participation and interaction between the representatives of the population involved, organised civil society and the competent local, regional and national entities and authorities. There is also a system for preventing and monitoring social conflicts and information on them, which is linked to ONDS.

The Advisory Office on Socio-environmental Matters (OAAS), created within MINAM in 2011, is responsible for the management, prevention and solution of socio-environmental disputes, and for proposing "updating strategies", which are appropriate to the circumstances and the demands of the population. In 2013, OAAS and several other MINAM agencies, participated in 48 national dialogues, 10 in the north, 17 in the south, three in the east, nine in the south-east, and nine in the central zone (MINAM, 2013).

Other citizen-participation mechanisms include the production of participatory budgets and consensus-based regional and local development plans, which prioritise investments in different spheres, including the environment. The regional technical commissions on ecological and economic zoning and land-use management are another alternative mechanism for consensus- building, and they represent good sustainable development practices.

Despite the existence of these mechanisms, citizen participation needs to be made more effective in terms of environmental impact assessment, plans, standards and programs, as well as other social interaction spaces. Progress should also be made in applying the prior consultation mechanism envisaged in ILO Convention 169, particularly in relation to the large investment projects in the mining and energy sectors.

2.2. Citizen access to environmental justice

Legal remedies under Peruvian environmental protection legislation are specified in constitutional, criminal, civil, and administrative laws. In particular, the Penal Code defines environmental offences. Under Law 29263 of 2008, the concept of "ecological offence" was replaced by that of "environmental offence", and the applicable penalties were increased.

In 2010, the Specialized Prosecution Office for Environmental Offences was created within MINAM, to defend the interests of the state in investigations or judicial processes launched or to be launched, and which are related to the environmental offences specified in the Penal Code.

The Specialized Prosecution Office processed 5 077 cases in 2009-2012, and 2 041 of national scope in 2013. In this period, the most common concerned environmental pollution (1 438), forestry offences (3 990 cases of destruction of forests and illegal trafficking in forestry timber products) and offences related to illegal mining, of which 421 were resolved.[5]

Specialised prosecution departments were created within the Attorney General's Office, to deal with environmental issues, with authority to prosecute offences nationally. In addition, the Superior Co-ordinating Prosecution Department was created, with nationwide jurisdiction.

In 2013, two preliminary investigation courts, specialised in environmental offences, were created in the districts of Piura and Cusco. In the same year, MINAM set up a toll-free telephone line for environmental consultations, advice and complaints, known as "Línea Verde" (the green line).

The National Environmental Evaluation and Oversight System, consisting of sanctioning entities, oversees the fulfilment of environmental legislation by the entire population, and monitors effective compliance with the functions of evaluation, supervision, inspection, control, and sanctioning related to the environment.

Under the legislation on the subject, the governing body of the National Environmental and Oversight System is the Agency for Environmental Assessment and Enforcement (OEFA), which is also responsible for imposing sanctions through the Enforcement, Sanctions and Incentives Directorate. This frames the work of the public administration courts, specifically the OEFA Environmental Enforcement Tribunal (Chapter 2).

Despite the changes made to the country's institutional and legal frameworks, there are still major challenges in terms of justice and the enforcement of environmental legislation. The lack of social licence in numerous projects and works,[6] together with the empowering of society with respect to the defence and protection of the environment and natural resources, has fuelled an increase in environmental litigation. The cases in question have been submitted for hearing by administrative entities and the courts. This has raised the need to improve the capacities of those responsible for applying and enforcing environmental regulations in both spheres. Issues relating to technical expertise or the burden of proof in court proceedings remain major challenges for justice administration.

Consequently, the recommendation is to enhance the capacities of the members of the judiciary and other institutions responsible for enforcing environmental legislation, to evaluate the creation of specialised environmental courts. Another suggestion is enhance the technical skills of the judiciary and other stakeholders in connection with legal mechanisms and to expand environmental education and training mechanisms for the Judiciary School.[7] It is also necessary to provide training on environmental issues to members of the aforementioned institutions, to improve technical and scientific support for justice administration and enforcement of the laws.

2.3. Education and awareness-raising

In 1996, the National Environment Council (CONAM) approved the first National Environmental Action Agenda, which prioritised education; and in 2006 initial steps were taken to formulate a policy on the subject.

Since 2011, the country has been implementing the Environmental Education Project (PEA), with the objectives of promoting education on eco-efficiency, developing knowledge and promoting the adoption of values, attitudes and practices that make it possible to establish a harmonious relation with the environment.

In keeping with the above, in 2012, Supreme Decree 017-2012-ED was issued, approving the National Policy on Environmental Education (PNEA), for which implementation began in 2015. The aim of this policy is for the education system to adopt an environmental approach centred on four components: (i) school management; (ii) health; (iii) eco-efficiency; and (iv) risk management. The policy contains eight guidelines applicable in basic, technical, higher and community education, together with the promotion of interculturalism and social inclusion, educational resources, citizen participation, and innovation and recognition of environmental performance (MINEDU, 2016).

Most universities in Peru offer environment-related courses, such as environmental engineering, biology, geography and sustainable tourism. In Lima, 2.9% of undergraduate students study courses related to environmental sciences. The Department of Madre de Dios, located in the Amazon region, has the highest percentage of students on courses related to environmental issues: 72.6% of the regional total (Bazan et al., 2012). Throughout the country, many universities also offer postgraduate courses in environmental disciplines, including environmental management.

The National Strategic Plan for Science, Technology and Innovation for Competitiveness and Human Development 2006-2021, of the National Council for Science, Technology and Technological Innovation (CONCYTEC), prioritises seven sectors of production: agriculture and agribusiness, fishing and marine and continental aquaculture, mining and metallurgy, forestry, energy, telecommunications, and tourism. It also attaches special importance to health, education, housing and sanitation, disaster prevention, clean technologies and technologies aimed at mitigating the environmental effects of mining, oil, manufacturing and urban activities.

The 2013-2021 Environmental Research Programme, prepared by MINAM, establishes four strategic areas of work to facilitate scientific knowledge to satisfy the needs of the environmental sector: strengthening of the institutional framework for environmental research, implementation of an environmental research management system, financial support, and implementation of mechanisms for exchanging environmental knowledge (MINAM, 2013b).

The sustainable development culture has been promoted in both the public and the private sectors. In the former, Supreme Decree 009-2009-MINAM establishes measures of eco-efficiency and the integration of environmental accountability criteria in public management. As from 2009, MINAM has also supported the Youth Environmental Volunteer Network, which, at the end of the period under analysis, encompassed 69 organisations, groups and networks of 15 regions in the country. In 2010, the University Environmental Network was created at the third National Forum of Universities, Environmental Management and Sustainable Development.

In the private sector, the Business Eco-Efficiency Award was created, jointly administered by MINAM and Universidad Científica del Sur, with support from the National Confederation of Private Business Institutions (CONFIEP); in 2011, this activity was supported by 180 firms. In addition, the National Prize for Environmental Citizenship has been awarded since 2009, with the aim of identifying, recognising, and disseminating innovative and environmentally outstanding activities undertaken by civil society and the private sector.

Notes

1. The unmet needs considered refer to the following: housing of inadequate structure and without hygiene services, whose inhabitants live in conditions of overcrowding and display a high rate of economic dependency and lack of school attendance by school-age children and young people (INEI [online] http://www.ipe.org.pe/content/necesidades-basicas-insatisfechas-ya-satisfechas).
2. This category refers to households with a connection to the public drinking water network either in the home, or outside the home but inside the building, and those who have access to a standpipe.
3. Vehicle density corresponds to an estimate based on demographic data from INEI and information on the vehicle stock from the Ministry of Communications (MTC).
4. See "Indoor air pollution" [online] http://www.who.int/indoorair/en/#.
5. Data from the MINAM Specialized Prosecution Office for Environmental Offences [online] http://www.minjus.gob.pe/ambientales/.
6. The term "social licence" refers to acceptance of the projects, either by the affected parties or those who could suffer an impact from the projects, or by other interest groups.
7. Public institution created under the Constitution for the training of judges and prosecutors, see [online] http://www.amag.edu.pe/es.

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Chapter 5. International co-operation and commitments

This chapter reviews Peru's efforts to fulfill its international commitments to protect the environment. It covers climate change mitigation, with Lima hosting COP20, and biodiversity protection, with Peru being a megadiverse country. It also covers the UN Convention to Combat Desertification and international conventions for the protection of the marine environment. The chapter reviews free trade agreements that address environmental matters, as well as regional and bilateral co-operation. Finally, it discusses measures to make the best use of official development assistance.

Key findings and recommendations

The National Environmental Policy of 2009 reflects in its wording both the Rio Declaration on the Environment and Development and the Millennium Development Goals, as well as the international conventions and treaties to which Peru is a party. The policy mentions the ratification of international treaties at the multilateral, regional and bilateral levels, and cites the free trade treaties as a strategy for integration.

As a result of the international commitments adopted at the United Nations Conference on Environment and Sustainable Development (from Stockholm, 1972, to Rio de Janeiro, 2012), Peru has promoted the incorporation of environmental management instruments that will facilitate their fulfilment. In light of Programme 21, a significant number of municipalities strengthened their institutions by developing local environmental management capacities for the purpose of adopting action plans for local sustainable development. The results were uneven, due to lack of a strategy for promoting this agenda. In response, a Strategy for Strengthening Decentralized Environmental Performance was developed. In 2013, Peru reported auspicious progress toward achieving the Millennium Development Goals.

Peru has ratified the United Nations Framework Convention on Climate Change as well as the Kyoto Protocol. It presented its first Communication on Climate Change in 2001, its second in 2010, and is currently working on its third report. Its greenhouse gas emissions represent slightly more than 0.3% of the world total, with a heavy component attributable to land-use change and deforestation, and growth coupled with the evolution of the economy. Over the last decade there has been systematic progress in the normative and institutional framework relating to climate change. Peru has also developed regional strategies on climate change. It is among the countries that comprise the Cartagena Dialogue for Progressive Action (Diálogo de Cartagena para la Acción Progresiva), a discussion forum that is seeking areas of international convergence toward a solution to climate change. It is also a member of the Independent Alliance of Latin America and the Caribbean (AILAC), a group of seven countries dedicated to concrete progress under the Convention. At the fourteenth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP14), Peru undertook to preserve 54 000 000 hectares of forest as a contribution to mitigating greenhouse gas emissions. At the fifteenth session of the Conference of the Parties (COP15), it pledged to reduce to zero the net deforestation rate in its tropical forests by the year 2020. On the basis of these commitments, it has developed the National Programme of Forest Conservation for Mitigating Climate Change, which in 2014 covered a total of 542 000 hectares of protected forest land. After hosting the twentieth session of the Conference of the Parties (COP20) in 2014, Peru presented its intended nationally determined contributions (INDC) at the twenty-first session (COP21), in which it undertook to reduce its emissions by 30% from the base scenario. The forestry sector will account for 60% of the expected reduction.

Peru is recognised as one of the world's 17 megadiverse countries. In 1993 it ratified the Convention on Biological Diversity; it has been a signatory to the Cartagena Protocol on Biosafety since 2004; and in 2014 it became party to the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilisation. In 2014 it presented the National Strategy for Biological Diversity and its Action Plan, both of which are consistent with the Aichi targets. Although that strategy has achieved a degree of synergy with the National Strategy on Climate Change, in general terms national policies in the energy, agriculture, water, fisheries and other areas bear no direct relationship to the targets, with the exception of the National Environment Policy. In 2015, the Organization of Latin American and Caribbean Supreme Audit Institutions produced a positive assessment of progress in compliance with the agreement established by AICHI Target 11, although mobilising the required financial, human and institutional resources remained a challenge. In 1991 Peru ratified the Convention on Wetlands of International Importance, also known as the Ramsar Convention, and at the beginning of 2015 it adopted a National Wetlands Strategy to promote the conservation and sustainable use of such ecosystems.

In 1995 Peru ratified the Convention to Combat Desertification: the proportion of its surface area in dry lands (around 40%) is in fact one of the highest in South America. In its fourth National Communication, Peru reports that a third of its surface area was in some state of desertification. The main instances of desertification are to be found along the Costa Árida (“Arid Coast”), in the semi-arid Sierra and in Amazonia. An anti-desertification strategy 2008-2018 has been adopted, covering various initiatives by governments, research institutions and NGOs at the national, regional and local levels. It is estimated that USD 225 million has been committed in 46 programmes and projects.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was ratified in 1975. The CITES Secretariat has ranked Peru in category 1, meaning that its legislation meets the requirements for application of the Convention and the country has sufficient administrative, scientific and supervisory authorities to control trade in species covered by the Convention. Peru has two forest species of great commercial interest, mahogany and cedar. In the 1980s and 1990s the mahogany trade enjoyed a great boom, with the consequent increase in illegal logging as a result of which the species was listed in CITES Appendix II in 2002. The restriction on marketing this wood came into force in November 2003. It must be noted, however, that Peru is one of the main exporters of biotrade products, and product controls and traceability must therefore be maintained.

Peru is also party to a series of international conventions for the protection and conservation of the marine environment. These include the International Convention for the Prevention of Pollution from Ships (1973); the Action Plan for the Protection of the Marine Environment and Coastal Area of the Southeast Pacific; the Protocol for the Protection of the Southeast Pacific against Pollution from Land- Based Sources; the International Convention for the Safety of Life at Sea (1974), the Convention for the Protection of the Marine Environment and Coastal Area of the Southeast Pacific; the Supplementary Protocol to the Agreement on Regional Cooperation for Combating Pollution of the Southeast Pacific from Hydrocarbons and Other Harmful Substances; the Protocol for the Conservation and Management of Protected Marine and Coastal Areas of the Southeast Pacific; the Protocol on the programme for the regional study on the El Niño phenomenon in the Southeast Pacific; the International Convention on Oil Pollution Preparedness, Response and Cooperation; and the 1992 Protocol amending the International Convention on Civil Liability for Oil Pollution Damage. It is also a party to the Latin American Agreement on Port State Control of Vessels, signed in 1992 with a view to maintaining an effective inspection system to guarantee that foreign vessels visiting a country`s ports meet the standards established in the international conventions. The objective is that the respective maritime authorities will inspect at least 20% of all foreign vessels entering their ports each year. According to figures for 2013, Peru inspected 27% of the vessels entering its ports, thereby complying with the objective of this agreement.

In 2009 the FAO approved the Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing. While Peru has signed that agreement, it has not yet ratified it. Peru has also had legislation since 1996 prohibiting the catching of dolphins and small cetaceans. Given the existence of a shark fishery, in 2014 Peru adopted the National Action Plan for the Conservation and Management of Sharks, Rays and Related Species, known as PAN Tiburón Perú. Peru is also a party to the International Convention for the Regulation of Whaling and the Agreement on the International Programme for the Conservation of Dolphins. It is a member of the Inter-American Tropical Tuna Commission, the Permanent Commission for the South Pacific, the Latin American Organization for Fisheries Development, and the Amazon Cooperation Treaty Organization, through which it has adopted initiatives to protect, conserve and manage its resources. In addition to the foregoing, Peru ratified the Convention on the Conservation of Migratory Species of Wild Animals in 1997 and the Inter- American Convention for the Protection and Conservation of Sea Turtles in 1999. In its last report, dated 2014, it described a series of activities aimed at conservation of the species. Notwithstanding those efforts, a study conducted in three Peruvian ports estimated that some 5 900 turtles were being taken as by-catch each year.

Peru has been a member of the World Trade Organization (WTO) since 1995, and its commitment to the multilateral system is reflected in the presentation of various proposals in such areas as special and differentiated treatment, agriculture, fisheries subsidies, market access, biodiversity, traditional knowledge, genetic resources, trade facilitation, and environmental goods and services. Peru has an open and diversified economy, and it has pursued international trade as a component of its growth.

Few imports and exports are subject to restrictions or bans, and these are imposed only for reasons of health and safety, to protect the environment, and to comply with international commitments given by the country. Peru has 17 trade agreements in force. At the regional level, it is a founding member of the Andean Community and the Pacific Alliance, and it has a free trade agreement with the Southern Common Market (MERCOSUR). In addition, it has signed trade agreements with the European Free Trade Association and the European Union, as well as with the Bolivarian Republic of Venezuela, Canada, Chile, China, Costa Rica, Japan, Republic of Korea, Mexico, Panama, Singapore, Thailand and the United States. It has concluded two trade agreements (not yet in effect) with Guatemala and Honduras, and is negotiating others with El Salvador and the Trans-Pacific Partnership. The trade agreements that address environmental matters are those signed with the United States, Canada, Republic of Korea and the European Union, although their provisions vary in depth and scope. In the context of these trade agreements, Peru has developed co-operation with the United States on forestry, for example, and with Canada on climate change mitigation in the housing sector. A new project is now being developed on conservation of biodiversity.

When it comes to bilateral and regional co-operation, Peru is an active member of the Forum of Ministers of Environment of Latin America and the Caribbean. It is also a party to the Amazon Cooperation Treaty Organization (ACTO), comprising the Plurinational State of Bolivia, Brazil, Colombia, Ecuador, Guyana, Suriname and the Bolivarian Republic of Venezuela. ACTO has launched a project for monitoring deforestation, logging and land-use change in the Pan-Amazonian forest, the purpose of which is to ensure participatory monitoring of forest cover in Amazonia and to strengthen the existing regional co-ordination mechanisms for forest management. In addition, Peru has a series of bilateral co-operation agreements with countries of the region, including Argentina, Brazil, the Plurinational State of Bolivia, Chile, Colombia, Costa Rica, Cuba, Ecuador, Honduras, Mexico and Panama. With those countries it has been developing an environmental agenda dealing with, among other matters, illegal logging and cross-border pollution, especially from the artisanal gold mining industry.

Peru is promoting the Andean Strategy for Integrated Water Resource Management, being developed under the auspices of the Andean Community. In the Pacific Alliance, Peru is working with Colombia, Chile and Mexico to develop a research network of climate change scientists, who have already produced and published a report on opportunities for collaboration in research on climate change in the countries of the Pacific Alliance (Oportunidades de Colaboración en Investigación sobre Cambio Climático en los países de la Alianza del Pacífico).

According to OECD data, in 2013 Peru received official development assistance (ODA) in a gross amount of USD 532.1 million, and a net amount of USD 367 million. The OECD also reports that annual development co-operation between 2005 and 2009 averaged USD 425 million. Since its adherence in 2006 to the Paris Declaration on Aid Effectiveness, Peru has been working to make more effective use of the resources it receives in the form of ODA. During 2011, Peru conducted an assessment of achievements in terms of co-operation effectiveness. According to this evaluation, there had been progress with respect to aid predictability and co-ordination of local capacity building, but further work was needed on making the national development strategy operational. International co-operation has played a fundamental role in a number of environmental projects, accounting for around 3% of public spending on the environment in Peru. The country has been an active participant in South-South co-operation, primarily within the region, and this has included environmental activities.

Recommendations

- Continue strengthening synergies between the strategies for climate change, biodiversity and desertification; bolster co-ordinated collaborative efforts in those areas to continue making progress with meeting international commitments.
- As a megadiverse country, continue efforts to protect underrepresented land ecosystems and to increase the marine areas under protection in order to progress towards meeting Aichi Biodiversity Target No. 11. Ensure that all Peru's marine ecosystems are duly represented, bearing in mind the proposal for Ecologically or Biologically Significant Marine Areas (EBSA) in the Convention on Biological Diversity. For continental ecosystems, consider increasing the representation of aquatic habitats in the protected natural areas system.
- Continue strengthening capacities for controlling the illegal trade in endangered species under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).
- Strengthen the management of waste products, chemicals and hazardous substances in accordance with international treaties, in particular the Stockholm Convention on Persistent Organic Pollutants, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. Take actions for the implementation of the recently ratified Minamata Convention on Mercury, in particular those aimed at the environmentally sound storage and management of mercury wastes in mining and the elimination of the use of mercury and trading in it.
- Continue the efforts to meet Peru's international environmental commitments in order to reflect the country's growing role in the economy of Latin America and its potential for OECD membership. Continue to make progress with the development of effective and efficient international co-operation that is geared towards the country's environmental needs; seek out synergies between activities and, to the extent that is possible, assess ways to ensure that the achievements obtained through co-operation are sustainable over time, with their own capacities and resources.
- Conduct environmental assessments of trade and investment agreements to identify their adverse repercussions. Continue with the international co-operation activities associated with commercial treaties, in particular those intended to prevent environmental harm caused by the extractive sector's production of export goods. Promote compliance with the OECD Guidelines for Multinational Enterprises and with the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas.

1. Environmental policy objectives

The National Environmental Policy, formulated in 2009, took account of the Rio Declaration on Environment and Development and the Millennium Development Goals, along with the international agreements and treaties to which Peru is a party. The fundamentals of this policy mention the ratification of multilateral, regional and bilateral treaties, and identify free-trade agreements as an integration strategy. One of the objectives of this policy is to "achieve eco-efficient and competitive development of the public and private sectors, while promoting national and international economic and environmental potentials." The policy also establishes a specific pillar related to international commitments on the environment and the opportunities these offer.

2. Sustainable development and multilateral agreements

Peru has participated actively in the international debates on sustainable development, and it was represented at the United Nations Conference on the Human Environment (Stockholm, 1972), the United Nations Conference on Environment and Development (Rio de Janeiro, 1992), the World Summit on Sustainable Development (Johannesburg, 2002) and the United Nations Conference on Sustainable Development (Rio de Janeiro, 2012).

Peru has adopted environmental management tools to facilitate compliance with the international commitments signed at those conferences. Among other things, in connection with Agenda 21 (Programme of Action for Sustainable Development), adopted in Rio de Janeiro in 1992, many municipalities strengthened their environmental management capacity to put plans of action for local sustainable development in place. Although progress has been made in applying Agenda 21, it has been uneven, because there is no strategy for promoting it (Peru, Government of, 2012). Accordingly, a strategy for strengthening decentralised environmental performance was developed, which aims, among other things, to promote better environmental performance by the municipalities, through a recognition awarded by the Ministry of the Environment (MINAM) (Peru, Government of, 2014c).

In 2013, Peru submitted a progress report on its fulfilment of the Millennium Development Goals, which stated that it had reduced the percentage of the population that use solid fuels, although the rate itself remained high, while carbon dioxide emissions had increased. The land area with forest cover had shrunk, as a result of land-use change; and considerable progress had been made towards the target of halving the percentage of the population without sustainable access to drinking water and basic sanitation services (Peru, Government of, 2013b).

Peru has undertaken to apply the 2030 Agenda for Sustainable Development, which includes 17 development goals, aimed at bringing an end to poverty, combating inequality and injustice, and mitigating the effects of climate change. In 2014, two national public consultations were held to discuss the means for implementing the new Sustainable Development Goals of the United Nations by 2030, as part of the post-2015 Development Agenda.

2.1. Climate change

Having ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1993, Peru submitted its first national communication on the subject in 2001, reporting on greenhouse gas (GHG) emissions since the base year of 1994. At that time, the main source of carbon dioxide emissions was the non-energy sector, owing to deforestation, while in the energy sector, urban transport was the largest source (Peru, Government of, 2001). In 2010, Peru presented its second national communication, reporting CO_2 equivalent emissions in excess of 120 000 Gigagrams (Gg), representing just over 0.3% of the global total. It also reported a 21% increase in emissions relative to those of 1994, which is probably directly related to the expansion of national economic activity in that period (Government of Peru, 2010). It has recently submitted its third national communication.

The second communication on climate change highlights mitigation and adaptation activities, but does not mention an exhaustive analysis being made of its impact at the national and subnational levels.

Peru is not obliged to reduce GHG emissions. Nonetheless, the country has adopted measures to meet the threat of climate change. In 2003 it approved the National Strategy on Climate Change; and it then adopted the National Environmental Agenda 2005-2007, and Law No. 27345) concerning the promotion of efficient energy use, the National Environmental Policy (2009) and the National Environmental Action Plan (2011). It has also formulated regional climate change strategies, the first of which corresponds to the region of Junín (2007). Fourteen of Peru's 25 regions had a strategy of this type in September 2014 (Government of Peru, 2015).

Peru is also a party to the Cartagena Dialogue for Progressive Action, which seeks areas of convergence to combat climate change; and it is a party to the Independent Alliance of Latin America and the Caribbean (AILAC), which aims to make concrete progress towards the UNFCCC objectives.

In 2014, Peru hosted the twentieth session of the Conference of the Parties to UNFCCC (COP20), the highlight of which was the approval of the "Lima call for climate action", which includes the draft negotiating text for COP21. In the same year, it prepared the draft of the new National Strategy on Climate Change, an update of its 2003 predecessor, and this was approved in 2015. The new strategy focuses on two large-scale objectives: (i) increase awareness and adaptation capacity to deal with the adverse effects of climate change and the opportunities this offers; and (ii) conserve carbon reserves and contribute to GHG reduction. Like the second national communication, the new strategy recognises the close interrelationship that exists between climate change and biodiversity, and the latter's contribution to mitigating GHG emissions and adaptation to the phenomenon (Government of Peru, 2015).

2.2. Mitigation

The second national communication cites a projection that sees emissions growing on a sustained basis in all sectors, although more rapidly in the energy, agriculture and land-use sectors. By 2050, emissions are expected to have tripled in the first two of these sectors and to have increased by 137% in the third (Government of Peru, 2015).

In view of the importance of land-use change, in COP 14 (held in 2008), Peru undertook to conserve 54 million ha of forest as a contribution to global efforts to mitigate GHGs. In COP 15, its commitment was to reduce to zero the net deforestation rate in tropical forests by 2020. These commitments formed the basis for developing the National Forest Conservation Programme for the Mitigation of Climate Change (PNCBMCC). The objective of this programme is to strengthen the capacities of indigenous and rural communities living in and around Peru's Amazon tropical and dry forests, with a view to their good management and the promotion of sustainable production activities. In 2014, the results achieved by the programme by granting conditional transfers had meant a conservation commitment of 542 000 ha and benefits for 5 038 families (MINAM, 2016).

Peru is a party to the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD). The design and implementation of this programme in Peru are the responsibility of

PNCBMCC, for which it receives assistance from Japan. As part of this programme, between 2012 and 2013, activities were undertaken to develop capacities among indigenous peoples, with the aim of disseminating the UN-REDD mechanism and enhancing its contribution to the formulation of measures and their application in the country. A total of 400 indigenous people participated in these activities (UN-REDD, 2014). One of Peru's objectives in this area is to produce a national strategy on forests and climate change, to address deforestation and forest degradation in a co-ordinated manner across all government levels.

Although Peru is not a large emitter in absolute terms, it is adopting mitigation measures. The energy sector has supported the adoption of legal measures encouraging the use of renewable energy sources and energy efficiency. The country has significant renewable resources for power generation, so it would be advisable to continue promoting their use. Transport remains the largest consumer of oil, which is still the country's major energy source, contributing just under 50% of the total.

Altogether 60 projects have been registered with the Executive Board of the Clean Development Mechanism (CDM), which should allow for a reduction of over 9 million tonnes of carbon dioxide equivalent. Just 15 of these have been issued mission reduction certificates for a total of 4.5 million tonnes (UNEP DTU Partnership, 2015). In 2012, 185 CDM projects were registered, of which 44 were approved by a designated national authority, which in the case of Peru is the Ministry of the Environment (FONAM, 2012). Progress has also been made in developing initiatives that could be classified as country-appropriate mitigation measures, with international assistance. These include a measure that aims to improve the Lima public transport system, by strengthening the institutions responsible for its management and fleet modernisation, among other things (GIZ, 2014). A preparatory programme is also being implemented to develop a household waste management measure, with assistance from the governments of Nordic countries, (NORDEN, 2015).

In October 2015, Peru presented its intended nationally determined contributions (INDC), in which it undertakes to reduce its emissions by 30% relative to the base situation. Domestic public and private funds will be available for the first 20% of reduction, while the remaining 10 percentage points are conditional on receiving international co-operation and financing. As much as 60% of the proposed reduction corresponds to the forestry sector, specifically the mitigation of deforestation (MINAM, 2015).

2.3. Adaptation

Between 1970 and 2009, Peru was the Latin American country which registered the largest number of fatalities and the second largest number of affected people, owing to 105 natural disasters of which 71% were of a hydro-meteorological type. In this context, the El Niño phenomenon, which produced two severe episodes in 1982-1983 and 1997-1998, caused losses estimated at USD 6.8 billion (IDB, 2011). Some studies suggest that unless appropriate measures are adopted, the negative effects of these events could represent between 1% and 4% of GDP by 2030, and 3% – 20% by 2050. An estimated PEN 1.6 billion were assigned from the annual public budget in 2007-2009 for adaptation to the effects of climate change (IDB, 2011).

Given the country's vulnerability to climate change, the adoption of adaptation measures is a priority. Peru's second national communication notes that over 60 projects and activities were executed in this sphere between 1999 and 2009 —concentrated in the regions of Piura, Cusco, Apurímac, Junín, San Martín and Cajamarca (Government of

Peru, 2015). In 2007-2008, a pilot project was implemented in Piura and Arequipa, which served as a basis for designing adaptation measures related to water management, the agriculture sector, environmental education and policy-making (Piura and Arequipa, Governments of, 2010).

In 2009 the Climate Change Adaptation Programme (PACC PERU) began execution, involving co-operation between the Ministry of Environment and the Swiss Agency for Development and Cooperation; and it was executed in the regions of Apurímac and Cusco. In the first phase, information was collected on climate change and its effects, regional and local policies were formulated on the subject, and impact indicators were monitored (MINAM/SDC, 2013). In 2008-2012, an Andean micro-watershed project was executed through the MDG Achievement Fund, which allowed for capacity building in the regional and local governments of Apurímac and Cusco (MDGF, 2012). Another example is the proposal of adaptation measures in the forestry-agricultural, energy and health sectors in the Mantaro River watershed (Government of Peru, 2005).

Many of the activities that are under way are receiving international technical and financial assistance; and progress has been made in strengthening climate change adaptation capabilities. Studies have been conducted on vulnerability and adaptation, and measures have been adopted in some regions. Nonetheless, work remains to be done: in particular, actions need to be intensified in regions where interventions are as yet incipient; wherever possible adopting technologies that promote adaptation; and intersectoral integration needs to be fostered to achieve synergies in the adoption of measures. In the medium term, internal mechanisms need to be created to make it easier to finance the activities.

2.4. Biodiversity

Peru ratified the Convention on Biological Diversity in 1993; and it has been a signatory to the Cartagena Protocol on Biosafety since 2004, and of the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization since 2014.

The fifth national report on the application of the Convention on Biological Diversity gives details on the status of all aspects of biodiversity, the threats facing it and the challenges posed for its conservation. In 2014, the National Strategy on Biological Diversity was published along with the corresponding Plan of Action, which sets objectives for 2021, and identifies indicators and activities for achieving them. Both instruments are consistent with the Aichi Targets1 (Government of Peru, 2014a).

Application of the National Strategy on Biological Diversity has made it possible to exploit a number of synergies with the National Strategy on Climate Change, which could be expanded by integrating national strategies on forests and climate change. Nonetheless, apart from the National Environmental Policy, national policies on energy, agriculture and water and fishing resources, among others, are not directly related to the Aichi Targets. The same is true of the national energy plans and strategies, which also do not contain implementation guidelines. Nonetheless, it has been possible to preserve the diversity of some ecosystems through a mechanism of control, supervision and inspection of the exploitation of biodiversity; and measures have been adopted to encourage respect for, and recognition of, their value. Progress has also been made on protecting aquaculture species, in applying a system for the distribution of benefits and access to them, and on the participation of indigenous and local community organisations (Government of Peru, 2014b).

Peru's protected marine areas include the Paracas National Reserve, the San Fernando National Reserve and the Islands, Islets and Guano Capes National Reserve. The National System of State- Protected Natural Areas (SINANPE) is responsible for managing these protected areas, whether public or private. In 2014, the Organization of Latin American and Caribbean Supreme Audit Institutions, performed an evaluation to determine the degree of fulfilment of Aichi Target 11, in the framework of the Convention on Biological Diversity. That exercise analysed 1 120 protected areas in 12 Latin American countries, of which 77 were in Peru. An evaluation made by the Comptroller General of the Republic found that 50% of the 64 protected areas were subject to a high level of management and implementation, 44% displayed a medium level and 6% were of low-level. In the 13 remaining areas, the respective percentages were 31%, 31% and 38% (OLACEFS, 2015). In fact, Peru displayed the highest level of management and implementation of the protected natural areas of all countries analysed.

In 1991, Peru ratified the Convention on Wetlands of International Importance especially as Waterfowl Habitat, also known as the Ramsar Convention. The report presented at the twelfth Conference of the Parties shows that Peru has 13 wetlands covering an area of nearly 8 million ha.

In early 2015, the country adopted the National Wetlands Strategy, which aims to promote the conservation and sustainable use of these ecosystems, based on four strategic pillars, to: (i) reduce their vulnerability; (ii) strengthen management capacity; (iii) achieve participatory management; and (iv) foster application of the traditional knowledge and techniques of originating peoples in managing these ecosystems.

Wetland management is not a simple task. The most problematic aspects are surveillance and monitoring, owing to the lack of information. Accordingly, the authorities suggest an initial step would be to prepare a national wetlands inventory, for which financial, institutional and human resources are needed (MINAM, 2014b).

The Programme on Man and the Biosphere of the United Nations Educational, Scientific and Cultural Organization (UNESCO) recognises four biosphere reserves in Peru. These are the Huascarán Biosphere Reserve, which contains Cordillera Blanca, the highest in the world in tropical zones; and the Manu National Park spanning the departments of Cusco and Madre de Dios, which conserves stretches of tropical forest, both of which are declared World Heritage Sites. In addition, there is the North-East Biosphere Reserve, which protects the dry equatorial forest of the North of Peru, and the Oxapampa-Asháninka-Yanesha Biosphere Reserve, which is a biological corridor in the country's central rainforest (selva) zone (SERNANP, 2014).

2.5. Bio-trade

The National Programme to Promote Bio-Trade, in which public and private entities participate, began execution in 2003. It is chaired by the Ministry of Foreign Trade and Tourism (MINCETUR), the Commission for the Promotion of Peruvian Exports and Tourism (PROMPERU) and the Institute for Research in the Peruvian Amazon (IIAP). Peru's bio-trade exports were estimated at USD 111 million in 2007 and USD 114 million in 2008 (UNCTAD, 2012). In 2010 these figures exceeded USD 300 million, making Peru one of the largest exporters of this type of product.

The Perúbiodiverso project, implemented by the Swiss Agency for Development and Cooperation and the German Agency for International Cooperation financed the holding of the "Perú Natura" fair, which, since 2006, has been the main platform for promoting bio-trade. The fair attracts participation from exporters, marketers, agents, distributors, importers and processors from all over the world.

The Commission for the Promotion of Peruvian Exports and Tourism operates a mechanism to support exports of bio-trade products. In 2012, the Bio-trade Research and Innovation Agenda was adopted, with backing from the National Council for Science, Technology and Technological Innovation (CONCYTEC), the Ministry of the Environment, the Peruvian Institute of Natural Products (IPPN), and the Perúbiodiverso project. In addition, MINAM published the Bio-trade Manual in 2014, to disseminate bio-trade principles and criteria, and promote the application of good practices in this sphere.

Peru participates in the Andean Bio-trade Programme, which has representation from the United Nations Conference on Trade and Development (UNCTAD), the Development Bank of Latin America (CAF) and the Andean Community General Secretariat. The objectives of this programme are to provide support to national bio-trade programmes in Andean countries, foster the creation of markets for their products, develop capacities and accumulate financial resources for entities that engage in bio-trade in the region. Among other activities, a programme is being implemented in Peru to facilitate exports of Andean and organic agricultural products with nutraceutical value,[2] and to promote experience-based ecotourism in the province of La Unión, located in the north of the Department of Arequipa, where the Cañón de Cotahuasi is situated (CAN-CAF-UNCTAD, 2005).

2.6. Desertification

The United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa (UNCCD) was ratified in 1995 by Peru, which has one of the largest areas of dry lands in South America, after Argentina and Brazil. These lands encompass 516 000 km^2, representing roughly 40% of national territory.

Peru's fourth national communication presented to UNCCD reported that one third of Peru's land area was affected to some extent by desertification, whether as an outright desert zone (3%) or as an area undergoing desertification (23%). This process is occurring most intensively along the arid coast, in the semiarid highland (sierra) area and in the Amazon zone, albeit for different reasons. On the coast, the main causal factor of this phenomenon is soil salinisation; in the highlands it is the erosion caused by precipitation and wind, and in the Amazon area it is hydric erosion caused by constant rainfall (Government of Peru, 2011).

Peru's 2008-2018 Strategy to Combat Desertification and Drought encompasses state, regional and local initiatives by government entities, research institutions and non-governmental organisations. An estimated USD 225 million has been allocated to the strategy's 46 programmes and projects.

2.7. Endangered species

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was ratified by Peru in 1975. The CITES Secretariat has placed Peru in category 1, after analysing its legislation, which means that it fulfils the requirements imposed by the convention (CITES, 2015).

Peru has administrative, scientific, and inspection institutions that control the species trade pursuant to the provisions of the Convention. Its 2011-2012 biennial report indicated that 1 016 permits had been granted to export endangered species. In 2011, major confiscations led to the recovery of 1 301 specimens of fauna and 131 flower specimens, and in 2012, 1 257 specimens were seized (Government of Peru, 2013a).

In 2013, the sixteenth Conference of the Parties analyse the trends of trade in the species listed in appendix II of the Convention. This found that Peru was the world's second largest exporter of mammal skins (840 219 units), after Argentina. It is also the world's third largest wood exporter (66 173 m^3), after Cameroon and Congo (CITES, 2012).

Peru bans commercial hunting, extraction and export of certain species of wild fauna, including sea lions, except for research purposes or for exhibition in animal parks and zoos, for which prior authorisation is required from the Ministry of Agriculture and Irrigation. This prohibition is also applicable to live species of vicuña, chinchilla and guanaco. Exceptions are specimens unsuitable for breeding destined for scientific and cultural dissemination purposes, and those that originate from management or breeding areas authorised by the Ministry. There is also an export ban on llamas, alpacas, vicuñas and guanacos and their hybrids; and on caoba and cedar, camu camu, cats' claw herb, botanical seeds and maca root byproducts (MINCETUR, 2009).

Peru has two forest species of high commercial value: caoba and cedar. Exports of caoba began in the mid-twentieth century, and in the 1980s and 1990s its trade surged, leading to an increase in illegal tree felling. As a result, in 2002, the species was included in appendix II of CITES, which means that it is threatened, and corrective measures must be adopted to prevent it becoming extinct. In November 2003, a restriction was imposed on the sale of this wood, and its exportation requires a declaration on the status of the crops of the species issued by the Faculty of Forestry Sciences of Universidad Nacional Agraria La Molina, which is the scientific authority for wood flora in Peru (UNALM, 2007). In 2010, a decree was issued to strengthen articulation mechanisms between the authorities to determine and apply the national export quota. The quota indicates the maximum number of trees that can be felled per year and the management areas from which they originate. Each unit must be checked before and after felling, which is the responsibility of the National Forest and Wildlife Service. In 2015, a quota of 109 trees was established, with a volume amounting to 1 152 m^3.

3. Trade and the environment

Peru has been a member of the World Trade Organization (WTO) since 1995; and its adherence to the multilateral system is reflected in its constant and active participation in this organisation and in the Doha Development Round negotiations. It has also sponsored several proposals, both individually and with other WTO member countries. These cover issues including special and differential treatment, agriculture, fishing subsidies, market access, biodiversity, traditional knowledge, genetic resources, trade facilitation, environmental goods and services, and services (WTO, 2013).

Peru currently has 17 regional and bilateral trade agreements in force. Regionally, it is a founding member of the Andean Community and the Pacific Alliance, and it is a signatory to a free-trade agreement with the Southern Common Market (MERCOSUR). It has also signed trade agreements with the European Free Trade Association (EFTA) and the European Union, and with the Bolivarian Republic of Venezuela, Canada, Chile, China, Costa Rica, Japan, Mexico, Panama, the Republic of Korea, Singapore, Thailand, and the United States. It also signed trade agreements with Guatemala and Honduras, although these are not yet in force; and it is participating in negotiations with members of the Trans-Pacific Partnership (TPP) and El Salvador.

The agreements with Canada, the European Union, the Republic of Korea and the United States address environmental issues, albeit with differing scopes and ambitions. For example, the Trade Promotion Agreement with the United States has a chapter on the environment, but an environmental co-operation agreement has also been signed. The agreement with the European Union also has a chapter on trade and sustainable development, which addresses issues such as trade, the environment, and labour practices and policies. The Canada-Peru Free Trade Agreement has an environmental chapter, although an agreement on the environment was also signed.

The application of commitments and co-operation are evaluated to determine the degree of compliance with the contents of the agreements in question. These evaluations involve representatives from the Ministry of Foreign Trade and Tourism and the Ministry of the Environment. Specifically, since 2010, the Environmental Affairs Council, provided for in the Environmental Cooperation Agreement with the United States, meets periodically to determine the progress achieved in applying its provisions. In 2013, the Peru-Canada Environmental Committee met to analyse the issues considered in the agreement regarding the environment. Meetings have also been held of the Subcommittee on Trade and Sustainable Development of the Trade Agreement between Colombia, Peru and the United States.

During the process of negotiating an agreement, some countries make ex ante evaluations to analyse the potential environmental effects attributable to trade between the parties. Canada made an assessment of this type before signing its agreement with Peru, and concluded that the expansion of trade between the two countries would not have a significant domestic environmental impact, but it does not refer to the effects that the agreement could have for Peru. Moreover, the evaluation performed before the signing of the agreement between the European Union, Colombia and Peru, found that it could have negative consequences for the two countries such as deforestation and a reduction in biological diversity, owing to the expansion of agricultural and timber operations. It could also generate an increase in pollutant emissions from the manufacturing, agricultural and mining sectors (OECD, 2010). Peru has not yet performed ex ante environmental evaluations; but, given the sustained increase in its international trade, it might be advisable to start doing so.

Trade agreements are also subjected to ex-post environmental assessments. A recent study performed by the United States Government Accountability Office shows that Peru has adopted a series of measures including to improve environmental protection, strengthen the supervision agencies and combat illegal tree felling and trafficking in wild species (GAO, 2014). Peru does not expect to perform ex post environmental evaluations despite the fact that the agreement with Colombia and the European Union does provide for an evaluation of this type. In collaboration with the European Union, the country is collecting information on the experience gained from these evaluations, with a view to developing its own methodology.

Peru has engaged in co-operation activities in the framework of the trade agreements it has signed. The co-operation agreement with United States envisages activities focused on the forestry sector (MINCETUR, 2015). In addition, in fulfilment of the agreement on the environment with Canada, up to 2013 activities were developed in relation to climate change, particularly mitigation of the effects of climate change in the housing sector. A new project is currently being formulated on biodiversity conservation (OECD, 2014).

The measures implemented under the aforementioned trade agreements aim to adequately incorporate environmental protection, both in trade activities and in those related to foreign investment. Nonetheless, enforcement of the OECD guidelines on multinational enterprises and due diligence need further strengthening, for the responsible management of the supply chains of minerals sourced from conflict-affected and other high-risk zones.

4. Marine environment

4.1. International instruments to prevent marine pollution

Peru is signatory to several international conventions on the protection and conservation of the marine environment, including the following: the International Convention for the Prevention of Pollution from Ships (1973); the Action Plan for the Protection of the Marine Environment and Coastal Area of the Southeast Pacific; the Protocol for the Protection of the Southeast Pacific against Pollution from Land-Based Sources; the International Convention for the Safety of Life at Sea (1974); the Supplementary Protocol to the Agreement on Regional Cooperation for Combating Pollution of the Southeast Pacific from Hydrocarbons and Other Harmful Substances; the Protocol for the Conservation and Management of Protected Marine and Coastal Areas of the Southeast Pacific; the Protocol on the programme for the regional study on the El Niño phenomenon in the Southeast Pacific; the International Convention on Oil Pollution Preparedness, Response and Cooperation, and the 1992 Protocol amending the International Convention on Civil Liability for Oil Pollution Damage.

Some of these instruments have been adopted under the auspices of the International Maritime Organization (IMO). The General Directorate of Harbour Masters and Coastguards (DICAPI), attached to the Ministry of Defence, is responsible for their application, by verifying that vessels entering Peruvian ports have international certificates accrediting fulfilment of the conditions needed to avoid risks in terms of safety and environmental damage. Although the system functions efficiently, implementation of the International Convention for the Prevention of Pollution from Ships is still insufficient.

Since 1992, Peru has been a party to the Latin American Agreement on Inspection of Ships by the State having Jurisdiction over the Port, the aim of which is to apply an effective inspection system to guarantee that foreign ships visiting the ports of countries in the region fulfil the regulations specified in the international conventions. Thus far, the agreement has been signed by 15 countries, whose maritime authorities undertake to inspect at least 20% of foreign ships entering the ports annually (Acuerdo Latino, 2012). Figures for 2013 show that the Maritime Authority of Peru inspected 27% of foreign ships entering its ports, thereby fulfilling the targets of the agreement.

Since 2008, Peru has been participating in the regional task group for application of the GloBallast Project, which aims to reduce the risk of blooms of exotic invasive aquatic species that use ballast waters as a vehicle of dispersion. This is a co-operation project financed by the Global Environment Facility (GEF) and implemented by the United Nations Development Programme (UNDP). In the fifth meeting of the regional group, held in Colombia, Peru reported on the awareness raising measures it is adopting, and activities aimed at ratifying the future international convention on the control and management of ship's ballast waters and sediments (CPPS, 2014).

4.2. Conservation and regulation of maritime resources

Although Peru has fishing regulations, illegal fishing is also practised in the country. The Ministry of Production is responsible for inspecting catches in Peru's coastal waters, and has often confiscated illegally caught specimens. As a way to combat illegal fishing internationally, the thirty-sixth session of the Conference of the Food and Agriculture Organization of the United Nations (FAO), in 2009, approved an agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing. The agreement was signed by Peru but has not yet been ratified.

In 1996, Peru adopted a regulation prohibiting the catching of dolphins and small cetaceans. In addition, in 2014 it approved a National Action Plan for the Conservation and Management of Sharks, Rays and Related Species (PAN Tiburón – Perú). This plan includes other regional and international instruments for the protection of marine species, such as the Regional Plan of Action for the Conservation and Management of Sharks of the Permanent Commission for the South Pacific and the International Plan of Action for Conservation and Management of Sharks, of FAO. It is also a party to international and regional instruments to protect marine resources, including the International Convention for the Regulation of Whaling and the Agreement on the International Programme for the Conservation of Dolphins, and it is a member of the Inter-American Tropical Tuna Commission, the Permanent Commission for the South Pacific, the Latin American Organization for Fisheries Development and the Amazon Cooperation Treaty Organization. Under these instruments, Peru has adopted measures to protect, conserve and manage marine resources. As an affiliate State, it also participates in the Commission for the Conservation of Antarctic Marine Living Resources.

In 1997, Peru ratified the Convention on the Conservation of Migratory Species of Wild Animals, and in 1999 it ratified the Inter-American Convention for the Protection and Conservation of Sea Turtles. Its most recent national report, submitted in 2014, states that it is undertaking a number of activities to promote the conservation of this species, including awareness-raising, observation and research programmes. Nonetheless, small-scale fishing tends to result in the unintentional capture of turtles. A study performed in three of the country's ports on the incidental capture of this species owing to bottom set nets and drift nets, estimated that about 5 900 marine turtles are caught at these three sites every year (Alfaro-Shigueto et al., 2011).

5. Multilateral agreements on the environment related to waste, chemicals and hazardous substances

The Ministry of the Environment reports that fulfilment of international commitments on the environment, specifically related to solid waste and chemicals, adopted by Peru are governed in particular by the following: (i) Strategic Approach to International Chemicals Management and the non-binding Global Plan of Action on the subject of 2006; (ii) the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, ratified in 1993; (iii) the International Code of Conduct on the Distribution and Use of Pesticides, of FAO, the most recent version of which was adopted in 2002; (iv) the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, ratified in 2005; (v) the Stockholm Convention on Persistent Organic Pollutants, ratified in 2005; (vi) the Convention concerning Prevention and Control of Occupational Hazards caused by Carcinogenic Substances and Agents of the International Labour Organization (ILO), ratified in 1976; (vii) the ILO Safety and Health in Mines Convention, ratified in 2008;

(viii) the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, of the International Atomic Energy Agency (IAEA), signed in 1998; (ix) the International Convention for the Prevention of Pollution from Ships of the International Maritime Organization (IMO), signed in 1980; (x) the International Convention on Civil Liability for Oil Pollution Damage of 1969, ratified in 1987, together with its protocols of 1976 and 1984, and the amendment to the latter; (xi) the IMO International Convention on Oil Pollution Preparedness, Response and Cooperation, of 1990, signed in 2001; and (xii) the IMO Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972), also known as the "London Convention", ratified in 2003 (MINAM, 2014a).

In 2015, Peru ratified the Minamata Convention on Mercury, through Supreme Resolution No. 038-2015-RE; this ratification has far-reaching implications because the instrument will make it possible to deal with the problem of controlling mercury emissions and releases and their serious consequences for human health, forests, biodiversity, air quality, and water bodies. The European Commission proposes to adopt stricter laws on mercury use. In June 2016, a draft law was discussed which proposed banning its use in member States where artisanal gold mining activities take place.

The ratification and signing of these international agreements have enabled Peru to provide funding, transfer technologies and receive international technical assistance to deal with environmental problems. The implementation and fulfilment of commitments on the environment is framed in the National Environmental Management System, which consists of working commissions or groups at the initial level, including the technical group on chemical substances.

6. Bilateral and regional co-operation

Peru participates in the Forum of Ministers of the Environment of Latin America and the Caribbean, which meets twice a year and serves as a platform for regional dialogue and co-operation. Among other issues, the 2014 meeting considered sustainable consumption and production, climate change, application of Principle 10 of the Rio Declaration on Environment and Development, environmental education and atmospheric pollution.

Peru also participates in the Amazon Cooperation Treaty Organization (ACTO), consisting of Brazil, the Bolivarian Republic of Venezuela, Colombia, Ecuador, Guyana, the Plurinational State of Bolivia and Suriname. This organisation approved a strategic co-operation agenda on the environment in 2010, which includes activities being implemented in relation to forests, water resources, endangered species of wild flora and fauna, and protected areas, among others (ACTO, 2010). The organisation is implementing the project for monitoring deforestation, logging and land use change in the pan-Amazonian forest, aimed at establishing participatory systems for monitoring forest cover in the Amazon region and the strengthening of regional platforms for managing forest areas, which cover some 8.2 million km² of Peruvian territory. It is also executing the project for integrated and sustainable management of transboundary water resources in the Amazon River basin, considering climate variability and climate change, which receives financial assistance from GEF and is being implemented by the United Nations Environment Programme (UNEP). The objective of this project is to formulate a consensus-based programme of strategic actions that allow for integrated planning and management of the watershed (GEF, 2015).

Peru has signed bilateral co-operation agreements with several countries in the region.[3] Alongside the intensification of co-operation in the last decade, it has also participated in annual meetings of Councils of Ministers, joint commissions and binational technical commissions, among others. These meetings have gradually prepared an environmental agenda which, among other things, addresses illegal logging and cross-border pollution, particularly owing to artisanal gold mining.

In 2014, the Plurinational State of Bolivia and Peru used GEF funding to launch the project for the integrated management of water resources in the Titicaca-Desaguadero-Poopó-Salar de Coipasa system, to promote the conservation and sustainable use of that system's water resources, by updating the Binational Global Master Plan. At the Presidential Meeting and First Binational Cabinet of the Ministers of Peru and Bolivia, held in June 2015, the presidents of the two countries created the High-Level Binational Commission, which has met twice.

Another of the cross-border agreements supported by Peru is the Andean Strategy for Integrated Water Resources Management of the Andean Community, which includes seven lines of action. This strategy was adopted by the Ministers of Foreign Affairs of Colombia, Ecuador, Peru and the Plurinational State of Bolivia in 2011, and implementation has begun (CAN, 2012).

Under the auspices of the Pacific Alliance, Peru is co-operating with Colombia, Chile and Mexico in the climate change scientific research network, which aims to exchange experiences in the scope of the research, study of the application of scientific knowledge and development of capacities for managing climate change. Peru was represented by the Ministry of the Environment and the National Council for Science, Technology and Technological Innovation. The Committee on Scientific Research into Climate Change drafted and disseminated a study on opportunities for collaboration in research on climate change in the countries of the Pacific Alliance. In addition, the project for scientific co-operation on climate change in the Pacific Alliance: monitoring of new generation biodiversity to support processes of adaptation to and mitigation of climate change is expected to be developed. Another focus of this network is sustainable consumption and production, particularly clean production, business development, green labelling and sustainable public procurement (Pacific Alliance, 2015). This co-operation is taking place within the framework of the Memorandum of Understanding on the Pacific Platform for Cooperation.

At the bilateral level, Peru has recently signed a technical co-operation agreement with Japan on forest conservation and reduction of emissions from deforestation and forest degradation, which is expected to help reduce the associated greenhouse gas emissions.

7. Official development assistance

International co-operation provides major support for the efforts being deployed by Peru in the environmental and other domains. Peru has been considered an upper-middle-income country since 2008. According to OECD data, in 2013 official development assistance (ODA) amounted to USD 532.1 million in gross terms, and USD 367 million net. The main donor countries were Germany, Spain, the United States and Japan (OECD, 2015). In 2005-2009, development co-operation averaged USD 425 million per year.

Since its accession to the Paris Declaration on Aid Effectiveness in 2006, Peru has adopted measures to make more effective use of the ODA resources it receives. The Peruvian Agency for International Cooperation is the country's governing body for international development co-operation. In 2011, an evaluation was made of progress in the effective use of external assistance funds, and the areas that needed to be strengthened. The evaluation noted progress in terms of the predictability of assistance and co-ordination of local capacity building; but it also found that the national development strategy needed to be made more operationally effective (OECD, 2011).

In 2012, Peru published its National Policy on International Technical Cooperation, the aim of which is to increase the contribution of international non-reimbursable co-operation to activities in Peru on development and international engagement. The policy defines five targets to be attained by applying strategies in four areas, one of which relates specifically to natural resources and the environment (APCI, 2012).

The Peruvian Agency for International Cooperation developed an annual international co-operation plan in 2013, which describes the progress made and identifies the challenges that would need to be addressed to make this form of co-operation effective. This is highly important, since international co-operation has been declining in absolute terms; and, although it represented less than 0.5% of GDP, the transfer of knowledge and good practices and the development of capacities are very important for the country. The annual plan shows that the non-reimbursable resources received are thematically and territorially dispersed. Analysis of these resources showed that 25% had been channelled into the seventh Millennium Development Goal of guaranteeing environmental sustainability.

South-South co-operation has been increasing in recent decades, and Peru remains a recipient country, although it is also a supplier in several domains. The 2015 report on the subject by the Ibero-American General Secretariat describes Peru as an emerging country in terms of capacity transmission, an area in which is implementing eight projects in 19 bilateral co-operation activities (SEGIB, 2015).

Peru also participates actively in international projects targeting climate change. In 2013 it received USD 50 million from Climate Investment Funds (CIFs) to develop a project in the forestry sector. The aims of the project included improving governance, innovation and the granting of land titles, so as to reduce pressure on the forest and increase the recovery of degraded areas (FIC, 2013).

Peru has financed 38 national projects with GEF contributions totalling USD 118 million that generated USD 552 million in co-financing. These projects are divided into the following categories: biodiversity (20), climate change (12), multifocal (3),[4] persistent organic pollutants (1) and soil degradation (1). Peru has also participated in 33 regional and global projects that received a GEF contribution amounting to USD 208 million and generated USD 435 million in co-financing. These were divided into the following categories: biodiversity (12), multifocal (10), climate change (6), persistent organic pollutants (3) and international waters (2) (GEF, 2013).

Notes

[1] The tenth session of the Conference of the Parties, held in Nagoya, adopted the Strategic Plan for Biodiversity 2011 2020 and the 20 Aichi Biodiversity Targets set for 2020.

[2] The term “nutraceutical” was coined by Stephen L. Defelice as a compound of the words “nutrition” and “pharmaceutical”. It refers to products or foods that provide medical benefits, including for the prevention and/or treatment of diseases [online: http://www.nutraceuticamedica.org/definicion.htm].

[3] Including Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Honduras, Mexico, Panama and the Plurinational State of Bolivia.

[4] These projects aim to implement several agreements simultaneously and in a mutually complementary manner.

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Part II. Environmental quality of life

Chapter 6. Air quality management

This chapter discusses the main developments in air quality management, including action plans in priority zones of attention. It reviews the state of air quality and health impacts and discusses information measures (or lack thereof). The chapter presents the regulatory framework for air quality management and focuses on the transport sector, detailing the measures taken to improve vehicles, fuel quality and public transport, and to reduce congestion.

Key findings and recommendations

Peru has experienced major economic, social and institutional changes during the past decade. These changes have brought with them both increased pressures on the environment and new approaches to environmental management. Progress has been made in consolidating a management system with specialised institutions and tools for preventing and controlling pollution, which has also served to eliminate conflicts through the promotion of productive activities. The regulatory framework now in place for managing air quality is quite comprehensive: it includes environmental quality standards (EQS), maximum permissible limits (MPLs), and instruments for restoring environmental quality such as action plans. In addition, air quality is supported by tools such as the environmental impact assessment system, clean production agreements, information and environmental education.

Peru has air quality information dating back to the year 2000 for Lima-Callao, a large metropolitan area with a population of some 10 million (31% of the nationwide population) according to figures from the National Statistics and Information Institute (INEI) for the year 2015. Other cities for which systematised information is available are Cajamarca, Tacna, Arequipa, Huaraz and Ilo, where there are monitoring networks of varying size and date of entry into operation. In other cities, especially those where action plans have been implemented, there is information available from isolated monitoring campaigns, but this cannot be used to assess EQS compliance. In some cases, it may be inferred on the basis of the available information that these standards, especially the daily EQS, are not being met. Studies conducted by the Ministry of the Environment (2014, using the AIRQ methodology) on morbidity and mortality attributable to air pollution in metropolitan Lima found 1 220 deaths that were likely attributable to PM_{10} pollution in the city, of which 468 were caused by respiratory diseases and 165 by cardiovascular diseases. The economic cost of these and other health impacts analysed in the study was USD 806 million, of which USD 802 million corresponded to mortality.

The information available on pollutant emissions into the atmosphere is incomplete: it does not cover all pollutants, it includes only certain activities (albeit the most important ones), it encompasses only a portion of the assessment period, and it is estimated in most cases on the basis of activity reports from the sectors concerned. The underlying information used to perform these estimates does not always represent local conditions, leading to potentially significant, yet unquantifiable, distortions. These problems are believed to limit the authorities' capacity to pinpoint the sources responsible for pollution and to design corrective measures.

Transportation has been identified as one of the main causes of air quality problems, appearing as the first or second source of pollution in all 31 priority attention zones (ZAP) that have an action plan. Peru's vehicle fleet is old and poorly maintained. The country allows the importation of used vehicles, although restrictions have recently been imposed, including a five-year vehicle age limit. Vehicle emissions are controlled through MPLs, which have been in place since 2001 and regulate emissions of CO, NOx, SOx, HC, PM and other pollutants. Observance of these limits is verified by Vehicle Inspection Centres, which were established in 2008 under Law No. 29.237. However, background information in various action plans suggests that this obligation is not observed everywhere. Emission controls for diesel vehicles have been deferred until such time as fuel is available with characteristics that meet the MPL. The fuel now in use has a high sulphur content, except in the departments of Lima, Arequipa, Cusco, Puno, Madre de Dios and the province of Callao, where there is a ban on the use and sale of diesel with more than 50 ppm of sulphur. Supreme Decree No. 009-2015-MINAM, in effect as of 1 January 2016, extended a similar ban to the departments of Junín, Tacna and Moquegua.

In 2005 a timetable was adopted, setting 1 January 2010 as the date on which diesel with 50 ppm sulphur must be available nationwide. The date was postponed owing to various factors, including the need to upgrade the country's main refineries, and this fuel improvement is now being introduced gradually at the regional level. Regardless of the justifications, the delay has extended beyond what may be considered reasonable, considering the public health impact of poor fuel quality. The quality issue also limits the importation of vehicles with more advanced technologies and lower emissions. At the present time, the vehicle emissions standard is Euro III, which may be considered outdated. The incorporation of natural gas into the country's energy mix has made an important contribution to pollution reduction and prevention, as its use in power generation, industry and transportation has spread. Roughly 8% of the vehicle fleet is gas-powered. Since 2003, Peru has had legislation promoting biofuels (Law No. 28.054), which sets a minimum ethanol content of 7.8% in gasoline, and a minimum biodiesel content of 5% in diesel fuel. It is being gradually implemented by region, with the intent of supporting the entire productive chain. After an initial effort to produce locally, these products are now largely imported. Public transportation is provided for the most part informally, with obsolete and poorly maintained rolling stock, except in Lima where efforts are being made to streamline the system. Transit routes and frequencies are not planned, and service providers (small firms or individual vehicle owners) compete among themselves for passengers in the cities. For these reasons, the public transit system is deficient and of poor quality.

The vehicle ownership rate is low in Peru, compared with other countries of the region: 73 vehicles per 1 000 inhabitants in 2013 (including heavy vehicles). However, most of the major cities have traffic congestion problems. As the Peruvian economy grows, this indicator can be expected to rise. At this stage, it is important to try to prevent an uncontrolled increase from exacerbating pollution and mobility problems. The authorities must provide alternatives to automobile use through efficient transportation systems, adequate road infrastructure, and control over unplanned urban sprawl. On this point, major efforts have been expended in Lima, with construction of a metro system within the city and the *Metropolitano*, a transit system with segregated rights-of-way and high-capacity rolling stock that is backed by local feeder routes. Both initiatives are taking a comprehensive approach to the transportation problem, and they have done much to alleviate transit problems in the capital. However, implementation timetables have been delayed by financing problems.

Thirty-one priority attention zones, located in an equal number of atmospheric basins, have action plans, an instrument designed to reverse or prevent atmospheric pollution problems. For an area to be declared a priority attention zone, it must have populated centres or towns with more than 250 000 inhabitants or a population density per hectare that justifies its priority attention, or there must be socioeconomic activities with a significant influence on air quality. As the definition does not require that an area be failing in compliance with a particular standard in order to be declared a priority attention zone, this encourages the implementation of preventive measures. The lack of systematic information on air quality has meant that, in most of these areas, compliance with EQS cannot be reliably verified. In some cases, it is possible to establish failure to comply with certain daily standards, which by inference indicates non-compliance with annual EQS. The measures contained in the action plans cover a range of aspects, including improving information on air quality and emission sources, delivery of information to the public and environmental education, improving fuels, combustion processes and technology, primarily in transportation, and urban planning, also focused on transportation. In some cases they contain measures to ensure compliance with other standards, such as technical inspection of vehicles. Many are presented in general terms, without indicating any specific targets to be met or the manner of implementing them, and information on their financing is not always available. Measures are not subjected to any economic assessment of the cost-benefit or cost-effectiveness type. The effectiveness of this instrument could be substantially enhanced by improving the information on air quality and emissions in the respective localities, and encouraging the design of more effective measures and better arrangements for their financing.

Peru's emissions of greenhouse gases are low, in both per capita and total terms, and they represent only 0.3% of global emissions. Roughly half the country's emissions come from activities related to land use, changes in land use, and deforestation. The 2010 emissions inventory reports 124 109 GgCO2eq, and the main sources as deforestation and degradation of tropical forests (35.1%), followed by the energy sector (32.7%), primarily through growth in the vehicle fleet, the agriculture sector (21%), waste (6.2%) and industrial processes (5.1%). The second national communication forecasts steady growth of emissions in all sectors. Emissions from energy and agriculture will triple by 2050, while those related to land use will rise by 137%. The incorporation of natural gas into the energy mix has displaced the consumption of oil in manufacturing and transportation, and has prevented increased carbon-intensity in power generation. In this last sector, hydroelectricity development has slowed, with a differentiated impact on global and local pollutant emissions. The Planning for Climate Change (PlanCC) project is a government initiative launched in 2012, the first phase of which was completed in 2014. It involved an update of Peru's greenhouse gas emissions inventory to 2009 and the production of qualitative and quantitative evidence on possible climate change mitigation scenarios for 2021 and 2050, applying 77 mitigation measures in energy, agriculture, forestry, transportation, waste management and industrial process. Phases II and III involve policy analysis of measures and their implementation, respectively.

Recommendations

- Strengthen the infrastructure of air-quality monitoring networks to ensure compliance with environmental quality standards (EQS). Increase the coverage of air-quality measurements in cities with histories of possible pollution problems. Expand the scope of the measures included in the air quality improvement action plans by, for example, taking residential emissions into account; assessing the cost-effectiveness ratio of the existing measures; and exploring the possibility of improving them.
- Improve the coverage and estimates of emissions from different sources in the priority attention zones (ZAPs). Make progress with the preparation of emissions inventories using local data to identify sources and assess the cost-effectiveness ratio of the measures applied. Make progress with setting maximum permissible limits for those sectors that do not yet have them. Complete the implementation of Pollutant Release and Transfer Registers (PRTRs) to facilitate the preparation of inventories and the design of decontamination measures.
- Extend the use of cost-benefit analyses of emissions and quality standards and of the measures contained in the action plans, using local information. Assess the inclusion of emissions offset schemes in new projects implemented in priority attention zones with atmospheric pollution problems, ensuring that the offsets are made within the affected area.
- Invest in the design and construction of efficient public transport systems and promote the use of means of transport other than automobiles. Make efforts to improve fuel quality, bringing standards closer to those of the OECD countries. Promote economic incentives based on the polluter pays principle to reduce vehicle emissions and atmospheric pollution. Further restrict imports of used vehicles and establish stricter entry requirements for new vehicles. Oversee compliance with vehicle emission standards and technical inspections of the vehicle fleet. Promote the scrapping of old vehicles still in use as a way to reduce NOx emissions.

1. Trend of emissions and air quality

1.1. Local pollutant emissions

The available information shows that pollutant emission trends have been heterogeneous. Whereas some have followed a similar trajectory to economic activity, partly because they are estimated on the basis of national fuel consumption by sector (INEI, 2015), others reflect the use of better-quality fuels.

Aggregate data on emissions of particulate material (PM) report a relatively stable trend over time, at roughly 75 000 tonnes per year. Nonetheless, this information suffers from several inconsistencies, because its sectoral breakdown attributes about 92% of the total to the residential and commercial sectors (INEI, 2015).

Sulphur emissions have been decreasing slightly. This trend strengthened towards the end of the period as emissions from the transport sector fell thanks to the use of low sulphur-content fuels, mainly in Lima and other major cities. Nitrogen oxide emissions have followed a different pattern. After an initial period in which they increased only very slightly (2003-2007), they later expanded more rapidly, basically owing to vehicle emissions. Carbon monoxide emissions grew by an average of 2.42% per year, which is a relatively low rate considering energy consumption by the transport and other sectors (Table 6.1 and Figure 6.4), together with the growth of the vehicle fleet and emissions of nitrogen oxide from mobile sources. Data from the Ministry of the Environment (MINAM, 2015a) are similar to those estimated by the Clean Air Initiative Committee for Lima and Callao (CGIALLC), which are limited to transport in the capital, so they must be treated with caution.

Table 6.1. Local pollutant emissions

(Thousands of tonnes and percentages)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Period variation
Particulate material	68.3	72.9	70.2	79.6	79.4	77.9	77.9	78.5	78.7	77.5	14%
Sulphur oxides	51.5	54.0	52.4	44.3	52.9	51.5	52.6	43.9	45.8	45.7	-11%
Transport-related sulphur oxides	11.2 (21.7%)	13.8 (25.6%)	12.9 (24.7%)	13.7 (30.9%)	13.6 (25.7%)	16.7 (32.4%)	16.4 (31.2%)	8.0 (18.3%)	7.3 (15.8%)	7.4 (16.2%)	-34%
Nitrogen oxides	66.5	77.2	71.5	74.6	75.3	89.6	92.6	105.9	111.6	114.6	72%
Transport-related nitrogen oxides	42.3 (63.6%)	53.1 (68.7%)	49.1 (68.7%)	53.8 (72.1%)	52.4 (69.5%)	67.9 (75.8%)	70.3 (76%)	83.1 (78.4%)	86.7 (77.7%)	90.2 (78.7%)	113%
Carbon monoxide	570	602	585	660	663	669	688	705	703	696	22%

Source: ECLAC calculations on the basis of INEI (2015), *Peru. Anuario de estadísticas ambientales 2014*.

Peru has information on the sources of pollution in localities that have been declared priority attention zones, for which the action plans adopted require emissions inventories to be maintained (see section 2.3 and the listing of action plans at the end of this chapter). Nonetheless, these inventories are of uneven quality, owing to the varying capacity to collect relevant information.

The data presented offer an overview of emission trends in Peru. Although they were estimated mainly on the basis of fuel consumption by sector, it would be useful to indicate the combustion technologies used and apply emission factors that are appropriate to the reality in the country. The available information address the most important emitting sectors or subsectors, but not all of them. For example, residential emissions are not recorded, and those not arising from direct fuel use have not been estimated. Nor is there systemised information on various types of emissions to which an EQS is applied, such as lead (except in Lima), benzene, hexane and hydrogen sulphide. These gaps are more prominent in the regional and local areas.

Insufficient information on air-quality makes it impossible to fully appreciate the extent of the air pollution problem. The available data are confined to 31 priority attention zones and are highly heterogeneous; in some cases they come from measurements made in operating networks, such as in Lima-Callao, but in others they were obtained from sporadic monitoring campaigns undertaken by public institutions performing environment-related functions. These include the National Meteorology and Hydrology Service (SENAMHI), the General Directorate of Environmental Health (DIGESA), the Agency for Environmental Assessment and Enforcement (OEFA) and the Ministry of the Environment (MINAM). As a result, they are not statistically representative and cannot be considered indicative of air quality.

Table 6.2 lists the zones in which there are monitoring stations. Owing to budgetary constraints, these are not always permanently operational outside Lima.

Table 6.2. Permanent monitoring stations

City	Number of stations	Entity in charge	Entity responsible for operation
Cajamarca	1	Regional government	Regional Health Directorate (DIRESA)
Tacna	1	Regional government	DIRESA
Arequipa	3	Regional government	DIRESA
Huaraz	1	Universidad Nacional Santiago Antúnez de Mayolo	Universidad Nacional Santiago Antúnez de Mayolo
Ilo	3	Local government	Local government
Lima	10 [a]	SENAMHI	SENAMHI
Callao	1	Regional government	DIRESA
La Oroya (Junín)	6	Doe Run Perú (private)	Doe Run Perú

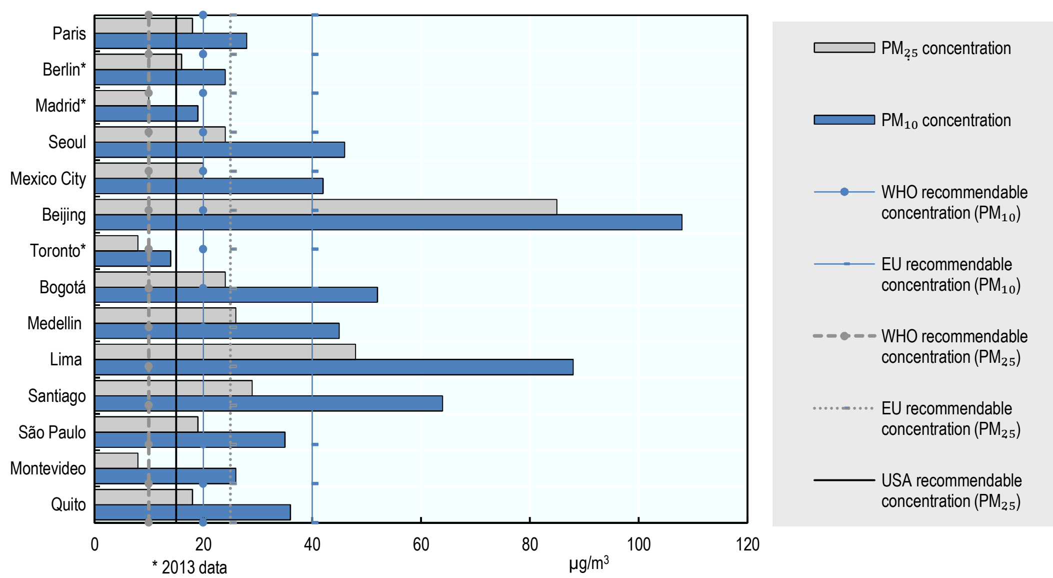
Note: a) Does not include the DIGESA network.
Source: ECLAC calculations on the basis of MINAM (2015), Estudio de desempeño ambiental, 2003-2013.

According to the background information included in the current action plans, air quality is affected first and foremost by transport and by mining activities, including a number of smelters; and also by fishing, and other smaller-scale industrial activities. As noted above, there is insufficient information on residential emissions and, in general, on pollution sources that are not directly related to combustion. The latter includes the burning of household waste, which is a common practice in localities that do not have a regular waste collection service.

Two air-quality monitoring stations operate in the city of Lima. The first and older one is administered by DIGESA, attached to the Ministry of Health, whereas the second is run by SENAMHI, which is part of MINAM. According to data on Lima and Callao obtained from the DIGESA air-quality monitoring programme, the average annual concentration of breathable particulate matter (PM_{10}) decreased by 29% between 2007 and 2013 (MINAM, 2015a).Apparently, the concentration also declined in other parts of the country. There was also a 43% reduction in the average annual concentration of fine particulate matter ($PM_{2.5}$). The same source also reports reductions in concentrations of SO_2 (by 33%) and NO_2 (by 16%). The average annual concentration of PM_{10} detected at three DIGESA monitoring stations exceeded the standard in 2007, and the same situation occurred in 2013 in another two stations (Figure 1.5). The annual EQS applicable to PM_{10} is 50 $\mu g/m^3$ (Supreme Decree 074-2001-PCM) and it has been monitored since July 2007. In 2014, gross particulate matter concentrations in Lima exceeded the limits set in the guidelines published by the World Health Organization (WHO); and they were also above the levels recorded in OECD member countries, and even in Peru's surrounding region (Figure 6.1).

In daily terms, several of the SENAMHI network monitoring stations in Lima have noted that PM_{10} often exceeds the respective EQS, and $PM_{2.5}$ does so even more frequently. Sulphur dioxide (SO_2) concentrations also exceed the permitted level in these stations, while the average annual concentration of NO_2 remains within acceptable limits. The reduction in pollutant concentrations can be explained partly by the better quality of fuels currently being sold in Lima; the adoption of natural gas in much of the industrial sector (particularly in subsectors that previously used industrial oils)[1] and a small segment of the transport sector; the implementation of a mass passenger transit system (the Metropolitan corridor and electric train) and technical inspections.

Figure 6.1. PM_{10} and $PM_{2.5}$ concentrations in selected cities, 2014



Source: ECLAC calculations on the basis of World Health Organization database.

The information that is available on the rest of the country comes mainly from isolated monitoring campaigns held in 2013 and 2014 in some of the 31 localities declared as priority attention zones, with the aim of collecting background data for formulating the respective action plans. These campaigns lasted three days on average and were undertaken by MINAM, DIGESA and OEFA; in other cases, the information comes from local government surveillance networks. The campaigns noted that the daily PM_{10} concentration in five of the 31 cities analysed exceeded the current daily limit (150 $\mu g/m^3$), on at least one of the three measurement days. Moreover, in 12 of 21 cities where the daily concentration of $PM_{2.5}$ was measured, this exceeded the current EQS for a 24-hour period (25 $\mu g/m^3$), on at least one of the three days considered. In the case of SO_2, ten of the 31 cities registered average concentrations above EQS for a 24-hour period on at least one of three days evaluated. Hourly NO_2 concentrations did not exceed the recommended limit (200 $\mu g/m^3$) in any of the 21 Peruvian cities here measurements were taken (MINAM, 2015a).

In most cases, this information does not make it possible to verify compliance with standards for daily and annual concentrations, although it does show that the daily limits are breached in several localities, and it is highly likely that this is also occurring with respect to annual concentrations.

1.2. Greenhouse gas emissions

The main source of greenhouse gas (GHG) emissions in Peru is land-use change, stemming from the conversion of primary forests into agricultural land or simply from their degradation. The inventory of GHG emissions for 2010 records a level of 124 109

GgCO2eq in that year, of which 56% corresponds to agriculture and land use, land-use change and forestry.

Table 6.3. Greenhouse gas emissions by sector, 1994-2010

($GgCO_2eq$ and percentages).

Sector	1994		2000		2010	
Energy	22 154	22%	25 400	21%	25 391	20%
Transport					15 215	12%
Industrial processes	9 899	10%	7 917	7%	6 274	5%
Agriculture	22 809	23%	22 545	19%	26 051	21%
Land use, land-use change and forestry					43 518	35%
Land-use change and forestry	41 218	42%	56 826	47%		
Waste	2 736	3%	7 335	6%	7 660	6%
Total	98 816	100%	120 023	100%	124 109	100%

Source: Ministry of the Environment (MINAM), Estudio de desempeño ambiental, 2003 – 2013, Lima, 2015.

Peru's Second National Communication forecasts that emissions will continue to grow on a sustained basis in all sectors — probably tripling by 2050 in the agricultural and energy sectors, and increasing by 137% in the land-use sector.

Peru's GHG emissions represented 0.34% of the world total and 3.5% of those corresponding to Latin America and the Caribbean in 2012. If emissions from land-use change and the deforestation process are excluded, the share drops to around 0.2% globally and 2.5% regionally (Chapter 1). Table 4.4 shows the trend of emissions.

Table 6.4. Greenhouse gas and CO_2 emissions, 2002-2012

($TgCO_2$ equivalent, CO_2 and percentages).

Year	Total GHG emissions, excluding land-use change and forestry	Total GHG emissions, including land-use change and forestry	CO_2 emissions associated with electricity and heating		CO_2 emissions associated with transport	
2002	61.08	105.74	4.86	8.0%	8.83	14.5%
2007	70.92	142.03	7.85	11.1%	11.17	15.8%
2012	88.24	159.50	15.17	17.2%	17.75	20.1%

Source: ECLAC calculations, on the basis of WRI (2015), "CAIT Climate Data Explorer".

The International Energy Agency (IEA) has published information that is comparable to the above (Figures 1.2 and 1.3), showing that Peru's global and per capita emissions are well below the average of OECD countries. There has also been an increase in emissions from the transport and power generation sectors, the latter having been transformed by the incorporation of natural gas. Until 2013, 39% of total emissions came from transport and 25% from power generation and heating. Between 2003 and 2013, CO_2 emissions declined by 1.6% relative to the total supply of primary energy and increased by 14% in relation to final energy consumption, owing to the efficiency loss caused by the greater use of gas in electric power generation.

Several estimations have been made of the economic impact of climate change in Peru. The first was done by the Andean Community, by taking the expected effects of climate change on agribusiness, agriculture, fishing, water availability and electricity in the United States, and extrapolating them to its member countries (CAN, 2008). This exercise concluded that, by 2025, climate change could reduce GDP by 4.5%. A later estimation by the Central Reserve Bank of Peru (2009) found that real GDP could decline by 6.8% by 2030. A joint publication by the Economic Commission for Latin America and the Caribbean (ECLAC) and the Inter-American Development Bank (IDB) estimated the cumulative reduction in GDP as fluctuating between 11.4% and 15.4% in 2010-2100, depending on the climate situation (IDB/ECLAC, 2014).

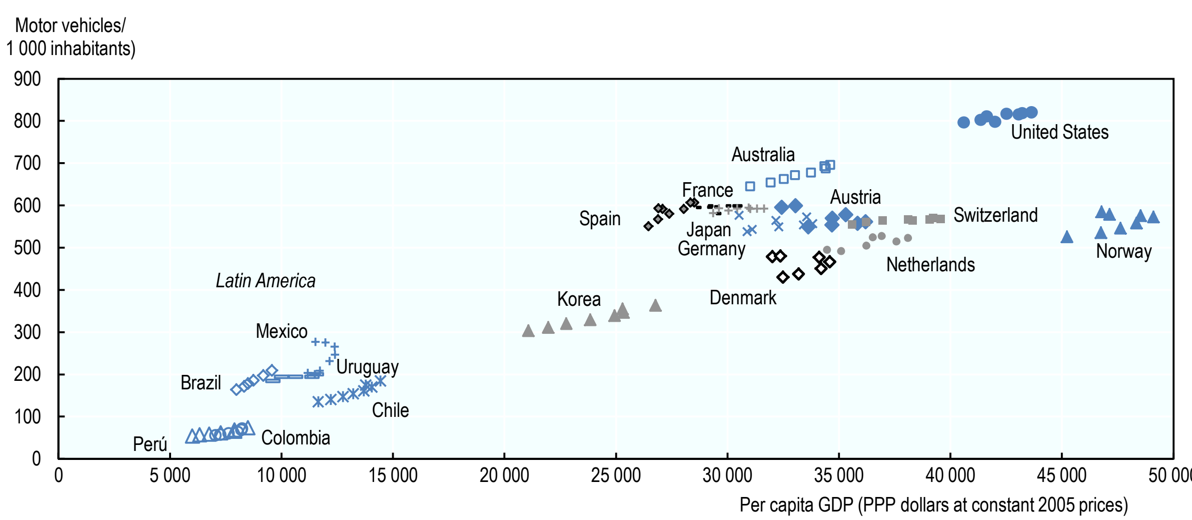
1.3. Transport

Transport is considered one of the main causes of air pollution in several Peruvian cities. In the 31 priority attention zones for which action plans have been developed, it is ranked as either the first or second cause.

The fact that Peru's vehicle fleet is old and receives little maintenance results in high emission levels. As Peru allows used automobiles to be imported, vehicles of all kinds have entered the country, frequently in a bad condition, which makes it harder to renew the fleet with units that meet stricter emission standards. In an attempt to correct this situation, the importation of vehicles aged over five years was recently banned. The motorisation (or vehicle ownership) rate in Peru is lower than in other countries of the region, at just over 70 vehicles per 1 000 inhabitants in 2013 and well below that recorded in OECD countries (Figure 6.2). In 2003, the rate was 50 per 1 000 inhabitants, so there has been a 45% increase in the period. Despite the low motorisation rate, most major cities suffer from congestion problems, and in the last five years the vehicle fleet has grown by an average of 7% per year. While vehicle ownership can be expected to increase along with economic growth, the rate is still low so there is room for effective implementation of a decoupling strategy.

Figure 6.2. Relation between the motorisation rate and per capita GDP, 2003-2010

(In purchasing power parity USD at constant 2005 prices and vehicles per 1 000 inhabitants)



Source: ECLAC calculations on the basis of World Bank database, World Development Indicators.

About two thirds of the vehicles existing in Peru are registered in the Department of Lima (65.4% in 2013). In 2004-2013, the vehicle fleet grew by 6.3% per year nationwide, and by 6.7% in the Department of Lima.

The existence of a deficient, and in some cases virtually non-existent, road infrastructure, does not contribute to good vehicle maintenance and is the cause of high emissions of particulate matter through re-suspension effects. More detailed information on the subject is not available, however.

In 2001, MPLs were adopted to control CO, NO_x, SO_x, HC and PM emissions from vehicles and other sources; and several action plans called for the implementation of vehicle emission controls. Observance of the limits should be verified periodically at the vehicle inspection centres, pursuant to Law 29.237 of 2008, but information suggests that compliance is limited. Controlling emissions from diesel vehicles has been postponed on several occasions, because Peru does not yet have fuel that allows for MPL compliance (Supreme Decree 012-2005-PCM, Supreme Decree 029-2005-MTC, Supreme Decree 026-2006-MTC, Ministerial Resolution 488-2007-MTC, Supreme Decree 005-2008-MINAM, Supreme Decree 020-2009-MINAM, Supreme Decree 017-2010-MINAM, Supreme Decree 100-2011-PCM and Supreme Decree 009-2012-MINAM).

Peru uses fuels with a high sulphur content, particularly diesel. Law 28.694, of 22 March 2006, banned the use and marketing of diesel fuel with a sulphur content above 50 ppm as from 1 January 2010. This provision was later amended to apply to Lima and Callao only (Supreme Decree 061-2009-EM), while implementation in the rest of the country was left pending. Ministerial Resolution 0139-2012-MEM then extended the prohibition to the whole department of Lima, plus the departments of Arequipa, Cusco, Puno and Madre de Dios. Recently, Supreme Decree 009-2015-MINAM established the same prohibition for the departments of Junín, Tacna and Moquegua as from 1 January 2016 (Table 6.5).

Table 6.5. Timetable for implementing the provisions on the sulphur-content of diesel fuel

2005	2010	2012	2016
5 000 ppm (whole country)	50 ppm (Lima-Callao)	50 ppm (Lima-Callao, Cusco, Arequipa, Puno and Madre de Dios)	50 ppm (Lima-Callao, Cusco, Arequipa, Puno and Madre de Dios)
	5 000 ppm (rest of the country)	5 000 ppm (rest of the country)	50 to 2 000 ppm (rest of the country)
	2 500 ppm (imported fuel)	2 500 ppm (imported fuel)	2.500 ppm (imported fuel)

Source: ECLAC.

Outside Lima and Callao, diesel fuel with a sulphur content of 2 000 ppm is used, but concentrations can rise as high as 5 000 ppm. One of the causes of the delay in adopting better-quality fuels is the delay in upgrading Peru's main refineries (Conchán and Talara, belonging to the state-owned Petroperú, and La Pampilla, owned by Repsol), which were initially scheduled to start producing diesel with a 50 ppm sulphur content as from 2010. The process has lasted beyond reasonable limits, considering the effects of the bad quality of fuel on the population's health. This situation also restricts the possibility of importing vehicles made with more advanced technologies that produce fewer emissions. Currently the European Euro III standard on polluting emissions is applied, which is out of date.

The incorporation of natural gas into the country's energy mix has made a significant contribution to reducing and preventing pollution, and its use has been extended to power generation, manufacturing industry and transport. Roughly 8% of the vehicle fleet now runs on natural gas.

The Biofuel Market Promotion Act (Law 28.054) requires a minimum ethanol content of 7.8% in the case of gasolines and 5% biodiesel content in diesel fuels. These provisions are being implemented gradually in the regions, and efforts have been made to support units throughout the production chain to promote the sector. Nonetheless, following an initial period in which there was a considerable boost to domestic production, it has since been decided to import biofuels.

Most public transport is operated on an informal basis, using old vehicles with little maintenance and reduced capacity. The routes and frequencies are not programmed; and the service providers, small firms and even individual vehicle owners, compete for passengers in the cities. In contrast, in Lima, significant measures have been adopted, including the construction of the metro system and creation of the *Metropolitano*, a transport corridor segregated into structuring roads or hubs connected to feeder routes, on which large-capacity vehicles circulate. These initiatives, which aim to address the transport problem in the capital on an integrated basis, have alleviated the problem considerably, but implementation has been delayed by financial difficulties.

At this stage, it is important to avoid haphazard growth, which would aggravate the problems of pollution and mobility. The authorities should foster the use of other means of transport apart from automobiles, through efficient transport systems, adequate road infrastructure and control of haphazard urban sprawl.

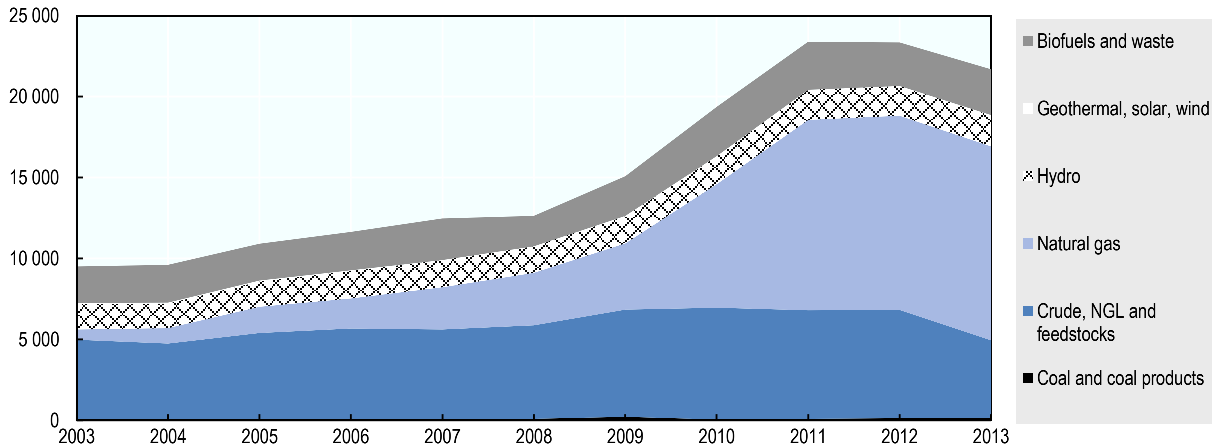
1.4. Energy

Modernisation of the energy sector has a significant influence on local and global pollutant emissions. This sector has undergone major changes in the period reviewed, as a result of economic growth and the momentum given to the exploitation of natural gas.

Data supplied by IEA show that national energy production grew by 128% in 2003-2013; moreover, the change in the composition of the energy mix made possible by the development of the gas industry led to the share of gas in national production increasing from 6.5% to 55.1% in that period. Trends in the other energy sources include a 4% drop in oil production in the same period, and moderate expansions of hydropower and biofuels, of 20% and 26.4% respectively (Figure 6.3).

Figure 6.3. National production of energy sources

(Thousands of tonnes of oil equivalent)



Source: ECLAC calculations on the basis of IEA (2015), *World Energy Balances*.

The importance of natural gas is also reflected in statistics on international trade in energy sources. Peru ceased to be a net importer of energy products in 2003, when it covered 29.1% of its needs[2] with purchases from abroad; and it became a net exporter as from 2011, basically owing to gas production. In that period, crude oil imports declined, while imports of oil derivatives increased in response to the requirement to use low-sulphur fuels imposed by the environmental authorities in the departments indicated in Table 6.5. This made it necessary to purchase abroad, in a context where the largest increase in fuel consumption occurred in the transport sector (annual average of 8.1%). Peru is also a net exporter of oil derivatives.

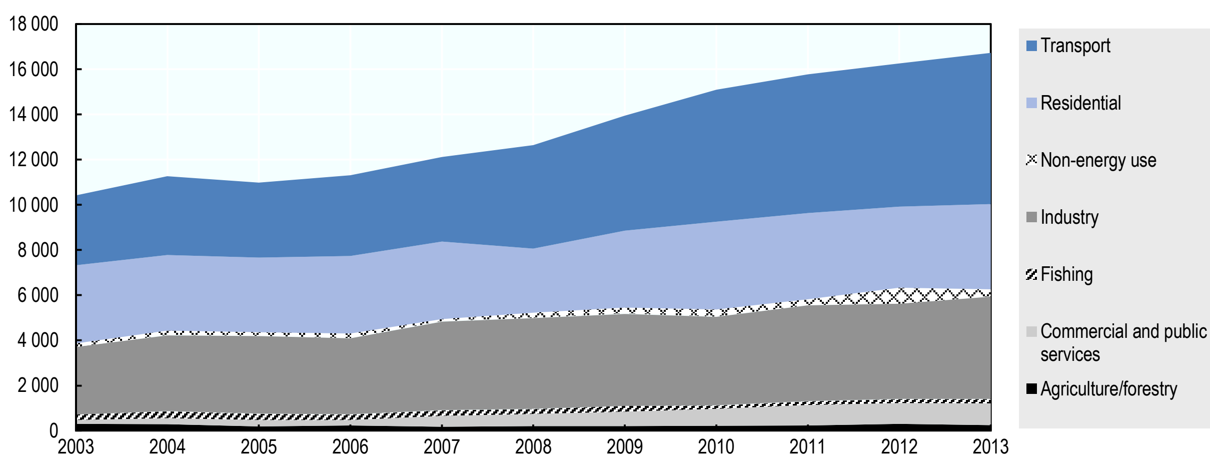
Peru's energy needs increased by 86% in the period analysed (average growth of 6.4% per year), while the demand for crude oil, excluding derivative products, increased by 45.6% (3.8% per year on average), which was less than the growth of the economy overall (Figure 1.4). The country's carbon needs are small (4.2% of total primary energy supply (TPES) in 2013); and they remained constant throughout the period analysed. Renewables accounted for 23.1% of TPES in 2013, and expanded by 30.6% (annual average of 2.7%). Hydropower generation has remained relatively constant, although it increased by 20.6% in the period (1.9% annual growth) while total power generation grew by 79% between 2003 and 2012, to reach 41 036 GW hours (GWh), 52% of which came from hydraulic sources and 48% from thermal sources. Just 0.5% of the power supply was sourced from solar energy.

Peru has major hydroelectric potential. A study by the Halcrow-Oist consortium in 2011 estimates this potential at 69 445 MW, of which 60 627 MW would come from the eastern, Atlantic-draining, side of the country and 8 731 MW from the Pacific side. Nonetheless, installed hydroelectric capacity amounted to just 3 662 MW in 2014 (MINEM, 2015), while national energy production from wind power is estimated at 22 450 MW, and from geothermal sources at 3 000 MW (IRENA, 2014). The same source shows that high rates of economic growth will lead to burgeoning energy demand, estimated at around 9% up to 2017, which will entail additional demand of 4.30 GW, of which 2GW are expected to be met from renewables.

Transport and its growth in the period under analysis dominated the trend of final energy consumption. In 2013, this sector accounted for a 41% share, compared to 29.7% in 2003. Consumption increased by 115% between those two years. The other large-scale energy consumers are the manufacturing, mining and residential sectors on the one hand, and the commercial and public sectors on the other; the latter two accounting for around 27% each. In the same period, energy consumption grew by 52.2% in the manufacturing sector, while the services sector posted the largest increase (457%) although its share is still relatively small (around 6% in 2013).

The transformation of Peru's energy matrix has had positive effects on local pollution. Thanks to the greater availability of gas, thermal electricity generation has not been carbon-based, which has enabled the industry to cease using industrial oils. It is also estimated that up to 2013 around 173 000 vehicles had started using natural gas, representing about 8% of the vehicle fleet in that year.[3] Nonetheless, carbon has gained a larger share of the power generation matrix, to the detriment of hydroelectric production, which was the main power source at the start of the period.

Figure 6.4. Final energy consumption by sector



Source: ECLAC calculations on the basis of IEA (2015), *World Energy Balances*.

2. Policy goals

2.1. Air quality

The National Environmental Action Plan (PLANAA - Perú 2011-2021) (Supreme Decree 014-201-MINAM) is a long-term environmental planning tool that specifies priority targets, strategic actions and the entity responsible. It also provides selected indicators to evaluate its application by the entities comprising the National Environmental Management System (SNGA) at the three levels of government. The plan defines the priority target in terms of air quality in the following terms: "100% of the prioritised cities implement their action plans to improve air quality and fulfil EQS for air".

Another instrument adopted in this area is the National Environmental Action Agenda, which is updated every two years. Its purpose is to ensure that the activities and institutions comprising SNGA are governed by the priorities set in public policies, namely the National Environmental Policy (PNA), sector policies, the National Environmental Action Plan and the Strategic Pillars of Environmental Management, to mention merely the most important regulations. The current National Environmental Action Agenda 2015-2016 (Ministerial Resolution 405-2014-MINAM) specifies the air quality objective in terms of reducing pollution levels, and the expected result is an improvement in atmospheric conditions in the 31 prioritised cities. Specifically, it provides for the adoption of measures aimed at reducing PM_{10} emissions, to ensure compliance with the relevant EQS in 24 of those cities. It also envisages progress in drafting a clean air law, which includes technical, administrative and taxation measures to speed up the process.

Given the available information on air quality and emissions, and the heterogeneity of institutional capabilities, achieving the proposed objectives could take longer than expected.

2.2. Climate change

One of the objectives of the National Environmental Policy, included in the chapter on the conservation and sustainable use of natural resources and biological diversity is to "enable the population to adapt to climate change and establish mitigation measures aimed at sustainable development".

The new National Strategy on Climate Change (ENCC) was published on 23 September 2015 through Supreme Decree 011-2015-MINAM. This instrument, which is an update of the strategy adopted in 2003 (Supreme Decree 086-2003-PCM), reflects the government's commitment to address climate change and also enables it to fulfil the international commitments assumed. The previous strategy contained 108 targets, of which only 12% were fully attained in the first six years of application. Progress was also made towards achieving 49% of them, including programmes, projects and ongoing activities (MINAM, 2015b). The National Strategy sets two strategic objectives: (i) avoid the adverse effects of climate change by reducing vulnerability of the economy and society, specifically by applying adaptation measures at an appropriate scale; and (ii) reduce GHG emissions, taking advantage of facilities for changing production patterns in key sectors such as forestry, energy, transport and manufacturing, and also in solid waste management. Given the origin of the emissions, the mitigation strategy is focused on reversing land-use change and deforestation processes, which cause 46% of emissions. In addition, special importance is accorded to adaptation measures, in view of the country's vulnerability to climate change.

Peru has developed projects under the Clean Development Mechanism, in which emissions reduction certificates have been issued totalling 4.5 TgCO2eq. Progress is also being made in formulating suitable mitigation measures for the transport and waste sectors, with funding from international co-operation (Chapter 5). The Planning the Climate Change Project (PlanCC) responds to a government initiative adopted in 2012, the first stage of which was completed in 2014 with the following results: updating of the GHG emissions inventory to 2009; compilation of qualitative and quantitative information for defining climate change mitigation scenarios up to 2021 and 2050; and the formulation of 77 mitigation measures applicable to the energy, agriculture, forestry, waste management, transport and manufacturing sectors. The second and third stages will focus on the political analysis of the measures and their implementation, respectively (MINAM, 2015a). Based on this, in October 2015, Peru presented its expected national contribution, which foresees a 30% reduction in GHG emissions by 2030, relative to the base scenario. Two thirds of the reduction is expected to be achieved through investments and expenditure funded domestically, both public and private, and the remaining third will depend on the availability of international financing. Sixty per cent of the expected reduction will come from the forestry sector, specifically through the adoption of measures related to deforestation (MINAM, 2015b). National contributions will be announced at the twenty-first session of the Conference of the Parties (COP21), Peru having made a major contribution to the organisation of the previous session, which paved the way for the Paris Agreement (Chapter 5).

2.3. Prevention and co-ordination

As regards local pollutants, air quality management is based mainly on EQS, MPLs, action plans and instruments relating to production units, in which institutions of the National Environmental Management system at the different government levels participate. According to the National Environmental Management System Framework Act (Law 28.245), the environmental functions of the entities forming it "are exercised on a co-ordinated, decentralised and deconcentrated basis, subject to the National Environmental Policy, the Plan and the National Environmental Action Agenda, and cross-sectoral standards, instruments and mandates, which are of compulsory observance in the different spheres and levels of government". This law also establishes a co-ordination framework between those institutions.

Environmental quality standards applicable to air

Peru has adopted the following standards on the key pollutants: particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO) and ozone (O_3). There are also quality standards for fuel-related pollutants: lead, benzene, hexane and hydrogen sulphide (H_2S) (Table 6.6).

Table 6.6. Environmental quality standards applicable to air

Pollutant	Period	Upper limit	Regulation	Entry into force
Sulphur dioxide (SO_2)	24 hours (average)	80	Supreme Decree 006-2013-MINAM	1 January, 2009
	24 hours (average)	20	Supreme Decree 003-2008-MINAM	1 January, 2014
Particulate matter (PM_{10})	1 year (average)	50	Supreme Decree 074-2001-PCM	22 June, 2001
	24 hours (average)	150		
Fine particulate matter ($PM_{2.5}$)	24 hours (average)	25	Supreme Decree 003-2008-MINAM	1 January, 2014
Carbon monoxide (CO)	8 hours (average)	10 000	Supreme Decree 074-2001-PCM	22 June, 2001
	1 hour (average)	30 000		
Nitrogen dioxide (NO_2)	1 year (average)	100	Supreme Decree 074-2001-PCM	22 June, 2001
	1 hour (average)	200		
Ozone (O_3)	8 hours (average)	120	Supreme Decree 074-2001-PCM	22 June, 2001
Lead	1 year (average)	0.5	Supreme Decree 069-2003-PCM	14 July, 2003
	1 month (average)	1.5	Supreme Decree 074-2001-PCM	22 June, 2001
Benzene	1 year (average)	2	Supreme Decree 003-2008-MINAM	1 January, 2014
Hexane	24 hours (average)	100 mg/m3	Supreme Decree 003-2008-MINAM	1 January, 2010
Hydrogen sulphide (H_2S)	24 hours (average)	150	Supreme Decree 003-2008-MINAM	1 January, 2009

Source: Ministry of the Environment (MINAM).

Peru's annual emissions standard for PM_{10} (50 $\mu g/m^3$) is above the annual average of 20 $\mu g/m^3$ recommended by the World Health Organization (WHO, 2006); but it is consistent with what WHO sets as intermediate objective 2 (although above intermediate objective 3 and the recommended guideline value), since air quality management is considered a progressive activity. In the case of the daily standard for PM_{10}, the upper limit imposed in Peru is equivalent to 150 µg/m^3, three times the level recommended by WHO (50 µg/m^3 as an average over 24 hours). This level would correspond to what is classified by that institution as intermediate objective 1, above intermediate objectives 2 and 3 and the recommended guideline value.

Although Peru has not yet adopted an annual standard for $PM_{2.5}$, its daily standard is consistent with that recommended by WHO. This produces an asymmetry because if the daily $PM_{2.5}$ standard were observed, then both the daily and annual PM_{10} standards would also be comfortably met, thus making them redundant unless much of the pollution caused by particulate matter is not the result of combustion processes.

In the case of nitrogen dioxide, WHO recommends averages of 40 µg/m^3 annually and 200 µg/m^3 per hour. Peru does not satisfy the annual recommendation, but it does meet the hourly standard. In the case of sulphur dioxide, Peru applies two daily average values, one of which coincides with the WHO recommendation, while the other is four times higher. The latter is implemented in localities where SO_2 concentrations were recorded above 20 µg/m^3; so, in the framework of the respective action plans, activities were designed and deadlines set for achieving the relevant targets. These provisions are applied in the localities of Ilo, Arequipa and La Oroya, two of which have smelters operating in them. Peru has not adopted a standard applicable to SO_2 emissions averaged over a 10-minute period, as suggested by WHO to avoid serious effects. In the case of ozone, the limit proposed by WHO is an average of 100 µg/m^3 for each eight-hour period, so the standard adopted in Peru can be considered adequate.

According to the available information, systematic measurements of air quality are only taken in Lima. In the rest of the country, there is no periodic monitoring to verify fulfilment of the aforementioned standards.

Maximum permissible limits applicable to atmospheric emissions

The maximum permissible limits refer to the concentration of substances in effluents or emissions which, if exceeded, have or could have serious effects on health, human well-being, and the environment. In the framework of the sectoral structure of environmental management in Peru, these limits are defined by economic sector, rather than by the technology employed; and they are inspected by the ministries responsible for the respective sectors, except where that responsibility has been delegated to the Environmental Assessment and Enforcement Agency, or to equivalent regional and local institutions.

Table 6.7. Sectors in which MPLs are applied

Institution responsible	Sector and subsector
Ministry of Production	Production of beer, cement and paper; leather products; fishery sector
Ministry of Energy and Mining	Mining-metallurgy, hydrocarbons
Ministry of Transport and Communications	Vehicle fleet

Source: Ministry of the Environment (MINAM).

Under current law, when determining MPLs, consideration must be given to the effect of the regulated emissions on air quality; but the degree of co-ordination between institutions responsible for verifying compliance and their capacity to perform that task is unknown. Thus far, this type of limit has not been imposed on any industrial sector that is important in terms of air quality.

Action plans applicable to air

The National Environmental Air Quality Standards Regulation (Supreme Decree 074-2001-PCM) defines priority attention zones as those with populated centres or populations larger than 250 000 inhabitants, or a per hectare population density that justifies their priority attention, or the presence of socioeconomic activities that have a significant influence on air quality. Under this definition, air-quality protection measures can be adopted, even if the area has not been judged non-compliant with a particular standard. The regulation also stipulates that the action plans aim to "establish the strategy, policies and measures needed to enable a priority attention zone to attain the primary air quality standards in a given period", notwithstanding environmental management measures or other tools in force in areas that are not declared priority attention zones.

Following promulgation of the regulation, the first 13 priority attention zones were created in 2001; and a further 18 were created in 2012, under the responsibility of MINAM (Ministerial Resolution 339-2012-MINAM).

Table 6.8. Localities declared priority attention zones in relation to air quality

Regulation	Zones
Supreme Decree 074-2001-PCM	Arequipa, Cerro de Pasco, Chiclayo, Chimbote, Cusco, Huancayo, Ilo, Iquitos, La Oroya, Lima-Callao, Pisco, Piura, Trujillo
Ministerial Resolution 339-2012-MINAM	Abancay, Utcubamba, Cajamarca, Chachapoyas, Huamanga, Huancavelica, Huánuco, Huaraz, Ica, San Román, Mariscal Nieto, Moyobamba, Tarapoto, Tumbes, Coronel Portillo, Tambopata, Puno, Tacna

Source: Ministry of the Environment (MINAM).

An estimated 18.3 million people (60% of Peru's population) have benefited from the action plans applied in the priority zones. The plans corresponding to 18 of those zones are currently being formulated, those of another six are in the approval process, and for the remaining seven zones existing plans are being updated.[4]

The first step in formulating an action plan entails organising a technical group with representatives from different sectors of society and the public institutions responsible for activities pertaining to the domain in question. The group must compile the necessary information, including emission inventories, quality data and epidemiological studies, and formulate the relevant measures. Then, a preliminary plan proposal is drafted and circulated for public consultation.

A review of several action plans reveals an egregious lack of information on air quality and emission sources. In many cases, emission inventories are mere listings which do not classify the sources properly and use inadequate emission factors. It is also common for generic measures to be proposed to control pollution, including rationalising transport systems, improving fuel quality, applying vehicle emission controls, or promoting the adoption of land management tools. This makes it impossible to determine their effectiveness or verify their application.

Environmental management tools related to production activities

To make sure the environmental regulations are being complied with, Peru requires industries to submit the following documents: (i) environmental impact statements or studies, either detailed or semi-detailed, as a prerequisite for obtaining permits to start activities; (ii) preliminary environmental diagnostic assessments, for the formulation of an Environmental Management Adaptation Programme (PAMA), which identifies and evaluates the environmental impact and problems caused by manufacturing industries; and (iii) PAMA, to facilitate the adaptation of an economic activity to new environmental requirements. These are related not only to air quality but also to other aspects of the environment.

The current regulations are being fulfilled progressively. Initially, four subsectors were considered: beer, paper, leather products and cement. In 2005, Ministerial Resolution 055-2005-PRODUCE, incorporated a further three: textiles, smelting and ceramics. Firms in these subsectors are required to report on their respective adaptation programmes and implement them.

Notes

[1] Residual fuels for industrial use obtained from the oil refining process.
[2] Expressed in terms of total primary energy supply (TPES).
[3] See [online] http://www.infogas.com.pe.
[4] [Online] http://www.minam.gob.pe.

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Chapter 7. Management of waste and chemicals

This chapter discusses major developments in waste management, including the development of waste management plans at different scales. It reviews the state of production, collection and disposal of waste and discusses related information measures (or lack thereof). It presents regulatory frameworks for municipal, industrial and hazardous waste management. The chapter also presents trends in the use of chemicals and points to the lack of specific policies and plans for chemicals. It reviews the chemicals risk management policy and import measures. Finally, it discusses mercury releases from small-scale mining.

Key findings and recommendations

Solid waste management

Peru's daily per capita generation of waste, at 0.58 kg, is low compared to other countries. The infrastructure in place for the disposal of domestic wastes is, however, inadequate. According to available information, there are currently only 11 supervised sanitary landfills, four of which are located in the city of Lima. This is clearly inadequate to handle the volume of wastes in the country, and produces a situation where 46.2% of wastes are not properly dealt with, being disposed of instead in unsupervised dumps or by uncontrolled incineration, or even thrown into rivers or the sea. There are major differences among regions with respect to the infrastructure available for final disposal of wastes and the availability of municipal trash collection services. These shortcomings can be explained to some extent by the high rate of municipal tax arrears, which denies municipalities the revenues needed to collect and process wastes.

An important step has been taken with the implementation of the solid waste management information system (SIGERSOL). Since 2009, municipalities have been required to report data on waste generation and management, for inclusion in this system. Prior to that, information came from the solid waste management plans (PIGARS). In 2007, the available information came from the 51 PIGARS reported for that year, a number that rose to 55 in 2008 and to 58 in 2009, when it was supplemented by information from the 246 districts that reported to SIGERSOL. The number of districts reporting to SIGERSOL increased to 251 in 2010, 447 in 2011, 664 in 2012, and 666 in 2013. In November 2015 Peru had 1 857 reporting districts, but this still represented sparse coverage. The lack of information is a more acute problem when it comes to the generation and management of non-municipal wastes, including hazardous wastes.

The legal framework for waste management is comprehensive and lays the basis for the national policy in this area. The General Solid Wastes Act (Law No. 27314-2000 and its amendments) and the regulations to the law (Reg. 057-2004-PCM) seek to ensure proper management and handling of wastes, both municipal and non-municipal, in ways that will prevent health risks and protect and promote environmental quality, health and well-being. The law makes the provincial municipalities responsible for managing solid wastes of domestic and commercial origin, and similar wastes from other activities. On the other hand, the district municipalities are responsible for the collection and transportation of these solid wastes, as well as for the cleaning of streets and public spaces and monuments. The law also provides that all solid wastes must be conveyed directly to the treatment plant, or to the final disposal site designated by the provincial municipality. This obligation today goes widely unobserved. In addition to this generic rule, there is a law regulating the activity of recyclers (Law No. 29419-2009) and its regulations (DS 005-2010-MINAM), designed to promote the protection, training, social and vocational development of recyclers, and to encourage them to form associations and formalise their work.

In the case of non-municipal wastes, the sector authorities are responsible for enforcing the General Act, the Regulations and other standards. The sectors covered here include manufacturing, agriculture, agro-industry and construction. In this context, specific regulations have been recently approved, such as those governing the management and handling of wastes from construction and demolition activities (DS 003-2013-VIVIENDA), and there is a specific standard for wastes from electric and electronic devices, whereby liability extends to the manufacturers of these products. There is also a specific standard regulating the production, storage, packaging, transport and transit of hazardous wastes, as well as their management and final disposal.

The Ministry of the Environment is responsible for adapting the National Solid Waste Policy and for promoting the preparation and application of comprehensive solid waste management plans (PIGARS) and the solid waste handling plans (PMRS) at the provincial and district levels. Despite the obligation to prepare such plans at the regional and local levels, only a small percentage of districts nationwide have these management tools in place at the present time.

A number of steps have been taken to improve waste management in Peru. The Ministry of the Environment has launched a series of programmes and investment projects that include various aspects of comprehensive waste management. Highly positive initiatives undertaken in recent years include the Municipal Modernization Programme (PMM) (in conjunction with the Ministry of Economy and Finance), the Segregation-at-Source Programme, and the Programme for Formalization of Recyclers. The Segregation-at-Source Programme, which involves the selective collection of solid wastes from urban dwellings across the country and was launched in 2011, should be accompanied by incentives and expanded to embrace more regions and municipalities.

The specific legislation governing comprehensive management of solid wastes at the national level dates from 15 years ago, and the Ministry of the Environment is working to revise and update that legislation. Meanwhile, the National Environmental Action Plan (PLANAA 2011-2021) made it a priority target for 2021 to have 100% of municipal solid wastes managed, recycled and disposed of properly. In addition it calls for the following: (a) 100% of reusable solid wastes to be recycled; (b) a 20% reduction in the generation of hazardous wastes in relation to the baseline; (c) 100% of hazardous wastes to be properly treated and disposed of in appropriate facilities; and (d) 100% of electrical and electronic waste to be recycled and disposed of properly. These are ambitious goals that will be difficult to meet without the necessary investments, better information and co-ordination among the sectors, and further assistance to local and regional governments.

Chemicals management

The use of chemical substances in Peru has expanded significantly in recent years, owing primarily to imports linked to growth in certain industries such as pharmaceuticals, cosmetics and bottle manufacturing, although information is available only for those chemicals included in a specific tariff line. Domestic production of chemicals has risen slightly from the levels observed between 2007 and 2012.

Peru currently has no unified system for recording data on imported products and substances that are not included in a specific tariff line, and there is room for improvement in this area. For some time now the government has been implementing a Pollutant Release and Transfer Register (*Registro de Emisiones y Transferencia de Contaminantes*, RETC), which will provide better information for managing chemical substances.

Peru's National Environmental Policy is the primary framework for managing chemical substances and hazardous materials, and is of compulsory observance by all economic sectors. It establishes six policy guidelines that promote the life-cycle approach, with a view to reducing the risks associated with final disposal and highlighting the need to communicate the risks associated with each stage of that cycle. It also stresses the dissemination of good practices in the handling of chemical substances, and consideration of health criteria and the protection of fragile ecosystems in the process of formulating contingency plans for the use and management of those substances. These two management approaches —life-cycle and risk-based— are spelled out in the National Environmental Health Policy 2011-2020 and in the National Disaster Risk Management Policy, respectively. More specifically, Peru has adopted the following instruments on chemical substances management: the General Health Act (Law 26.842/1997), the General Law on the Environment (Law 28.611/2005), and Decree Law 1.059 approving the General Law on Agricultural Health of 2008. These laws make it possible to classify hazardous substances and products, to limit their toxicity and their harmful effects on health, to hold firms accountable for exercising effective control over hazardous materials and substances inherent to their activities, in this way controlling the negative environmental impacts they may generate, and to manage agricultural inputs such as chemical pesticides that can have harmful effects on natural resources and on the environment in general. It is important to note that Peru does not have a chemical substances management policy as such: rather, this is governed by policies of a general nature that incorporate some form of chemical substances management, primarily from a risk perspective. This approach is less effective in terms of the environmental management of such substances, as there is no specific action plan.

Peruvian legislation governs the management of chemical substances through their use, and this poses a challenge for effective co-ordination among the authorities. This situation complicates the subsequent implementation of the objectives pursued in the strategic instruments, and the plethora of objectives and targets in each sector ultimately results in less effective and more bureaucratic management. As for pesticides, these are classified in terms of agricultural, industrial or domestic use, or public health protection. In the agricultural area, the tightest restriction applies to the persistent organic pollutants covered by the Stockholm Convention, as well as other pesticides recognised internationally as hazardous. In the industrial sector, there is a regulation governing substances that deplete the ozone layer, which was adopted in the context of the Vienna Convention and the Montreal Protocol.

Supreme Decree DS 015-2005-SA establishes allowable limits of exposure to chemical agents in the workplace, and those limits can be updated and new chemical substances added in light of scientific and technological progress. The provision regulates chemical substances only and not their blends, which complicates their monitoring and control. While formal businesses have instruments such as contingency plans and workplace safety systems for preventing and responding to chemical accidents, informal businesses present greater risks, and the resulting lack of information may impede response by the emergency services (fire brigades and police). With the adoption of environmental measures in the principal markets (especially the European Union) that export hazardous or controlled chemical substances to Peru, it is becoming common practice to apply for a health authorisation to import chemical substances. It would be very useful to supplement this action with control infrastructure in the ports, and communication with the authorities involved.

Emissions and releases of mercury from small-scale mining activity constitute the main national concern with respect to this substance, which is difficult to regulate and may moreover be linked to illicit activities. Peru has developed a strategy for rationalising small-scale and artisanal mining, and one of its priority targets for 2016 is to reduce the use of mercury in mining operations, with special measures for small-scale gold extraction and processing activities.

Recommendations

Waste management

- Create a propitious climate for attracting investment in infrastructure for the proper management of municipal solid waste, including its final treatment (controlled landfills) and facilities to allow the recovery of reusable waste, including compostable materials for organic fractionation. Continue with the plan of State incentives for improved management and modernisation as a temporary measure towards the full enforcement of the user pays principle. Ensure adequate investment in infrastructure for the treatment of hazardous wastes and their proper final disposal (including secure deposits). Take action to identify, close and reclaim the sites of illegal and abandoned dumps, treating them formally as contaminated sites.
- Maintain Peru's low rate of per capita waste generation by promoting activities to raise public awareness about reducing waste, at-origin separation, reuse of materials, recycling, and so forth. Provide education and training for managers of local entities to improve knowledge about solid waste management.
- Design user fees that cover the real total cost of providing municipal waste collection, transportation, treatment and final disposal services, including observation of the internalised costs or polluter pays principle (e.g. by progressing towards user fees based on the amount and toxicity of domestic waste). Design mechanisms to ensure these fees are collected, while address matters of affordability (e.g. discounting a part of the cost of their monthly waste generation from the beneficiaries of social assistance programmes).
- Ensure that the institutions responsible for managing non-municipal waste, chiefly industrial and hazardous wastes, liaise with the Ministry of the Environment to co-ordinate their management policies, thereby giving environmental considerations a stronger presence in regulatory policies.
- Improve the available information on the generation and management of non-municipal waste and its traceability. This includes construction and electronic wastes and, in particular, hazardous industrial wastes. Increase the level of reporting to the Ministry of the Environment of the agencies responsible for the management of sectoral waste.

Chemicals management

- Enhance the regulatory framework to improve the handling of chemicals throughout their life-cycle. Assess the usefulness of creating specific instruments for chemicals management, including combinations of chemicals, with a preventive approach and tied in with risk management, and with an action plan that includes specific measures and timeframes. Strengthen oversight activities and links between the services in charge of contingency plans in the event of accidents and emergencies.
- Review the effectiveness and efficiency of the institutional arrangements for managing risks related to the use of chemical substances, including co-ordination mechanisms. In the area of activity licences, establish an information system that provides guidelines for new chemicals industry facilities, with a focus on preventing and managing risks and accidents. Strengthen co-ordination between the agriculture and health sectors to improve oversight of pesticide use.
- Increase the human and financial resources of the public services responsible for chemicals management, chiefly in the areas of the environment, health and agriculture, in order to implement a qualified and effective institutional framework for the implementation of

regulations and actions to minimise risks in the handling of chemical substances, including the protection of workers' health.

- Devise a single, consolidated system for recording information on imported hazardous chemical products and substances that are not included in a tariff line, expanding the identification and registration criteria, creating new lines for new products, identifying their countries of origin and including locator maps of those companies involved in importing and marketing the products and substances so identified.
- Improve the port control infrastructure for the proper management and oversight of imported goods, facilitating inspections and compliance with the regulations in order to prevent environmental and health risks.

1. Solid waste management

1.1. Legal and institutional framework

Legal instruments

Solid-waste management activities and the establishment of the respective legal framework are relatively recent in Peru (Table 7.1). A document produced jointly by the General Directorate of Environmental Health and the Pan-American Health Organization (DIGESA/PAHO, 1998), which made a sectoral analysis of solid waste in Peru, was the first step towards managing solid waste correctly from the health and environmental standpoints (MINAM, 2012a; Office of the Ombudsman, 2007). In 2000, the General Law on Solid Wastes was approved (Law 27.314 and subsequent amendments), which, along with the respective Supreme Decree (057-2004-PCM), laid the foundations for a national policy on the subject. These legal instruments aim to ensure proper management and handling of waste materials, both municipal and non-municipal, in ways that will prevent health risks and will protect and enhance environmental quality, health and personal well-being. Following the promulgation of this law, steps were taken to formulate comprehensive solid waste management plans (PIGARS).

The national survey performed as part of the Regional Evaluation of Waste Management Services (2002), undertaken by the Pan-American Health Organization (PAHO, 2003), is one of the key reports highlighting the critical situation prevailing in Peru in terms of solid waste management at the start of this century. Nonetheless, its conclusions referred exclusively to the large cities, which at that time accounted for less than one third of the population. The National Solid Waste Management Plan approved through Executive Board Decree 004-2005-CONAM/CD, was based on this report.

Table 7.1. Regulations governing the management and handling of solid waste

Year of approval	Regulation	Publication date
1991	Legislative Decree 635, Penal Code	8 April 1991
1991	Legislative Decree 757, Framework Law for Private Investment Growth	10 November 1991
1993	Political Constitution of Peru	30 December 1993
1997	General Health Act (Law 28.842)	15 July 1997
2000	General Law on Solid Waste (Law 27.314)	21 July 2000
2001	Law of the National System of Environmental Impact Assessment (Law 27.446)	23 April 2001
2003	Organic Law of Municipalities (Law 27.972)	27 May 2003
2004	Framework Law of the National Environmental Management System (Law 28.245)	8 June 2004
2004	Law Regulating Land Transport of Hazardous Waste and Materials (Law 28.256)	18 June 2004
2004	Supreme Decree 057-2004-PCM, approving the regulations to the General Law on Solid Waste	24 July 2004
2005	General Law on the Environment (Law 2.861)	15 October 2005
2006	Legislative Resolution 28.766, approving the Peru-United States Trade Promotion Agreement	29 June 2006
2008	Legislative Decree 1.013, approving the Law creating the Ministry of Environment and establishing its organisation and functions	14 May 2008
2008	Supreme Decree 021-2008-MTC, approving the National Regulation on Land Transport of Hazardous Waste and Materials	10 June 2008
2008	Legislative Decree 1.065 amending Law 27.314, the General Law on Solid Waste	28 June 2008
2008	Law 29.263, amending several articles of the Penal Code and the General Law on the Environment.	2 October 2008
2009	Supreme Decree 012-2009-MINAM, approving the National Environment Policy	23 May 2009
2009	Supreme Decree 019-2009-MINAM, approving the regulations to the Law on the National System of Environmental Impact Assessment (SEIA)	25 September 2009
2009	Law regulating the activity of recyclers (Law 29.410)	7 October 2009
2010	Supreme Decree 005-2010-MINAM, approving the regulation to the Law regulating the activity of recyclers (Law 29.410)	3 June 2010
2012	Supreme Decree 001-2012-MINAM, approving the National Regulation for the Management and Handling of Electrical and Electronic Equipment Waste	27 June 2012
2012	Health Technical Standard 096-MINSA/DIGESA on the management and handling of solid waste in health establishments and ancillary medical services	July 2012
2012	Law 1.549-2012 strengthening the institutionalisation of the National Policy on Environmental Education and its effective incorporation in territorial development	November 2012
2012	Supreme Decree 016-2012-AG, approving Regulations on the Handling of Solid Waste Generated in the Agricultural Sector	November 2012
2013	Directorial Resolution 007-2013-EF/63.01 General Guide for Identification, Formulation and Social Evaluation of Public Investment Projects at the Profile Level	31 October 2013
2013	Supreme Decree 003-2013-VIVIENDA, approving regulations for the management and handling of wastes from construction and demolition activities	8 February2013
2013	Supreme Decree 002-2013-MINAM, Approving Environmental Quality Standards (ECA) for Soil	25 March 2013

Source: prepared by the authors on the basis of MINAM (2012a) and MINAM (2014b).

One of the milestones in this domain during the period analysed was the publication of the National Environment Policy (Supreme Decree 012-2009-MINAM). Policy pillar 2, on integrated environmental quality management, addresses the issue of solid waste through nine guidelines, but does not set any specific targets.

Subsequently, the National Environmental Action Plan *(PLANAA-PERÚ 2011-2021)* made it a priority target for 2021 to have 100% of municipal solid wastes managed, recycled and correctly disposed of. In addition, it called for the following: (a) 100% of reusable solid wastes recycled; (b) a 20% reduction in the generation of hazardous wastes in relation to the baseline; (c) 100% of hazardous wastes properly treated and disposed of in appropriate facilities; and (d) 100% of waste from electrical and electronic devices recycled and adequately disposed of. These ambitious goals reflect MINAM efforts to improve the management of municipal and non-municipal solid wastes; however, it seems unlikely that they will be achieved by 2021. The data available on progress achieved show that whereas the target for 2012 was to recycle 30% of reusable waste, the data supplied by the districts show that just 10.4% was being recycled in 2010 and only 13.8% in 2011. Moreover, although it was intended to provide adequate final disposal for 50% of non-reusable solid wastes, the levels actually attained were 42.7% in 2010 and 37.6% in 2011 (MINAM, 2012c).

In 2009, the activities of recyclers began to be regulated, under Law 29.419 and its statutes (Supreme Decree 005-2010-MINAM). Measures were adopted to promote the protection, training and social and vocational development of recyclers, and to encourage them to form associations and formalise their work, to help improve waste management.

Specific regulation of the handling of non-hazardous waste by non-municipal entities is very recent, since it was only in 2013 that the Regulations for the Management and Handling of Wastes from Construction and Demolition Activities were approved (Supreme Decree 003-2013–VIVIENDA). In 2012, rules applicable to electrical and electronic equipment waste were also approved, establishing extended producer responsibility in respect of this type of product. This regulation is a novelty in Peru, because it requires manufacturers to assume shared and differentiated responsibility, and it advocates comprehensive handling of solid wastes (National Regulation for the Management and Handling of Electrical and Electronic Equipment Waste, Supreme Decree 001-2012-MINAM).

In 2004, the Law Regulating Land Transport of Hazardous Waste and Materials (Law 28.256) was passed. This law also governed production, storage, packaging, transport, and final management and disposal. The National Regulation on Land Transport of Hazardous Waste and Materials (Supreme Decree 021-2008–MTC) also contains provisions on the transport of hazardous wastes, which must observe the principles of prevention and the protection of people, the environment and property.

Since 2009, awareness-raising initiatives have given rise to activities aimed at strengthening environmental management and advocacy capacities, observance of the Inter-American Cleanliness and Citizenship Day, organisation of the biodegradable and recyclable products fair, and public campaigns on the storage and collection of electric and electronic equipment. However, progress in this area remains slow.

In view of the situation described above, there is an urgent need to speed up the review of policy instruments, to set measurable and tangible targets, and make sure their achievement is supported by investments that provide for integrated waste management. The approval of the National Integrated Solid Waste Management Plan – PLANRES 2016-2024 (Ministerial Decision 191-2016-MINAM) thus stands out, as its implementation will make it possible to improve solid waste management in terms of measurable objectives, targets and indicators.

Institutional framework

The management and handling of municipal solid waste, along with the related environmental inspection, involves multiple entities, including the Ministry of the

Environment (MINAM), the Agency for Environmental Assessment and Enforcement (OEFA), the General Directorate of Environmental Health (DIGESA) of the Ministry of Health, and local government entities (provincial and district municipalities).

The Ministry of the Environment is responsible for promoting appropriate management of solid waste, pursuant to the National Environmental Management System created under Law 28.245, approving the National Solid Waste Policy, and promoting the formulation and application of integrated environmental management plans (PIGARS) and solid waste management plans (PMRS).

The Agency for Environmental Assessment and Enforcement (OEFA) is the governing body of the National Environmental Assessment and Oversight System (SINEFA); it is also responsible for supervising the municipalities in fulfilling their oversight functions with respect to waste producers.

The General Directorate of Environmental Health (DIGESA) is the technical agency responsible for the normative aspects of basic sanitation, occupational health, food hygiene, control of zoonosis and environmental protection. The Directorate fulfils a variety of functions, including proposing the draft National Environmental Health Policy, enforcing it in different domains, and administering and updating the records of solid waste service providers, solid waste marketing firms, and solid waste supervisors. It also authorises transboundary transport operations involving hazardous waste.

Under Law 28.245, the municipalities are required to promote the correct management and handling of household or commercial solid wastes within their jurisdiction. Consequently, they must prioritise public or public-private investments for the construction, implementation and environmental and sanitary adaptation of the relevant infrastructure. They are also responsible for providing solid waste collection and transport services, and for the cleaning of roads, streets and public spaces and monuments; and they are authorised to enter into service provision contracts with firms registered in DIGESA, which they must regulate and oversee. The legislation also requires all solid waste to be conveyed directly to the treatment and transfer plants, or to the final disposal point designated by the municipality. Although these provisions have been compulsory since 2000, they are largely ignored.

In 2008, Supreme Decree 1065 required all firms to report to the competent authority on the annual handling of non-municipal solid wastes, under a Solid Waste Handling Plan (PMRS). Firms that generate this type of waste are required to handle it according to technical criteria appropriate to the different categories, and to distinguish between hazardous and non-hazardous materials. This regulation applies to the manufacturing, agricultural, agribusiness and construction sectors, among others.

The sectoral authorities are responsible for enforcing the General Law on Solid Wastes, along with the respective regulations and related rules. The entities that generate this type of waste must be regulated, evaluated, overseen, and sanctioned by the ministries and relevant regulatory or inspection bodies. A comparison of data on the number of existing firms and those that reported on the subject shows that a large proportion of them do not report to the competent authority. Information on the handling of solid waste is very inconsistent (section 1.3).

The foregoing shows that responsibilities are dispersed between different ministerial entities, and that the municipalities are overburdened with solid waste management responsibilities that exceed their capacities. It would therefore be advisable to consider expanding inspection powers and increasing resources for awareness-raising among firms, to ensure correct management of solid waste and appropriate presentation of reports on its handling.

International agreements

International agreements in this sphere include the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, adopted on 22 March 1989, which Peru signed and acceded to in 1993. Under the Convention, all transboundary movements of hazardous waste, either originating in or destined for Peru, must receive prior authorisation. It is also hoped that this will reduce the volume of transboundary waste and ensure that such material undergoes treatment near its place of origin.

The Agency for Environmental Assessment and Enforcement issued a warning that, given the prevailing conditions and inadequate final disposal and incineration of solid waste, Peru was contravening the principles of the Kyoto Protocol to the United Nations Framework Convention on Climate Change, which it had ratified in 2002, in terms of reducing the generation of greenhouse gases (GHGs) such as carbon dioxide (CO_2) and methane (CH_4) (OEFA, 2014a). In this connection, one of the key items of the National Strategy on Climate Change (ENCC) is the proposal to reduce GHG emissions by introducing changes in key areas, including solid waste management. Implementation of the programme to prepare Nationally Appropriate Mitigation Actions (NAMAs) in the solid waste sector could contribute towards fulfilling international commitments in this domain.[1] The programme mainly targets the following: (i) the capture of landfill gas to generate electricity; (ii) the capture of landfill gas by flaring; and (iii) the composting of organic waste separated at source (MINAM/NORDEN, 2013).

As Peru is also a party to the Stockholm Convention, it is required to adopt measures to reduce the unintentional production of persistent organic pollutants (POPs) including dioxins and furans. In addition, OEFA recommended strengthening activities in this area, particularly those related to the reduction of pollutants generated by the burning of municipal and hospital wastes in garbage dumps (OEFA, 2014b).

1.2. Pressures on human health and the environment

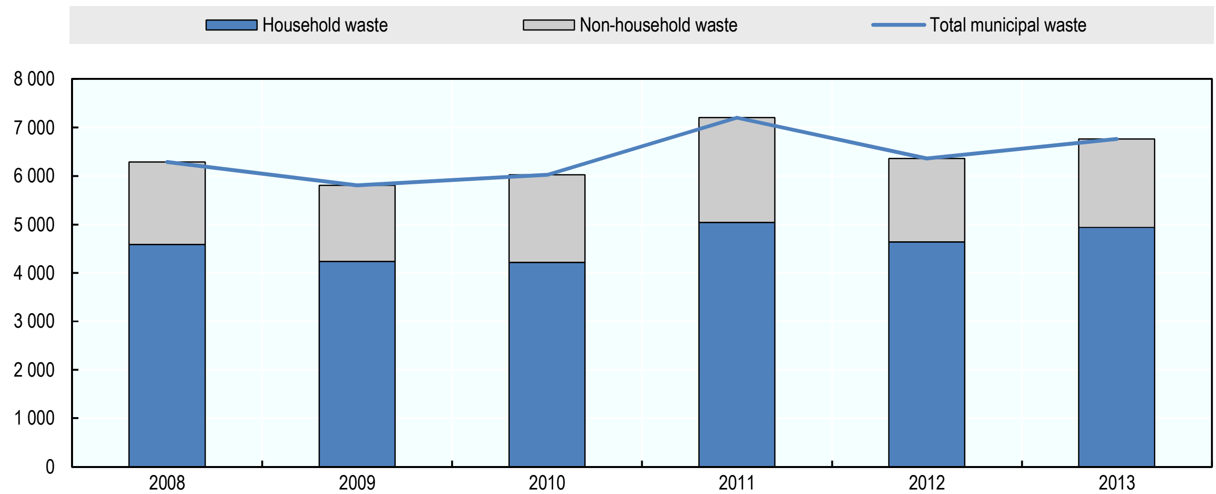
The combination of population growth, development patterns in urban zones and production activities has serious effects on human health and the environment, since they increase the production of solid and chemical waste. As the municipalities and districts provide little information on the subject it is hard to assess the situation in 2003-2013 (section 1.3).

Municipal solid wastes

National estimations performed in 2008-2013 indicate that municipal waste production varied between 6 million tonnes and 7 million tonnes per year, over 70% being of household origin (Figure 7.1). The fact that these waste materials grew from 4.2 million tonnes in 2009 to 5 million tonnes in 2013 suggests that they are directly related to per capita GDP growth in the same period (MINAM, 2012a and 2012c).

Figure 7.1. Generation of municipal household waste, 2008-2013

(Thousands of tonnes per year)

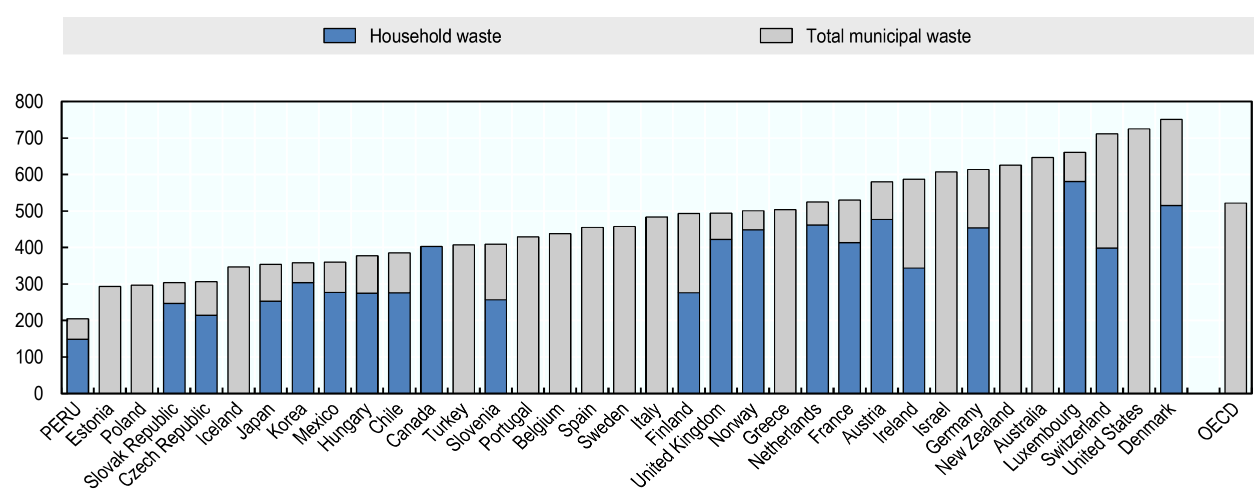


Source: Prepared by the authors on the basis of MINAM (2014b).

Waste production per capita averaged 223 kg in 2011, and dropped to 211 kg and 204 kg in 2012 and 2013, respectively (MINAM, 2012c and 2014a). These figures are low compared to the average of OECD member countries, which was 510 kg per capita in 2012 (Figure 7.2).

Figure 7.2. OECD member countries and Peru: generation of municipal waste, 2013

(Kg per capita)



Source: OECD, "Municipal waste", *OECD Environment Statistics* (database), 2015 [online] https://data.oecd.org/waste/municipal-waste.htm; and MINAM (2012a).

Official extrapolations show that waste production varies across regions and also fluctuates from year to year. On average, the coastal region generated a larger volume in

2010-2013, although in 2012 there was an increase in the rainforest (*selva*) region (Table 7.2). Lima is the Peruvian city that generates the most household solid waste, with the amount doubling between 2001 and 2014, from 4 097 to 8 014 tonnes per day, to represent over 40% of the national total in the latter year. Estimations made by the municipalities on the basis of the Integrated Solid Waste Environmental Management Plan of the Province of Lima see household waste in the province of Lima growing to 16 000 tonnes per day by 2034 (OEFA, 2014b).

Table 7.2. Generation of household waste by region, 2010-2013

Year	Coast	Highlands (sierra)	Rainforest (selva)
2010	0.511	0.533	0.510
2011	0.628	0.547	0.573
2012	0.597	0.527	0.599
2013	0.588	0.513	0.553
Regional average	0.581	0.530	0.558

Source: Ministry of the Environment (MINAM), Sexto informe nacional de residuos sólidos de la gestión del ámbito municipal y no municipal 2013, Lima, 2014.

Non-municipal solid waste

This category includes solid wastes originating in the hospital, construction, agriculture and manufacturing sectors, and also in special installations or activities such as transport and communications, among others. These are required to file annual declarations on their waste management to MINAM, but not all of them do so (MINAM, 2014b).

Data for 2010-2013 are inconsistent, owing mainly to the low level of compliance. The reports refer to over 11 billion tonnes of non-municipal solid waste generated in 2012, of which over 97% came from agriculture; but the figures for this sector vary widely in the other years (Table 7.3 and Chapter 10).

The reports indicate that over 1 million tonnes of non-municipal solid waste was produced in 2013, of which 80% came from the manufacturing sector. The largest volume of hazardous waste came from agriculture in that year; and 100% of waste material produced by the health sector was classified as hazardous or biocontaminated (MINAM, 2014b).

Special attention should be paid to electric and electronic equipment waste, in view of its rising trend. Although a specific regulation was issued on the subject in 2012, MINAM estimations show that in 2015 about 150 000 tonnes of used computers and communication equipment had been discarded. Waste materials of this type can pose health and environmental hazards, since, apart from recoverable materials (plastic and ferrous and nonferrous metals), they also contain substances that have a major environmental impact such as mercury, cadmium, chrome and lead (MINAM, 2014b).

Waste from the construction and demolition sector also poses problems owing to the shortage of adequate infrastructure (rubble tips) for their disposal. Regulations were issued on the subject in 2013, but the handling of this type of waste also requires correct zoning (OEFA, 2014b).

Table 7.3. Generation of non-municipal waste by sector, 2010-2013

(Tonnes per year)

Sector	2010	2011	2012	2013
Manufacturing	8 912	3 634	2 792	823 543
Fishing	112 116	30 205	41 034	114 673
Energy and hydrocarbons	...	519 676	...	...
Transport	...	...	1 288	...
Communications	688	3 217	3 622	...
Agriculture	51 336	889 902	10 765 456	77 681
Mining	...	116 857	...	...
Health	...	43 015	58 524	12 755
Housing and sanitation	...	...	166 182	...
Total	173 052	1 606 506	11 038 898	1 028 652

Source: Ministry of the Environment (MINAM), Sexto informe nacional de residuos sólidos de la gestión del ámbito municipal y no municipal 2013, Lima, 2014.

Main pressures

The pressures caused by incorrect management of municipal and non-municipal solid waste range from the harmful effects on health and the quality of life of populations living close to informal garbage dumps, contamination of water and soils, and socioenvironmental disputes in the communities where sanitary landfills operate or are scheduled to be built, among others.

One of the key pressures is caused by the limited facilities that exist for waste management (section 1.3). This is compounded by incorrect management of certain sanitary landfills, which has triggered major socioenvironmental conflicts (Box 7.1). The shortage of infrastructure resulted in 30 garbage dumps springing up in the country's most heavily populated cities outside Lima-Callao. These are sources of infection; how they are managed is unknown (MINAM/NORDEN, 2013); and at least 20 of them are in a critical state (OEFA, 2014c). A global study of the 50 sites at which the largest informal garbage dumps operate found that five of them are in Peru (ISWA, 2016).

Box 7.1. Socioenvironmental conflicts associated with the construction and operation of sanitary landfills

Although Peru has very few sanitary landfills, their construction and operation have not been free from conflicts with the communities in which they have been placed or are planned.

One of the most serious disputes broke out in November 2008, when construction work began on a sanitary landfill in Lastray, to dispose of solid wastes from the districts of Huancayo, Chilca and El Tambo. The confrontations left several people dead and hundreds injured, along with infrastructure damage, as a result of which construction was suspended. The problem originated in 2003, when the Paccha sanitary landfill, which received waste from Huancayo, was closed down owing to mismanagement. The authorities of this city, which did not have a sanitary landfill for its solid waste, declared a health emergency in 2009 when the inhabitants of Paccha refused to allow waste to continue being sent to their district.

Two years later, a similar dispute erupted in connection with the sanitary landfill of Yuncachahuayco, in Urubamba-Cusco, leading to its closure.

In September 2011, the Metropolitan Municipality of Lima definitively shut down the Ancón sanitary landfill owing to the pollution it was causing in the zone. A technical report by DIGESA showed that the landfill operator did not have an approved environmental impact study, nor had it received technical approval as part of the Solid Waste Infrastructure Project. As a result, the landfill was closed down.

Source: prepared by the authors on the basis of MINAM (2014b) and La República, "Clausuran un relleno sanitario de Ancón", September 2011 [online] http://larepublica.pe/29-09-2011/clausuran-un-relleno-sanitario-de-ancon.

Few studies of the harmful health effects of solid waste have been carried out in Peru. In general, the volume of residential emissions caused by the burning of waste, which is a common practice in localities where there is no regular garbage collection service, is unknown (Chapter 6).

A 1998 study on asthma prevalence among the population of north Lima and how it relates to the environment, found that 19% of households living alongside solid waste accumulation sites had at least one of their members suffering from asthma, compared to 13% in the case of other households (Office of the Ombudsman, 2007).

An analysis of vulnerability associated with the Lima and Callao landfills and garbage dumps found that, in zone 14 of the Comas district, the incidence of acute diarrhoeal diseases was nearly 4 000 per 100 000 inhabitants, compared to an average of 2 000 per 100 000 inhabitants in the district of Pachacamac. Zone 14 is the location for waste separation and recycling activities; and, in addition, its inhabitants are not connected to the drinking water and sewerage networks. The study describes the morphological impact on the banks of the Chillón river, where for many years construction waste has been deposited on flood-prone land areas with a view to urbanisation. This has produced very fragile soils, however, leading to frequent subsidence affecting the homes in the locality. Moreover, most of the people who work in waste recycling activities, who are already very vulnerable, belong to the informal sector and perform their tasks in poor health and safety conditions (Durand and Metzger, 2009).

A study to identify the main sources of pollution in several pilot watersheds in 2000-2012, ranked domestic solid waste dumps second in importance in the Pacific, Amazon and Titicaca watersheds (ANA, 2014). Nonetheless, information is very scarce, and an analysis would need to be made of the negative effects of solid wastes and the facilities into which they are deposited, both socially and in terms of human health and the environment.

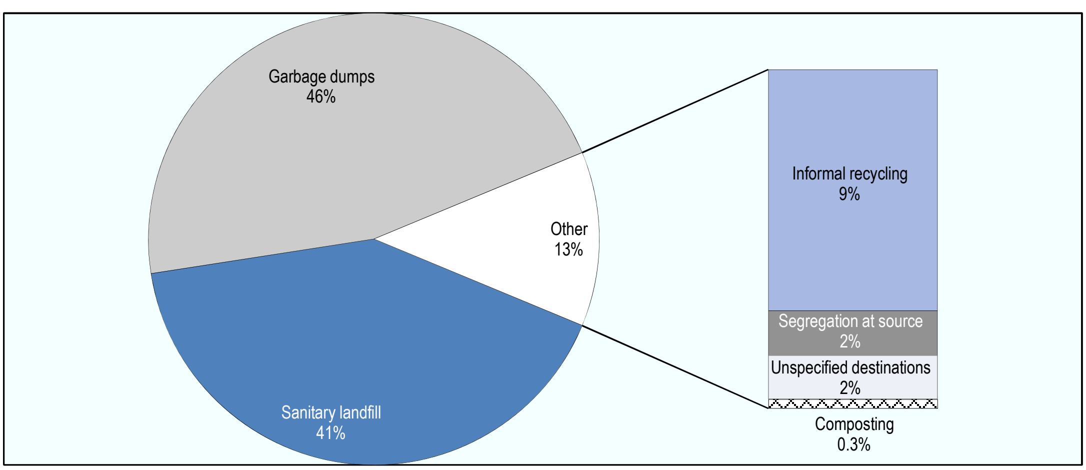
1.3. Trend of solid waste management

According to the Ministry of the Environment, solid waste management is ineffective, both in the municipalities and in the other institutions responsible for this (MINAM, 2012b). The handling of municipal waste has improved in recent years, but efforts must be continued to improve it further.

Under current legal provisions, entities that generate solid waste are responsible for its handling while in their possession; but, once delivered to the municipality or to an authorised solid waste service provider, the latter is responsible for its management until disposal in a sanitary landfill (OEFA, 2014b). Enforcing these provisions is difficult owing to the lack of sanitary landfills and the existence of numerous illegal waste dumps, compounded by the few facilities available for depositing non-municipal waste (including construction rubble and electronic and hazardous waste materials), and little or no separation of materials. This situation poses enormous problems for the municipalities, which overwhelm their waste management capacity (OEFA, 2014b and Office of the Ombudsman, 2007).

Figure 7.3. Collection and treatment services

(Percentages)



Source: Ministry of the Environment (MINAM), Sexto informe nacional de residuos sólidos de la gestión del ámbito municipal y no municipal 2013, Lima, 2014.

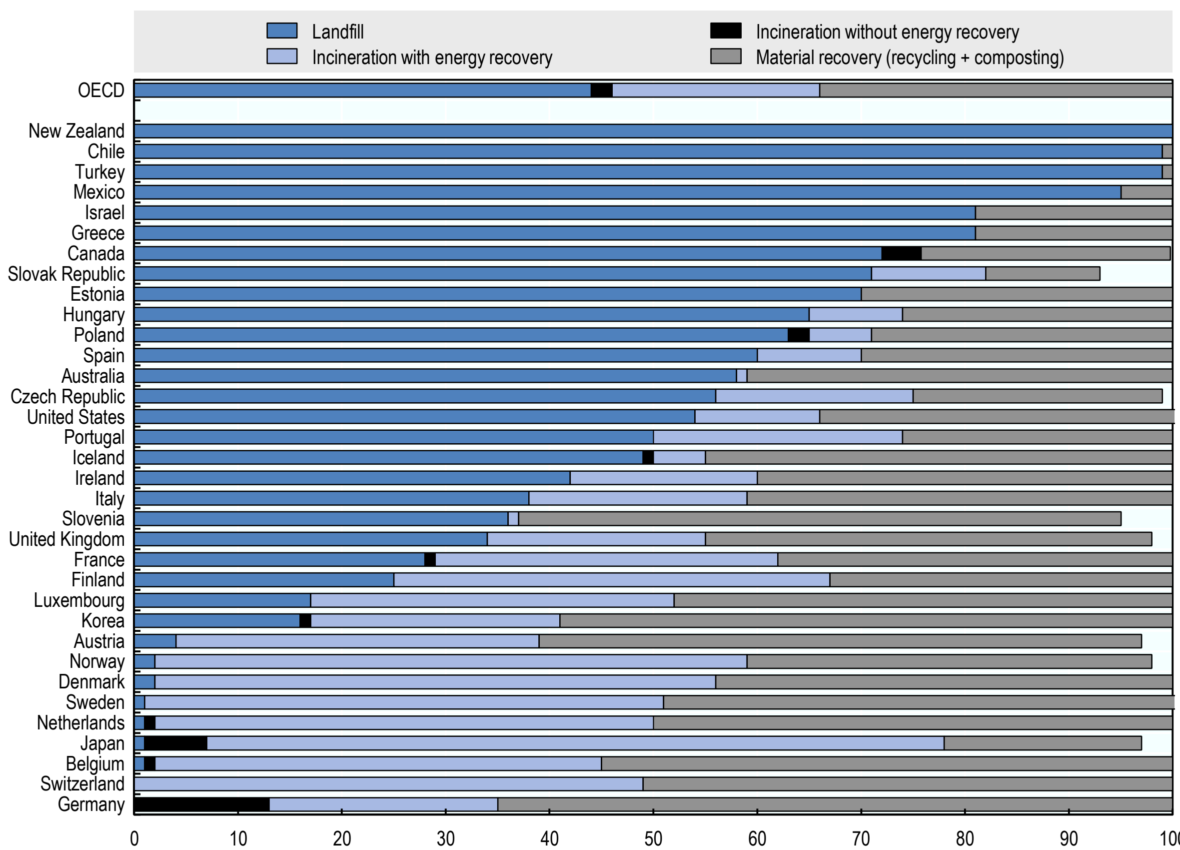
Waste collection and treatment services are generally sparse. Data provided by the municipalities in 2013 indicate that 18 533 tonnes of waste was generated daily; of that total, 87.5% was collected, but only 41% was taken to a sanitary landfill, whereas 47% was disposed of in an informal garbage dump (Figure 7.3). Owing to the lack of supervised garbage dumps, waste is disposed of inappropriately, deposited in unidentified locations and even in rivers and the sea, or burned without any control (MINAM, 2014b;

MINAM/ONUDI/GIZ, 2013). Waste materials that are classified, recycled or sent for composting represented just 12.5% of the total in 2013. This is well below the figure in OECD countries, where, on average, 34% of waste collected that year was sent for recycling and composting, and 44% was disposed of in sanitary landfills (Figure 7.4) (OECD, 2016).

Little use is made of waste materials; but if this were increased it could help reduce the amount of waste disposed of in informal garbage dumps and sanitary landfills. Most waste is organic; in fact, in 2013 over 50% of the total represented food remains, while 28% consisted of non-hazardous recyclable waste, including paper, paperboard, plastics, metals, electronic scrap and glass. Of all of these categories, the volume of plastic waste has increased the most (MINAM, 2012c and 2014b).

Figure 7.4. OECD countries: disposal and recovery of municipal waste, 2013

(Percentages)



Note : Data corresponding to 2013 or the last year for which information is available.
Source: OECD, "Municipal waste", *OECD Environment Statistics* (database), 2015 [online] https://data.oecd.org/waste/municipal-waste.htm; and MINAM (2012a).

Infrastructure

In the whole of Peru, there are only nine supervised sanitary landfills and two secure landfills for the deposit of hazardous waste materials (Figure 7.5). These are insufficient to absorb all of the garbage generated (OEFA, 2014b). While four of these landfills are in

Metropolitan Lima, there are no formal facilities for the final disposal or treatment of solid waste in the forest (*selva*) region (MINAM, 2010).

Figure 7.5. Location of sanitary and secure landfills

Source: OEFA (2014b).

The exploitation and final treatment of waste material is still incipient (Figure 7.3), owing partly to scant infrastructure, which calls for increased investment to facilitate the prior treatment and recovery of recyclable materials. This can be done through sanitary landfills that make it possible to minimise the harmful effects on the environment and human health.

Progress also needs to be made in terms of the oversight, environmental impact assessment and subsequent closure of informal garbage dumps. The regulations to the General Law on Solid Waste authorise the provincial municipalities to close informal dumps for reasons of environmental pollution, modify informal garbage dumps and build new supervised sanitary landfills for solid waste; some progress has been made on the latter. In 2012, a joint programme of the Japan International Cooperation Agency (JICA) and the Inter-American Development Bank (IDB), which aimed to close garbage dumps in 31 selected cities, began implementation. Further investment is needed to achieve this objective, however. The most recent portfolio of carbon projects published by the National Environmental Fund (FONAM) shows that by 2016 only two operating landfills had registered projects under the Clean Development Mechanism (CDM) (the landfills of Huaycoloro and Modelo del Callao).

Special attention also needs to be paid to shortcomings in the handling of non-municipal hazardous waste. The Ministry of Health acknowledges that it does not have storage deposits that comply with current regulations and, above all, that it does not have systems for treating biocontaminated solid waste. Only four of the country's regions apply the autoclave treatment system: Lima (the Sergio E. Bernales hospital), La Libertad (the Trujillo regional hospital), Loreto (the Iquitos regional hospital) and Cusco (the Cusco regional hospital) (MINSA, 2011c). Accordingly, additional investments are needed to build infrastructure for the treatment of hazardous wastes, including secure deposits.

Systemisation of the information

Since 2009, the Solid Waste Management Information System (SIGERSOL) has required the municipalities to report on waste generation and management. This mechanism serves as a basis for compiling quality statistical data, which facilitate the traceability of waste materials and policy decision-making on waste-management planning. The volume of information collected through SIGERSOL has been growing in recent years, and the number of reporting districts has tripled.[2] Nonetheless, according to MINAM, there is still a need to improve the quality of the information and ensure it has the consistency needed for adequate processing (MINAM, 2012c).

The Ministry of the Environment has only six reports on municipal solid waste management for the period 2008-2013, which were prepared using data supplied to SIGERSOL by the municipalities.

Although, under current regulations, the municipalities are required to draw up comprehensive solid waste management plans and solid waste handling plans at the regional and local levels, very few districts have adopted these management tools. In 2007, 51 municipalities reported having applied environmental management plans. By 2013 their number had risen to 149, equivalent to 76.4% of the entire country. In 2013, 398 districts had management plans approved and in force; of this total, 64 belonged to the Province of Lima (MINAM, 2014a), which shows that the level of application of these instruments remains very low.

SIGERSOL is also used to compile data on non-municipal solid wastes, which must be submitted by the sectors generating them. Nonetheless, not all sectors have reported the previous year's solid waste production,[3] so it is impossible to identify the trend. Nor has specific information been provided on the subsequent management of the wastes generated (MINAM, 2014b). To overcome this lack, measures should be adopted to improve traceability and ensure correct management.

In the case of non-municipal non-hazardous waste, it is expected that the implementation of the recent regulations on construction and demolition waste, and electrical and electronic equipment waste, will result in information being compiled on their generation and management.

The lack of information on non-municipal hazardous waste is serious, given the potential impact on human health and the environment of incorrect management of this type of material. In 2014, OEFA warned of the inadequacy of secure landfills for the deposit of hazardous wastes (OEFA, 2014a). In addition, the National Environmental Health Policy insists that, given the minimal technical, sanitary and security criteria applied when solid waste is disposed of in informal waste dumps, this represents a public health hazard; so it is recommended that the sanitary surveillance system be strengthened, to ensure its management pursuant to current legislation (MINSA, 2011a).

Resource allocation and training

Solid waste collection services are very precarious and vary from one municipality to another. The diagnostic study of municipal services performed in 2001 highlights their irregularity, owing to factors such as the preference given to commercial areas, the scarcity and obsolescence of the transport fleet, delays in payments and lack of training of operators (PAHO, 2003).

In 2007, the coverage of services providing final disposal for solid waste in authorised sanitary landfills was 92.6% in Metropolitan Lima, compared to 26.1% countrywide. In 2010, no solid waste collection and transport services were provided in 6% of districts. This figure rose to 10% in 2011. Daily collection also declined, from 66% of municipalities in 2010 to 57% in 2011 (MINAM 2012c and 2014b). In some cases — Callao, Moquegua and Áncash, among others— over 90% of waste materials were collected; but in Madre de Dios and Apurimac —again among others— the service is limited to 40% and 35%, respectively. Average coverage was 73% nationally in 2011.

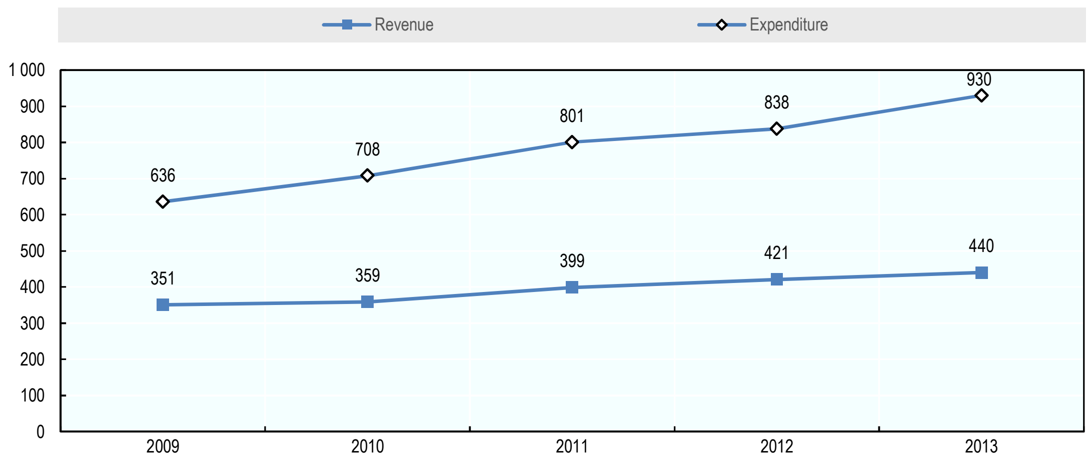
The above is compounded by the informal nature of recycling activities and the precarious work conditions endured by all operators, which reduces the chances of waste management being appropriate from the sanitary standpoint (PAHO, 2003). Although the number of public cleaning personnel practically tripled in recent years, from over 5 600 workers in 2008 to around 16 000 in 2012, there are still wide disparities between municipalities (MINAM 2008, 2012a, 2012c and 2014b). In addition, the fleet of collector vehicles suffers from qualitative and quantitative shortcomings. According to PAHO, 333 vehicles with compacting capacity were needed in Metropolitan Lima in 2001, but only 195 were operating (PAHO, 2003). Ten years later, in 2011, there were still only 613 compactor trucks. Most municipalities also report a lack of appropriate sweeping equipment and insufficient staff to fulfil cleaning and waste collection tasks (MINAM 2008, 2012a, 2012c and 2014b).

In 2009-2013, local government funding for public cleaning services grew by over 45%, from PEN 636 million to PEN 930 million; but revenue from the fees charged fell short by roughly 50% (Figure 7.6). In 2013, the average expenditure on public cleaning services in Peru amounted to PEN 19.97 per capita, compared to revenue of just PEN 6.95. In the same year, in the region of Callao, PEN 89.8 per capita were allocated to this service, whereas revenue was PEN 33.5, generating a deficit of 62.7% (MINAM, 2012c and 2014b). The low revenue level and high arrears rate are widespread problems in the municipalities; these make it difficult to provide a proper service and needs to be corrected. Many municipalities do not bother to charge, despite providing the service (MINAM, 2008).

To tackle this problem, rates should be set in line with the real cost; in other words, to cover all costs of public services of cleaning, collection, transport, transfer, treatment and final disposal, to make it possible to provide a permanent quality service. The municipalities of the districts are also recommended to collect the appropriate fees, according to the criteria set by the provincial municipality, which would help reduce the deficit.

Figure 7.6. Municipal expenditure and revenue for public cleaning services, 2009-2013

(Millions of Peruvian sol)



Source: Ministry of the Environment (MINAM), *Sexto informe nacional de residuos sólidos de la gestión del ámbito municipal y no municipal 2013*, Lima, 2014.

The availability of better trained staff could also help to improve the services. In 2013, cleaning staff received training in just 25% of the district municipalities (MINAM, 2014b).

At the end of the period under review, only 29 districts, representing 18.44% of the country's urban population, had reported having undertaken public awareness-raising and education activities on solid waste management.

Public investment projects for recycling and classification

Apart from investments in infrastructure for the final treatment of municipal wastes (controlled sanitary landfills), investment in prior treatment facilities would make it possible to recover reusable waste. Such facilities would include classification procedures to recover metals, paper and paperboard, along with organic waste composting points, equivalent to roughly 60% of the waste generated in the municipalities.

In this domain, investment programmes and projects have been implemented covering various aspects of the comprehensive management of this type of waste. These include the Municipal Modernization Programme (PMM), the National Solid Waste Segregation-at-Source and Selective Collection Programme, and the Programme for the Formalization of Recyclers. The programme of segregation at source and selective collection of solid waste in urban homes began executing throughout Peru in 2011. As the number of participating districts had doubled by 2013, with 304 tonnes of reusable waste being classified per day, the programme should be promoted and expanded to more regions and municipalities —particularly since informal collection services classified a much larger daily volume: 1 649.7 tonnes (Figure 7.4) (MINAM, 2014b).

2. Management of chemical substances

2.1. Legal and institutional framework

The policies implemented by Peru foster principles of prevention and vigilance in chemicals management, with the aim of minimising the potential environmental and occupational hazards and the risks to human health. As a result, they have been incorporated into planning instruments and national development strategies; and the country has signed several international agreements on the subject (MINAM, 2011).

The Stockholm Convention on Persistent Organic Pollutants was ratified in 2005. The National Plan to Implement the Stockholm Convention then allowed for the design and implementation of the Pollutant Release and Transfer Register (PRTR), under the responsibility of MINAM in its capacity as administrator of the National Environmental Information System (SINIA). In addition, the Ministry of Agriculture took steps to revive the National Pesticides Commission (CONAP) and to adopt strict rules on extremely dangerous pesticides. Peru is also a party to the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; nonetheless, the registration and national control of pesticides in conformity with Andean Community regulations continue to pose a challenge for the agriculture sector (MINAM, 2012c).

The procedures established to fulfil commitments under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal have been applied. In particular, Law 27.314 and its regulations were approved, empowering the General Directorate of Environmental Health of the Ministry of Health to authorise the importation and exportation of waste materials, and issue the relevant notifications to importing countries. The transport of hazardous materials and waste in national territory is governed by Law 28.256 and the corresponding regulations.

The management of chemicals and hazardous materials is basically governed by the National Environmental Policy (Supreme Decree 012-2009-MINAM), which is of compulsory observance by the government and regional and local governments, and serves as a guide to the private sector and civil society. The "integrated environmental quality management" policy pillar includes six guidelines aimed at "establishing and/or strengthening mechanisms of authorisation, vigilance and control in the life-cycle of chemicals and hazardous materials"; and to "promote the adoption of hazard-control criteria during their use and final disposal". Special importance is also attached to the dissemination of good practices on chemicals management and to "the incorporation of health criteria and protection of fragile ecosystems, in the establishment, monitoring and control of contingency plans in the use and management of chemicals and hazardous materials" (MINAM, 2009).

The application of the life-cycle and risk management approaches are backed by the National Environmental Health Policy 2011-2020 and the National Disaster Risk Management Policy, respectively. State Policy 19, on sustainable development and environmental management, supports the appropriate and safe management of chemicals. One of its objectives is to promote environmental management instruments, particularly those relating to prevention and clean production, with the aim of stimulating environmental investments and the transfer of technologies to generate mining, transport and sanitation activities, along with the use of clean and competitive energy sources.

National policies on the management of chemicals have been incorporated into environmental planning instruments. These include Strategic Action 7.17 of the National Environmental Action Plan PLANAA Peru 2011-2021, the objective of which is to diminish and control the environmental hazards represented by chemicals throughout their life-cycle, in accordance with commitments assumed under multilateral agreements on the environment.

Specifically, Peru has adopted the following instruments on chemicals management: the General Health Act (Law 26.842), the General Law on the Environment (Law 28.611) and Decree Law 1.059, approving the General Law on Agricultural Health of 2008. These laws contain provisions on the classification of hazardous substances and products, on limiting their toxicity, and on their harmful effects on human health. They require firms to adopt measures to effectively control the hazardous substances and materials that they use, to avoid negative environmental effects and adequately manage agricultural inputs such as chemical pesticides.

The legislation adopted in Peru regulates the management of chemicals by use, rather than according to the danger they pose. Owing to the multiple purposes and goals of the entities responsible, this makes it difficult to achieve the objectives of strategic instruments, while also limiting management effectiveness and making it unnecessarily bureaucratic.

Regulation of the different aspects of chemicals management is the responsibility of several government institutions. The Ministry of the Environment is the national entity responsible for policy-making on the subject (Table 7.4); but an overlap of powers has been detected in several stages of pesticide management, which restricts efficient articulation among the authorities. The situation is similar in management of petroleum products, industrial chemicals, chemicals of public consumption and civil-use explosives.

In view of the above, it is recommended to strengthen articulation between the institutions that have different responsibilities, through interagency roundtables co-ordinated by the National Environmental Authority. This would facilitate the preparation of joint work programmes and plans of action, along with the monitoring of selected activities, assignment of compliance responsibilities and the establishment of a work schedule for the execution of each activity. It would also be advisable to strengthen capacities among institutions that fulfil chemicals management functions regionally and locally, set related targets that are appropriate to the geopolitical units, and develop plans to monitor capacity development.

Peru has not adopted a policy on chemicals management as such, so this is framed in general policies, to some extent linked with chemicals management and prevention of the risks they represent, but in the general context of environmental management. This renders the measures adopted to manage these substances less effective, given the lack of a specific plan of action.

Table 7.4. Powers of the ministries and government institutions related to pesticides

Responsible Entity	Stage						
	Import	Production	Storage	Transport	Distribution	Use and handling	Final disposal
Ministry of Health/DIGESA	X	X					X
Executive Directorate of Environmental Health / DESA					X	X	
Ministry of Agriculture and Irrigation / National Agrifood Health and Quality Service (SENASA)	X		X	X	X	X	
Ministry of Agriculture and Irrigation / General Directorate of Environmental Affairs (DGAA)							X
Ministry of Labour and Employment Promotion		X	X	X		X	
Local governments / Municipalities	X	X	X		X	X	X
Ministry of Production / Vice Ministry of Industry							
Regional Production Directorates		X					X
Ministry of Transport and Communications / General Directorate of Environmental and Social Affairs (DGASA)				X			
National Tax and Customs Administration (SUNAT)	X						
Ministry of the Environment	National authority establishing the National Environmental Policy and issuing guidelines on chemicals management						

Note: Including POPs.
Source: MINSA (2011b).

In view of this situation, consideration should be given to developing a specific instrument, based on a preventive approach and related to risk management throughout the life-cycle of chemical substances. This should be complemented with a plan of action that sets short-, medium- and long-term compliance targets, which would make it possible to channel initiatives to strengthen the relevant normative and regulatory framework, and thus enhance management.

2.2. Current status and trends in chemicals use

Chemicals use in Peru has grown vigorously, mainly for two reasons. The first is the importation of the substances, although information is only available for those included in a tariff line. The second reason is the growth of industries such as pharmaceuticals, cosmetics and bottle manufacturing.

Importation

The main chemicals imported are classified as either organic or inorganic, and are listed in customs tariff chapters 28 and 29, of section VI (Products of the chemicals or allied industries). In 2008-2012, 76% of total imports were organic substances and 23% inorganic. There was a general reduction in imports. This was steep in the case of sulphuric acid owing to an increase in domestic production (MINAM, 2014a). In 2013, a total of 119 imported chemical products posed some degree of hazard: 52% had toxic effects for the environment and aquatic organisms, and 19% were toxic for human health, including reproduction.

In sectoral terms, imports of the pharmaceutical products listed in chapter 30 of the customs tariff grew (MINAM, 2014a). There were also increases in foreign purchases of chemicals used in the agriculture, mining and manufacturing sectors —particularly for the first of these, in which fertiliser production and imports grew by almost 50% in 2001-2007 (MINAM, 2011) and practically tripled between 2003 and 2013 (MINAM, 2014a).

In terms of data on imports, the indirect production of statistics on the subject was improved, since in Peru there is no unified system for recording substances and products that are not included in a tariff line. Consequently, the recommendation is to identify the country of origin; expand the classification and registration criteria on the basis of the tariff lines and also by gradually establishing lines for new products; and present maps indicating the location of the firms that import and use materials of this type.

Special importance should also be given to strengthening sanitary and environmental surveillance mechanisms at the border. The National Superintendency of Customs and Tax Administration (SUNAT) has a laboratory for analysing chemicals; but this could be insufficient for controlling all of those that have hazardous characteristics and are not identified in the tariff lines (MINSA, 2011b).

Mercury

Heavy metals, particularly mercury, have started to attract special attention on both domestic and international agendas. In South America, Peru is the largest importer of this metal, which is widely used in small-scale and artisanal mining, in the pharmaceutical industry and elsewhere, and in measurement and control equipment, among other sectors. Mercury imports have gradually declined as a result of government measures, which are expected to be strengthened following ratification of the Minamata Convention on Mercury in 2015 (Table 7.5). Imports of mercury from Latin American countries are estimated to have declined in 2010-2012, following the entry into force of the prohibition on mercury exports imposed by the European Union (March 2011) and the United States (January 2013) (UNEP, 2014).

Exports of this substance have dropped sharply since 2010, falling to a level of 16.6 tonnes in 2012 (Table 7.5) (SUNAT, 2016, and MINAM, 2016a). Among other factors, this could be because mining firms store mercury until they accumulate a sufficient volume to be worth exporting, to ensure its environmentally sound long-term storage as a waste product (UNEP, 2014).

Table 7.5. Imports and exports of mercury, 2010-2015

(Net tonnes)

	2010	2011	2012	2013	2014
Imports	143	176	111	167	102
Exports	159	53	17	0	0

Source: SUNAT (2016).

Special attention should be paid to the use of mercury in artisanal gold mining activities, where formalisation is essential (Box 7.2). Achieving this objective requires adequate interagency co-ordination and a continuous process of integration (Chapter 12).

Box 7.2. Mercury use in illegal gold mining

Mercury is used in illegal mining activities, particularly for gold extraction, and specifically in the amalgamation process.

In the Madre de Dios watershed, as elsewhere in the Amazon region, illegal miners extract sand and gravel, which is then taken to facilities where it is deposited on jute carpets. It is then washed with jets of water which precipitate the heaviest material, containing gold particles, under the carpet.

The gold-bearing sand is collected in receptacles in which the amalgamation process is performed, using up to 2.8 kg of mercury to extract 1 kg of gold. The amalgam obtained is 60% mercury and 40% gold. In most cases, the residues of the amalgamation are discharged into rivers.

Miners then heat the amalgam to separate the gold and evaporate the mercury. Between 50% and 60% of vaporised mercury disperses, while the reader reverts to the liquid state and drops into the soil. Given the scant application of mercury recuperation techniques, the residues end up in water bodies, where they are converted into methylmercury, a toxic substance.

Source: Ministry of the Environment (MINAM), "Quién es quién en la minería ilegal", Revista MINAM, No. 2, Lima, 2014.

Production of chemicals

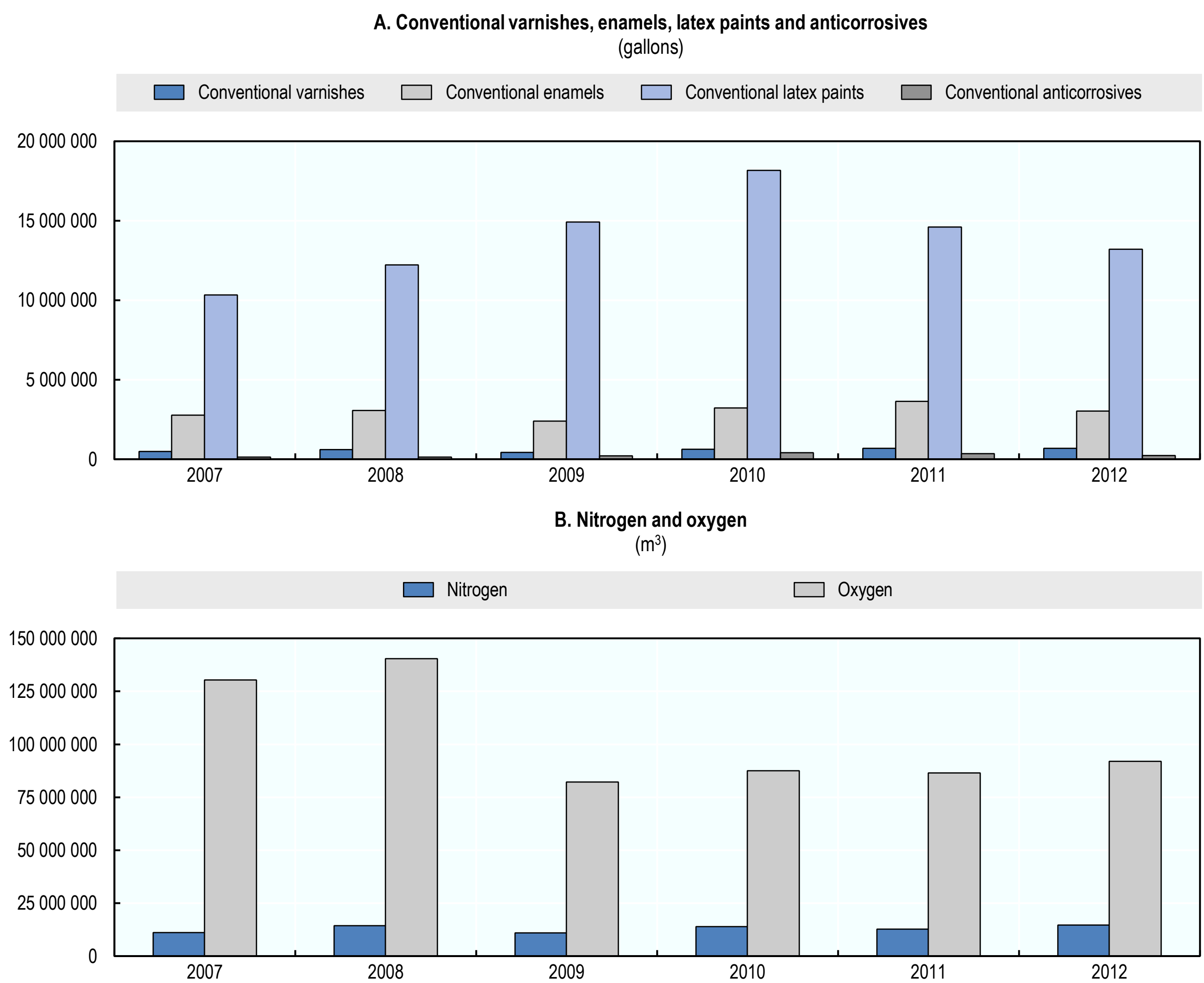
In general, the production of chemical substances and products in Peru also increased slightly between 2007 and 2012. The sharpest increase occurred in chemicals used to produce latex paints, while oxygen production has decreased (Figure 7.7). In 2008-2012, chemical-industry gross value-added grew by up to 1.16%; and the industry continues to rank second in terms of value-added in the manufacturing sector, behind the food industry (INEI, 2016).

A total of 40 industrial chemicals are produced in Peru, of which 29 pose a negligible hazard level according to the international treaties signed by the country (MINAM, 2014a). One of the main harmful effects of chemicals for human health is chronic intoxications, most often caused by lead, mercury, arsenic, copper and aluminium. These environmental risk factors are estimated to cause an annual loss of 210 000 disability adjusted life years (MINSA, 2011c).

The chemicals profile in 2010 reveals a substantial reduction in the use of certain substances, including chlorofluorocarbons (CFCs).[4] It also identifies the main problems and challenges in the management of substances such as persistent organic pollutants (POPs), and pesticides in particular. Although the use of many of these substances has been banned since the 1990s, the pesticides used in agriculture may have been brought in as contraband from neighbouring countries. In 1991, bans were placed on the use of aldrin, endrin, dieldrin, heptachlor, toxaphene and dichloro-diphenyl-trichloroethane (DDT). Then in 1999 the registration, importation, local production, distribution and marketing of commercial variants of chlordane and hexachlorobenzene were also banned. While there is no regulation expressly prohibiting the use of DDT to prevent diseases, the

Ministry of Health is running a programme based on an integrated control strategy, thanks to which it has been unnecessary to use this substance in the last 12 years.

Figure 7.7. Production of selected chemicals substances and products, 2007-2012



Note: Preliminary data.
Source: Ministry of Production.

Fertiliser production surged in 2005-2009, from 1 654 tonnes to 416 064 tonnes; and since 2007 it has continued to grow strongly. In that period, imports dropped by almost 50%, from 661 294 tonnes to 312 796 tonnes (MINSA, 2011b) (Chapter 10).

2.3. Trend of the management of chemicals and pollution control instruments

The main constraints that hinder the management of hazardous substances in Peru are the following: (i) shortage of infrastructure for the final disposal of hazardous wastes; (ii) lack of laboratories and trained staff for their analysis; (iii) non-standardisation of records of incidents and the information presented thereon; (iv) insufficient regional hazard maps to help identify populations at risk and critical evacuation routes; (v) insufficient training of workers, communities, and participants in the health and education sectors, on the prevention of chemical, radioactive and biological emergencies, and the corresponding responses; (vi) lack of homogeneity and limited implementation of prevention and response protocols, and scant dissemination of the protocols formulated by interagency organisations; (vii) inadequate disclosure and management of information; (viii) insufficient allocation of economic resources for prevention, equipment procurement, rehabilitation and remediation in cases of accidents or emergencies; and (ix) deficient medical care for the victims of accidents caused by radioactive materials, owing to a lack of infrastructure and trained staff (INDECI, 2010).

Table 7.6. Sectors of activity in which the most serious chemical accidents have occurred owing to radioactive and biological products

Sector	Stage
Oil	Exploration and prospecting, production, refining, storage, distribution, marketing and transport
Petrochemicals	Production, transport and marketing
Pesticide production	Supply, transport, storage, commerce, use and waste management
Mining	Prospecting, extraction, transport, marketing and waste management
Production of chemicals of industrial use	Manufacture, transport, storage, marketing, use and waste management
Use of radioactive substances in medicine (radiotherapy and nuclear medicine)	Importation, use and waste management
Use of radioactive substances in industry (oil refining, non-destructive testing, irradiation and sterilisation, among others)	Importation, use and waste management
Use of radioactive substances and research (nuclear reactors and biomedical research, among others)	Importation, use and waste management
Management of epidemics, pandemics and emerging or re-emerging endemics	

Source: National Civil Defence Institute of Peru (INDECI), Plan nacional de prevención y preparación para la respuesta ante riesgos por materiales y residuos peligrosos: guía técnica 2010, Lima, 2010.

In recent years, solid waste management has improved and there has been greater compliance with the provisions of the General Law on Solid Wastes (Supreme Decree 057-2004-PCM). Following the creation in 2014 of the National Quality System and its governing body, the National Institute of Quality (INACAL), which supports the Technical Committee on Standardization of Environmental Management, progress has been made in standardising the relevant methods and systems. Thus far, the committee has adopted 58 technical standards on environmental management, many of which are based on provisions of the International Organization for Standardization (ISO) that are applicable to various domains, including the management of chemical residues and containers used for pesticides and similar products (MINAM, 2016b).

Nonetheless, hindrances persist, including insufficient specific regulations; the limited application of the current regulations on the management of chemicals and hazardous waste; and weak inspection and sanctioning mechanisms, compounded by the slow process of decentralising the relevant administrative functions. An integrated system of information on the management of chemicals and hazardous wastes has yet to be adopted, which would make it possible to consolidate the available information and overcome its insufficiency (MINSA, 2011b).

As noted in the following section, Peruvian laws contain guidelines regulating use-based chemicals management, which poses a challenge for effective articulation among the authorities. It also hinders the subsequent achievement of objectives set in the strategic instruments of the public agencies involved.

Contingency plans and workplace safety systems

Chemicals and pesticides were among the 10 leading factors or agents behind workplace accidents in 2006-2015, and the number of cases notified has been rising (Figure 7.8).

Figure 7.8. Workplace accidents involving chemicals and pesticides, 2006-2015

Note: Excludes notifications of fatal accidents. The statistical yearbooks only report cases verified and notified as from 2006 and 2011, respectively
Source: Prepared by the authors on the basis of Ministry of Labour and Employment Promotion, Anuario Estadístico, several years

The diagnostic study performed by INDECI in 2010, recommends strengthening the formulation, dissemination and generalised application of appropriate public policies, to respond to accidents caused by the handling of hazardous materials and waste (INDECI, 2010). Current management instruments include the workplace safety plans and systems specified in the law, which require the preparation and presentation of contingency plans (Law 28.551) to prevent and respond to chemical accidents. Nonetheless, informal enterprises, which pose the highest risks, do not apply these instruments, so the personnel of services that are activated in the event of accidents and emergencies of anthropic or natural origin, including the fire service and police, do not have all the information they need. Moreover, the prevention, action and rehabilitation measures related to such cases are not clearly defined. It is very important to have information available on the properties of chemical products, because their inadequate handling can have harmful effects on workers; moreover, the information should be disseminated to allow for a rational use of these products with a preventive approach.

Recently, Directorial Resolution 006–2015/MINSA was approved, which aims to standardise the methodology and establish intersectoral articulation mechanisms, for the purpose of overseeing risk factors associated with exposure to, and intoxication by, heavy metals and metalloids.

With regard to workers' health protection, the recommendation is to strengthen oversight institutions, including the Ministry of Health. To generate the necessary synergies, these institutions can work in co-ordination with the Ministry of Employment, and propose guidelines and legal provisions to formalise occupational health control, along with administrative and financial directives to make it possible to provide funding to undertake the control activities established for the whole country.

Permissible limits

In terms of the permissible limits of chemical agents used in the workplace, the regulation issued through Supreme Decree 015-2005-SA stipulates that the limits applicable to chemicals listed in its annexes I, II and III should be updated every two years; and new chemicals should be incorporated "in the light of scientific and technological progress". The fact that the provisions of the regulation apply to chemicals only, and not their blends, complicates their monitoring and control. Observance of the permissible limits is controlled in the final stage of productive and extractive processes; and the Ministry of the Environment is responsible for co-ordinating with the authorities of all sectors.

The regulations identify three groups of actors that can participate in reducing risks arising from exposure to chemicals: (i) the Government, which is responsible for formulating standards, guidelines and monitoring protocols, and for updating the list of chemicals, as provided for in Supreme Decree 015-2005-SA; (ii) employers, who are required to perform the controls provided for and keep workers informed of the risks involved in the handling, use, conveyance, storage and final disposal of the substances, as well as providing them with adequate protection pursuant to article 33 of the regulation to the Workplace Health and Safety Act (Law 29.783); and (iii) workers, who must apply the safety, health and hygiene standards established by the respective firm.

Systemisation of information

Significant progress has been made in systemising information, particularly through PRTR, which the Government has prioritised as an action strategy of the National Plan for Implementation of the Stockholm Convention on Persistent Organic Pollutants, adopted in 2007. Its purpose is to create a database with information on these pollutants, to be used in the monitoring and quantification of progress in reducing emissions and discharges from the manufacturing, energy and mining, agriculture, housing and construction, health and defence sectors, into water bodies, the air, and soils (MINAM, 2014c). At the present time MINAM is working to implement the register, prepare the complementary tools and materials, and develop knowledge in conjunction with civil society and the entities that will have to submit the information.

Sanitary import permits for chemicals have increased in recent years, owing to the adoption of environmental measures in the main export markets for hazardous chemicals, particularly the European Union. As a result, there is more information on substances entering the country, but it would be very useful if this could be complemented with better control services in the ports, and if the data compiled were combined with those provided by the entities that supervise the management of authorised chemicals, to enable their monitoring throughout the life-cycle.

There is no unified information system to facilitate the adoption of guidelines on the creation of new chemical industries, in accordance with risk- and accident-management, among other approaches. This system should include georeferenced information on environmentally vulnerable sectors and zones in which accidents of anthropic or natural origin are most frequent.

Control of the land transport of hazardous materials and waste

Peru has a legal framework on this subject (Law 28.256 and Supreme Decree 021-2008-MTC), which is complemented by national-scope measures to mitigate and prevent the potential hazards associated with chemicals management. An example of this type of measure arises from an initiative of the Ministry of Transport and Communications to create an online register, enabling transport operators to report on the hazardous materials and waste products transported each month. This is a major step forward and a significant contribution to the preventive management of chemicals throughout their life-cycle.

Prohibitions on pesticide use

Pesticides are classified in the following use categories: (i) agricultural; (ii) industrial; (iii) domestic; and (iv) public-health protection. The main restriction imposed on the agriculture sector relates to POPs, the subject addressed in the Stockholm Convention, and pesticides that are recognised internationally as dangerous. In the industrial sector, the use of substances that deplete the ozone layer are restricted, as provided for in the Vienna Convention and Montreal Protocol.

National regulations restricting the use of pesticides classified as extremely dangerous or very dangerous should be complemented with measures to encourage the importation of alternative products, so as to safeguard the competitiveness of agricultural exports and protect the health of national consumers. The registration and control of agricultural pesticides are subject to the supranational regulations of the Andean Community (April 2015), which served as the basis for creating the National Agricultural Pesticides System. As this is a recent mechanism, it has not yet been possible to judge the extent to which it helps reduce their indiscriminate, informal and unlawful use, and to minimise the risks relating to food security and safety; and their effects on the competitiveness of agricultural products that are exported to markets with stricter regulations and controls on pesticide residues. No laws have yet been passed on the control of pesticides intended for the protection of human health, industrial use and in gardening.

It would therefore be advisable to strengthen co-ordination between the agriculture and health sectors; and to restrict related functions with the prohibitions applicable to pesticides of agricultural and domestic use, particularly in the framework of toxicological studies which should consider the ingestion of contaminated food products by the population and the performance of agricultural workers.

2.4. Research on chemicals management

Research and development

Research into chemicals management is prioritised in the 2013-2021 Environmental Research Agenda (MINAM, 2013). The agenda consists of two thematic pillars, which consider the analysis of chemicals in the following areas: (i) marine-coastal ecosystems (evaluation of the effects of chemical and toxic substances on aquatic organisms and their populations); (ii) climate change (the impact of chemical changes associated with greenhouse gas emissions (natural and anthropogenic); and (iii) environmental quality management in all of its dimensions. The prioritisation of these thematic areas is expected to elicit funding for studies on the subject, which should be supported by collaboration with research centres and universities.

Management of chemical products

The Bicentenary Plan: Peru towards 2021 includes technological modernisation strategies and the promotion of competitiveness to facilitate chemicals management and, hence support Peru's sustainable development. The application of this plan is complemented by MINAM activities to co-ordinate with different actors on sustainable production and consumption, according to the principle of extended producer responsibility, which is recognised in the National Regulation for the Management and Handling of Electrical and Electronic Equipment Waste, approved through Supreme Decree 001-2012-MINAM.

Notes

1 NAMA: Nationally Appropriate Mitigation Actions, established in the Bali Action Plan.

2 SIGERSOL received information from 246 districts in 2009, 251 in 2010, 447 in 2011, 664 in 2012, and 666 in 2013. The latter figure represents 36.31% of Peru's 1 834 districts.

3 The agriculture sector did not present information in 2007; nor did the mining sector in 2009, the health and energy and mining sectors in 2010, and the transport sector in 2011.

4 Chlorofluorocarbons are not manufactured in Peru so their consumption relies on imports.

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Chapter 8. Water resources

This chapter presents the main trends in water quality, progress in achieving (ambitious) water quality objectives, the challenges ahead and the health effects of poor water quality. It discusses the regulatory framework for water resource management, including at the watershed scale. It reviews pricing and infrastructure development for water supply and sanitation. Finally, the chapter discusses the role of direct regulations and economic instruments in water management and proposes a risk-based approach to water management.

Key findings and recommendations

In order to reduce the growing demand for water in Peru, the National Water Plan (PNRH 2015-2035) calls for increasing the crop area under mechanised irrigation from the current 2% to 24% by the year 2035, pursuing the installation of water meters in homes, and at the same time improving the water distribution canals, reforesting upstream areas of watersheds (to avoid sedimentation in the reservoirs), and more than doubling the reuse of treated urban wastewater for irrigation. On this last point, it will be important to ban the use of untreated wastewater for irrigation, as this would pose a risk to health and the environment. Since 2010, environmental quality standards (EQS) have been established for natural watercourses. Acute diarrhoeal illnesses in children under five years have declined, thanks to efforts to improve the coverage of drinking water services. The percentage of urban wastewater that is treated has risen to 50% (by volume) and the treatment method has evolved toward the use of more advanced techniques. However, the overloading of wastewater treatment plants is such that their treated effluents frequently exceed the maximum permissible limits (MPL). The PNRH calls for proper purification of 99% of the wastewater generated by the target population (urban and rural population of the Pacific Hydrographic Region and the urban population of the Amazonas and Titicaca hydrographic regions) by 2035. The number of activities that must comply with MPLs for effluents has increased, and the National Environmental Action Plan (PLANAA Peru 2011-2021) requires that 100% of permits must comply with the MPLs by the year 2021. The introduction of progressive tariffs for higher consumption blocks provides incentives for water conservation.

Recent years have seen a significant increase in investments in wastewater treatment infrastructure, although their level has not been sufficient to reduce the environmental impacts. As an intermediate step toward the long-term goal of total cost recovery, a combination of consumption-based tariffs, public financial support and transfers from official development assistance may help to close the financing gaps and pave the way for reimbursable aid.

The new Water Resources Act (Ley de Recursos Hídricos, 2009) and the accompanying National Water Resource Management System establish multisectoral (integrated) management by watershed, an approach that was reiterated in 2012 with the State Policy on Water Resources (Policy 33). The deconcentrated bodies of the National Water Authority, which oversees the system, are determined on the basis of the watersheds. The Water Resources Act introduces user participation in decision-making and planning through the Consejos de Recursos Hídricos de Cuenca (watershed boards). To date, Peru has six such boards in place, with binding plans approved. The watershed plans must include ecological flows based on specific studies for each stretch of the river. However, the watershed boards exclude some stakeholders, such as the economic sector and non-governmental organisations.

The PNRH, which was approved in July 2015, establishes activities and targets for meeting water demand and improving water quality, and also promotes a “water culture” and adaptation to climate change. Charges for water consumption and dumping have been introduced with the entry into force of the Water Resources Act. Rates have been evolving as information on water resources becomes available: the rate for consumption varies according to water availability, reflecting the scarcity of the resource, while the rate for dumping considers the EQS, reflecting the quality of the recipient watercourse.

Recognising the growing demand for water, the deficit in the watersheds (already at 10%) and the fact that nearly 30% of aquifers are overexploited, the PNRH calls for a 50% increase (by volume) in transfers from Amazonia to the Pacific and in water reservoirs for consumption purposes, by the year 2035. Special attention will have to be paid to the possible adverse environmental effects of these transfers and reservoirs, such as alterations to aquatic ecosystems.

More than 40% of the monitored watersheds do not comply with the EQS, and it will therefore be very difficult to meet the (very ambitious) target of PLANAA Peru whereby all watercourses must be EQS-compliant by the year 2021. The main obstacles relate to improperly treated domestic wastewater, untreated dumping from informal mining activities, the increasing extraction of sand from rivers to supply the construction industry, the use of agrochemicals in intensive agriculture, and environmental liabilities that continue to pollute the adjacent rivers. Gold mining and oil production are also contributing to the decline in water quality in the Amazon hydrographic region. There are high levels of noncompliance with the EQS in the Titicaca hydrographic region. There has been no assessment of water quality monitoring in the aquifers.

In half of the 24 regions more than 30% of the population has no access to safe drinking water or sewage services. Moreover, the quality and the continuity of the water supply are often very deficient. For the year 2035, the PNRH calls for achieving total water and sewage coverage for the target population. There is no treatment of urban wastewater in nine of the 24 regions, all of them located in the Amazonas hydrographic region. The entities providing sanitation services are for the most part financially bankrupt, and are consequently subject to evaluation and recovery under the Law on Modernization of Sanitation Services (2013). The percentage of unbilled water exceeds 40%, due to leaks and apparent losses.

There is a cross-subsidy from industrial users to domestic users and from wealthy households to poor households, via the "social tariff" or rate. If the social tariff, which reduces incentives to save water, were replaced by a mechanism that would fully compensate only a portion of the poorest households' water consumption, this would improve affordability without distorting price signals. The system of charges for consumption and dumping is designed to finance the operating costs of the National Water Authority: such an earmarking of levies for specific purposes is problematic. The base and the rate of the charge should not vary with the use made of the water but should be geared to the cost of the environmental externalities involved. No charge is levied for subterranean waters.

In many regions of Peru water security is under threat from the growing demand for water, hydric stress, and increasingly numerous sources of water pollution. In 2013 alone, 25 cases originating in 13 departments were registered with the National Tribunal for the Settlement of Water Disputes. Risks relating to water shortage, flooding and water quality need to be better managed, as does the risk of harming the resilience of water bodies. If the country adopts a vision that highlights clear management of water-related risks, it is more likely to achieve its economic, environmental and social objectives as they relate to water, without imposing excessive costs on Peruvian society.

Recommendations

- Introduce a new risk-based approach into water resource management, including the risks of water shortages, flooding, inadequate water quality and the risk of harming the resilience of water bodies; to that end, develop a knowledge base on those four risks and strengthen participation mechanisms for all the stakeholders in defining, accepting and jointly managing risks.
- Align the rates (fees paid) for consumption and for disposal into the environment, regardless of how the water is used, and, in this way, create appropriate incentives for adjusting consumption and promoting better irrigation techniques and facilitate compliance with maximum permissible limits and EQS. Expand the fee base for underground water.
- Continue efforts to ensure universal access to drinking water and to improved sanitation infrastructure. Create a favourable climate for reimbursable assistance to speed up the elimination of funding shortfalls in the provision of drinking water and sanitation; to this end, implement a combination of usage fees, public financial support and official development assistance transfers, while pursuing the long-term objective of total cost recovery through consumption fees. Combat payment evasion, reduce losses on the network and evaluate the creation of incentives for the conservation of drinking water in urban areas by replacing the social rate with compensation schemes that offset a portion of the monthly consumption of that rate's beneficiaries, following the example of Chile.
- Expand the coverage, parameters and frequency of water quality monitoring in order to meet EQS and extend those standards to situations and areas at risk from the failure to treat wastewater, pollution from industry and mining and the intensive use of agrochemicals.
- Continue to expand the coverage of wastewater treatment plants in line with the National Water Plan. Prohibit the reuse of untreated wastewater for irrigation, in light of the risk it poses for health and the environment.
- Consolidate interinstitutional co-ordination forums such as the National Water Resource Management System, the board of the National Water Authority and the watershed boards, and their ties with the National Environmental Management System.

1. Diagnostic assessment of water resources [1]

1.1. Availability

In Peru, farming consumes more surface water than any other activity, accounting for 87.5% of demand —ahead of human consumption (10%) and the mining and manufacturing sectors (1.5% and 1%, respectively) (MINAM, 2014). Irrigated farmland has expanded steadily over the last 50 years. In 1994-2012it grew from 1.7 million ha to 2.6 million ha, accounting for 36% of the total at the end of this period, compared to 32% in 1994. In 2012, 30% of irrigated land was fallow and not being worked, so the cultivated area totalled 1.8 million ha.

Around 10% of Peru's watersheds (17 out of a total of 159) record an annual or monthly deficit with respect to the mean. All of these are in the Pacific hydrographic region (HR), with none in the Amazon or Titicaca regions. To compensate for the monthly deficit, there are plans under the National Water Plan (PNRH 2015-2035) to build regulation reservoirs in watersheds that have sufficient water of their own, with a canal connecting to neighbouring basins.

Eighty per cent (3 694 hm^3/year) of water transfers occur between watersheds within the Pacific hydrographic region, and 20% (950 hm^3/year) pass from the Amazon HR to the Pacific HR. The volume transferred within the Pacific region represents 35% of the water resources of the transferring river basins (62% of that total is subtracted from the Chira river to the Piura), compared to 4% mobilised from the Amazon HR watersheds to those of the Pacific region. The National Water Plan envisages a 50% increase in the volume of water transfers between the Amazon and Pacific hydrographic regions by 2035. As indicated in the strategic environmental assessment contained in the Plan, special attention needs to be paid to the potential negative effects of these transfers, including alteration of the ecosystem in the transferring watersheds and the transference of aquatic organisms to the recipient regions.

Peru's reservoirs have a total capacity of 5 566 hm^3, of which 80% (4 500 hm^3) is intended for irrigation (consumptive use) and the remaining 20% (1 066 hm^3) for hydroelectric power generation (non-consumptive use). The National Water Plan foresees an expansion of 2 266 hm^3 (or 50%) in reservoir capacity for consumptive uses by 2035. A further aim is to respond to the additional demand driven by population growth and the expansion of irrigated land areas, manufacturing industry and mining, by implementing water-saving measures that enhance the efficiency of systems of water transportation, distribution and use.

Payment for water use (section 2.2) provides incentives to reduce its consumption and to mechanise irrigation. Nonetheless, data compiled in the 2010 National Household Survey (ENAHO) show that just 2% of farmland is under mechanised irrigation. One of the goals of the National Water Plan is to raise this proportion to 24% by 2035, thus postponing the target date set in the National Environmental Action Plan (PLANAA Peru, 2011-2021).[2] The saving achieved by using irrigation water more efficiently could contribute to the anticipated expansion of irrigated land areas (Table 8.1).[3] Greater efficiency could also reduce salinity levels in the 300 000 ha —18% of total irrigated land— that are affected to a greater or lesser degree.[4]

Table 8.1. Planned mechanisation of irrigated farmland

(Thousands of hectares)

Irrigated land area	2012	2021	2035
Total	1 640	2 090	2 510
Under mechanised irrigation	33	397	602
Percentage of total	2	19	24

Source: ANA (2013).

Peru's water distribution canals have fallen into disrepair, partly because the rates charged for their use do not cover operating and maintenance costs (section 1.3). The inventory performed in 2007 by the National Institute for Natural Resources (INRENA) showed that about 85% (46 241 km) of the canals were not lined. This has resulted in water distribution losses of 15%-20%. Most of these canals are used to irrigate farmland, but some are also used to supply water to the population after the appropriate treatment.

The National Water Plan sets a goal of laying concrete lining on roughly 50% of the canals that are unlined or in poor condition, by 2035.

It has been found that 12 of the 43 aquifers used in the Pacific HR are overused, and in many cases their use has been banned. Overexploitation has caused a deterioration in water quality owing to saline intrusion in the case of aquifers located near the coast, while the extraction of deep ground and mineralised water has affected inland aquifers.

The National Water Plan also aims to install water meters in homes, to regulate both the consumption and cost of drinking water. In 2012, 62% of homes connected to the networks of the water service providers (*Empresas Prestadoras de Servicios de Saneamiento* – EPSs) had a meter (INEI, 2014).

The Government of Peru intends to triple the country's installed hydroelectric capacity from 3 235 MW in 2008 to over 10 000 MW by 2027. If this objective is achieved, the hydro contribution to the electricity grid will increase from 45% to 65% in the period. The majority (87%) of hydroelectric potential is located in the Amazon HR.

The large regulation reservoirs are becoming clogged ever more rapidly, owing to deforestation within the headwaters areas of watersheds caused by timber and firewood extraction, and by agricultural activity that generates high rates of sedimentation. Under the National Water Plan, there are plans to reforest 600 000 ha by 2035, preferably with native species, to protect water resources; while the National Environmental Action Plan includes the conservation of headwaters in 50% of watersheds by 2021. In the Moyobamba region, a pilot programme of payment for environmental services has been implemented. Under this programme the water supply entity has, since 2009, added a charge of one Peruvian sol (PEN 1) to the drinking water and sanitation bill. This is expected to generate revenue for a fund for reforestation activities in the upper river basin of water catchment areas. The revenue obtained constitutes seed capital, and it is hoped that regional and local governments and civil and social organisations will supplement this (Rojas-Ortuste, 2010).

The recycling of treated urban wastewater increases the availability of water for consumptive uses, other than human consumption. The National Environmental Action Plan foresees 50% of treated water being recycled by 2021, whereas the National Water Plan foresees reusing 45% (572 hm^3/year) of water collected in sewerage networks by 2035 —over twice the current rate of 21% or 260 hm^3/year. Most of the recycled water is destined for farmland irrigation, and to a lesser extent, manufacturing industry and mining. The demand for recycled water for irrigation is so high that it is being met with wastewater from the sewerage network that has not gone through the treatment plants, which poses a health and environmental hazard (OEFA, 2014).

The National Water Plan does not attach a high priority to the desalinisation of seawater, owing specifically to the high cost of the technology, transport and management of the brine tanks, and its reliance on energy resources. The plan stipulates that desalinisation should be considered as a last resort, after having rejected or exhausted the other possibilities.

1.2. Quality

Water quality is monitored in 98 of Peru's 159 main watersheds (over 60%).[5] In 41 of these (over 40%) the relevant environmental quality standards are not applied (ANA, 2015). The main causes of the deterioration of water quality in Peru are the lack of wastewater treatment, industrial pollution, indiscriminate use of agrochemicals, the dumping of domestic solid waste, the existence of mining and hydrocarbon liabilities, informal and illegal mining activity, and deforestation.

In Peru, domestic wastewater is inadequately treated, owing to deficient or non-existent systems (section 1.3). Wastewaters contaminate water courses by raising nutrient concentrations, and by adding organic material and microorganisms that restrict their consumptive and irrigation use. Many of the effluents from informal extractive operations are discharged into rivers without adequate or any prior treatment. This causes various problems, including pollution by metals and hydrocarbons, acidification and an increase in suspended solid particles. Increasing rates of sand and gravel extraction from river beds, to meet the needs of an expanding construction sector, are causing serious problems for stream-bed morphology and increasing the dragging of solids.

The main source of pollution stemming from intensive agriculture is the use of agrochemicals (Chapter 10). It should be noted, however, that only 11% of farms use chemical fertilisers intensively, and 30%-40% use pesticides (INEI, 2013).

In the Amazon HR, particularly in the Department of Madre de Dios, gold mining pollutes rivers with sediments, mercury, cyanide, sulphuric acid and oil. Oil extraction activities in the Pastaza, Tigre, Corrientes and Napo watersheds generate brackish water and contaminate water flows with hydrocarbons, heavy metals (Hg, Cd, Cr and Pb), cyanide and arsenics.

Many environmental liabilities resulting from extractive activities carried out long ago arise from mines having been closed without appropriate sealing measures. Over 6 500 of these liabilities have been identified, and they continue to pollute neighbouring rivers (Chapter 12).

The Environmental Quality Standards (EQS) for water, adopted in 2008 and implemented as of 2010, "constitute the objectives applicable to natural water bodies,"[6] based on the current or potential use of the water body in question. They are classified in four categories:

- Category 1: Population and recreational use. Applicable to surface waters destined for the production of drinking water and recreational use.
- Category 2. Applicable to marine-coastal activities, such as the extraction and cultivation of molluscs and other marine species.
- Category 3: Irrigation of plants and animal consumption.
- Category 4: Conservation of the aquatic environment, including lakes and lagoons, rivers and marine-coastal ecosystems (marine estuaries).

Of the 292 water bodies classified, 214 correspond to category 3, 54 to category 4, and 24 to category 1. Unclassified water bodies are provisionally placed in the category into which they flow. This means that once the sources of pollution have been identified, a monitoring network can be designed and set up. Evaluations of the quality of surface water bodies performed in recent years have shown a high level of non-compliance with EQS, which will make it more difficult to achieve the target for 2021 set out in the National Environmental Action Plan, namely compliance with the standards by all water bodies.

In 2012, 30 watersheds were evaluated, of which 21 belong to the Pacific HR, four to the Amazon HR and five to the Titicaca HR (MINAM, 2014). In the first case, concentrations of iron, manganese, aluminium, pH and heat-tolerant coliforms exceeded the EQS limits. The highest levels of non-compliance were found in the Piura and Locumba (Moquegua) watersheds. The Amazon HR displayed concentrations of pH, dissolved oxygen, thermotolerant coliforms, solids in suspension, oils and fats, total nitrogen, ammoniacal nitrogen, lead and mercury, above the EQS limits. The Pastaza river basin recorded the largest number of parameters that exceeded EQS. In the Titicaca HR, many parameters did not comply, specifically those relating to pH and to oils and fats, total coliforms, thermotolerant coliforms, chemical and biochemical oxygen demand, total nitrogen, ammoniacal nitrogen, nitrates, phosphates, total solids in suspension, arsenic, aluminium, cadmium, cobalt, copper, lead, zinc, lithium, mercury, calcium, manganese, magnesium, mercury, nickel, boron, iron and sodium. The largest number of parameters above the EQS limits was detected in the Coata and Azángaro rivers. Another evaluation of the quality of surface waters, performed in July and August 2013, found a high level of non-compliance in the Chamaya and Santa rivers, owing to elevated metal concentrations (Table 8.2). Peru has a chemical monitoring network covering 47 aquifers, which consists of 5 862 control points that track levels of chlorides, sulphates, bicarbonates, calcium, magnesium, sodium and potassium, but not nitrates.[7]

Table 8.2. Non-compliance with water quality standards (EQS)

River	Environmental quality standards	Non-compliance[a]
Pacific hydrographic region	Category	Number of samples that exceed the standards
Chamaya	3 (irrigation)	Aluminium (6) and manganese (3)
Jequetepeque	3 (irrigation)	pH (3)
Santa	1 (population)	Aluminium and arsenic (7), iron (6), boron (4); cadmium (3), manganese (2), nickel (1)
Pampas	3 (irrigation)	Arsenic (1)
Amazon hydrographic region[b]	4 (environmental conservation)	Lead (2), pH and dissolved oxygen (1)

Note: *a)* Of a total of eight samples analysed. *b)* Rivers Amazonas, Nanay and Napo in the Iquitos area.
Source: ANA (2013).

1.3. Drinking water supply and sanitation services

The General Sanitation Services Act (Law No. 26338), promulgated in 1994, provides for the subsidiary firms of the National Water Supply and Sewerage Service to be transferred to the municipalities.[8] Under this law, the sanitation service providers (EPSs) must be set up as joint-stock companies, with shares representing the equity of the municipalities in their coverage zone (Rojas-Ortuste, 2010). The only exception is the Drinking Water and Sewerage Service of Lima (SEDAPAL), which is a State-owned enterprise. There are currently 50 entities of this type operating throughout Peruvian territory; they serve over 18 million people and are supervised by the National Superintendency of Sanitation Services (SUNASS). The municipalities are required to serve the population not yet covered by EPSs. Law No. 30045 (the Sanitation Services Modernization Law), of 2013, requires EPSs to undergo evaluations and submit to bailout procedures, since most of them are insolvent.

The National Water Plan provides for the expansion of the coverage of drinking water and sanitation services in poor areas (rural zones of the Amazon and Titicaca HRs) to cover up to 85% of households by 2035, compared with current rates of 65% and 16%, respectively.

Drinking water

In 2012, 83% of households in urban areas and 52% in rural areas were connected to the public drinking water network (Table 8.3). In urban areas, 7% of households were supplied from public networks located outside the home. In rural areas, the secondary household water source (32%) consisted of rivers, irrigation canals or springs (Chapter 3).

Table 8.3. Sources of water supply for human consumption, 2012

(Percentages)

Zone	Connection to public network, inside the home	Connection to public network, outside the home but inside the building	Public standpipe	Tanker truck or similar	Well	River, irrigation ditch, spring or similar	Other[a]
Urban	83	7	2	2	1	1	4
Rural	52	1	2	1	6	32	6

Note: *a)* Includes asking for water from neighbours and other forms of water supply such as rain, melted snow, etc.
Source: MINAM (2014).

In half the country's 24 departments, over 30% of the population did not have access to drinking water in 2011, whether through a connection to the public network or access to a public source, a borehole, pump, or protected well, or to a protected source or rainwater. In the departments of Amazonas, Loreto and Pasco, over 50% of the population has no access to drinking water, whereas in Huancavelica and Puno only half do. Moreover, the quality of the water supplied to many of the households with public-network connections is very deficient, and supply is frequently interrupted. The National Water Plan envisages coverage for the whole of the target population by 2035, which includes the inhabitants of the urban and rural areas of the Pacific HR and those of the urban areas of the Amazon and Titicaca HRs. The rural population of the latter two regions is covered by a specific programme for poverty-stricken areas.

Despite this situation, the adoption of measures to expand the coverage of drinking water services made it possible to cut the incidence of acute diarrhoeal diseases among children under five years old to around 200 000 cases in 2012, compared to between 600 000 and 700 000 cases per year in the first decade of this century. The departments with the highest incidence of diarrhoea include Loreto, Cajamarca, Cusco, Áncash, San Martin and Ica (MINAM, 2014).

The diseases caused by the poor quality of water distributed by some tanker trucks, which supplied 2% of drinking water in Peru (3.5% in Lima), calls into question the legal framework and monitoring of the quality of water distributed by such vehicles. To address the problem, local water committees, headed by women, have been set up in three districts of the eastern cone of Lima, with the aim of creating dialogue mechanisms with the authorities. This mechanism made it possible to finance community drinking water networks through the Ministry of Housing, Construction and Sanitation, and the municipalities (Páucar, 2008).

Sanitation

A large proportion of households, particularly in rural areas, still do not have a connection or access to an adequate drainage system (Table 8.4). However, the general trend is positive as the number of homes connected to the public networks has been rising. At the same time, the use of septic tanks, cesspits and other means of wastewater disposal, including rivers, irrigation ditches and canals has been declining (MINAM, 2014).

Table 8.4. Means of disposal of excreta, 2012

(Percentages)

Zone	Connection to public network, inside the home	Connection to public network, outside the home but inside the building	Septic tank	Cesspit	River, irrigation ditch or canal	Latrine	Other	None
Urban	79	7	3	4	1	2	1	3
Rural	12	1	30	17	1.5	12	0.5	26

Source: MINAM (2014).

As in the case of drinking water supply, in 2011, over 30% of the population of Peru's 24 departments did not have access to the public sewerage network, but instead made use of drains, septic tanks, water-seal latrines, or either simple or ventilated pit latrines. In the departments of Loreto, Madre de Dios and Ucayali, over half the population still has no access to the sewerage network; and in Apurímac, Cusco and Pasco only 50% do. Haphazard population growth in the large cities has made it difficult to expand coverage; but the National Water Plan envisages increasing this to 90% before 2021, and to 100% before 2035. Rehabilitation of the existing networks is also planned.

In terms of the volume of treated urban wastewater, the coverage provided by EPSs grew from 21% in 2000 to 32% in 2012 (SINIA, 2013); and then to 50% in 2013, when the Taboada wastewater treatment plant came online benefiting 50% of the population of Lima and Callao. In general, there is a wastewater overload in the treatment plants, which have inadequate infrastructure, so the effluents treated exceed the maximum permissible limits (MPLs) (OEFA, 2014) (Table 8.5). The National Water Plan has set targets for the treatment of wastewater generated by the target population, of 60% in 2021 and 99% in 2035. It is unclear how these targets are harmonised with those set under the National Environmental Action Plan, according to which all urban wastewater and 30% of that originating in rural areas should be treated by 2021.

Table 8.5. Maximum limits for effluents processed in wastewater treatment plants

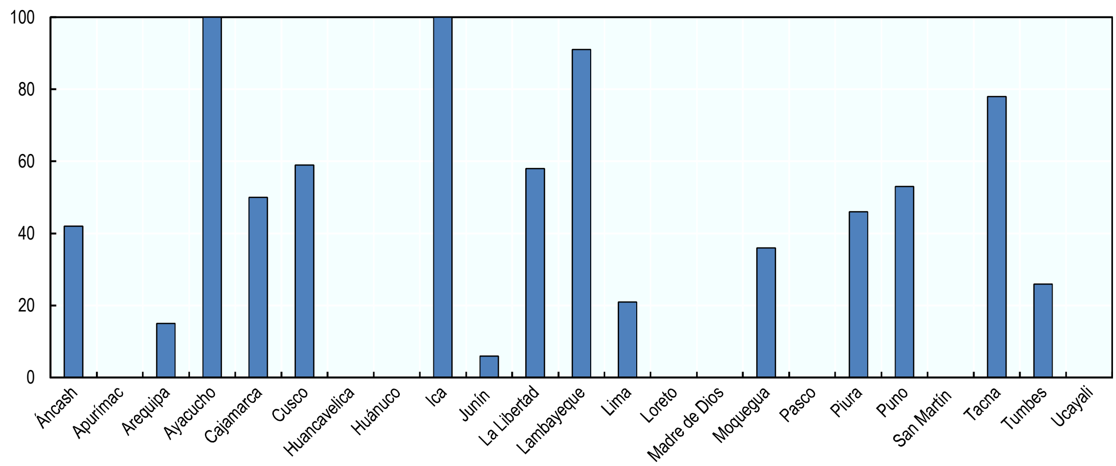
Parameter	Unita	MPL
Oils and fats	mg/l	20
Thermotolerant coliforms	MLN/100 ml	10 000
Biochemical oxygen demand	mg/l	100
Chemical oxygen demand	mg/l	200
pH	unit	6.5-8.5
Total solids in suspension	ml/l	150
Temperature	C	<35

Note: MLN stands for most likely number.
Source: Ministry of the Environment, Supreme Decree 003-2010-MINAM.

In 2012, urban wastewater went untreated in at least nine of the country's 24 departments located in the Amazon HR (Figure 8.1).

Figure 8.1. Wastewater receiving treatment, by department

(Percentages)



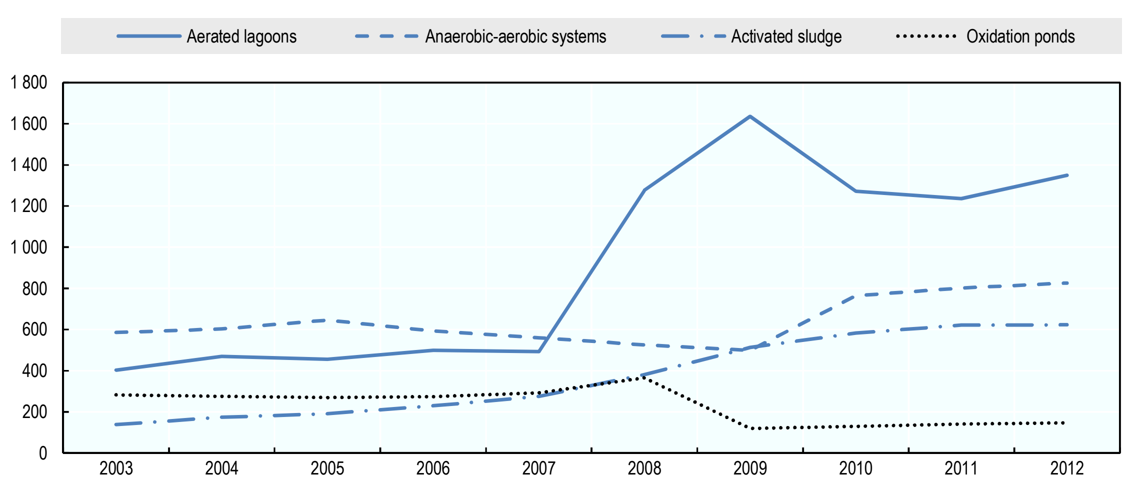
Source: National Superintendency of Sanitation Services (2013), Tratamiento de aguas residuales 2012.

In comparison, in OECD member countries, the proportion of the population connected to a treatment plant has risen from roughly 60% in the early 1990s to over 75% today.

The wastewater treatment technology used in Peru has evolved since 2003, with conventional methods such as the use of oxidation ponds being discontinued, and aerated lagoons, anaerobic and aerobic processes and activated sludge being introduced (Figure 8.2). In 2012, 46% of the wastewater produced in the Metropolitan Region of Lima was treated with secondary techniques (including aerated lagoons), 28% with anaerobic and aerobic systems, and 21% with activated sludge.

Figure 8.2. Waste water treatment methods in the Metropolitan Region of Lima.

(Litres per second)



Source: INEI (2014), *Perú. Anuario de Estadísticas Ambientales 2013*.

The National Environmental Action Plan provides that all persons authorised to discharge wastewater must observe the MPLs by 2021. Failure to comply will result in suspension from the Wastewater Discharge and Reuse Adaptation Programme (PAVER). In recent years, the number of provisions issued on effluent MPLs has been increasing (Table 8.6). In 2012, most of the authorised volume of wastewater discharge was absorbed by the mining sector, with the fisheries, hydrocarbons and food sectors accounting for a much smaller share (MINAM, 2014).

Table 8.6. Activities and sectors subject to maximum permissible effluent limits

Sector/activity	Regulation
Mining-metallurgy	Supreme Decree 010-2010-MINAM
Domestic or municipal wastewater treatment plants	Supreme Decree 003-2010-MINAM
Electric power generation, transmission and distribution	Ministerial Decision 008-97-EM-DGAA
Liquid effluents in the hydrocarbons subsector	Supreme Decree 037-2008-PCM
Industrial activities producing cement, beer, leather and paper	Supreme Decree 003-2002-PRODUCE
Fish meal and fish oil production	Supreme Decree 010-2008-PRODUCE

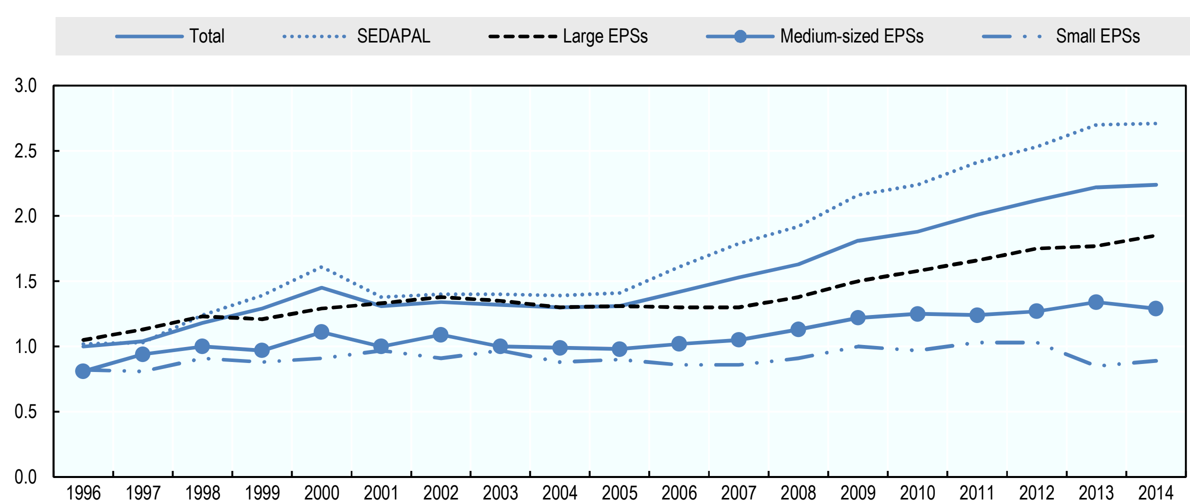
Source: MINAM (2014), *Informe nacional del estado del ambiente 2012-2013*.

Rates

In the Metropolitan Region of Lima, water consumption tariffs rose sharply by just under 60%, between 2005 and 2014 after having been frozen since 2000. The average amount charged by the Lima Drinking Water and Sewerage Service (SEDAPAL) rose from S/.1.41 per m^3 in 2005 to PEN 2.24 per m^3 in 2014 (Figure 8.3). This rate is lower than that charged in other Peruvian cities, and it also varies according to the size of the supplier company. The water consumption charges prevailing in OECD countries vary from USD 0.7 in Seoul to USD 9.2 in Copenhagen (Figure 8.4) (IWA, 2010).

Figure 8.3. Drinking water consumption charges, 1996-2014

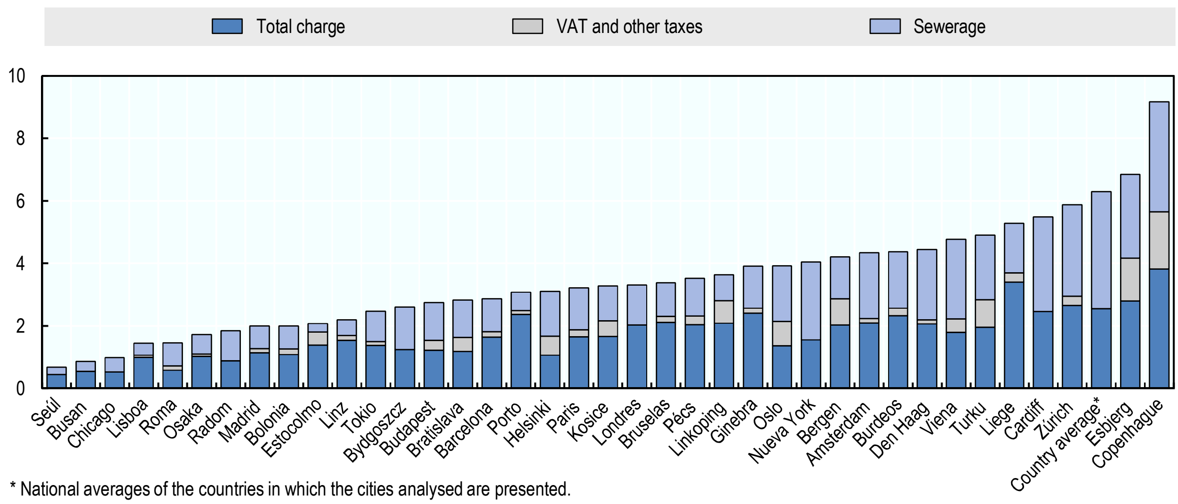
(Peruvian sol per m^3)



Source: National Superintendency of Sanitation Services (SUNASS).

Figure 8.4. Drinking water consumption charges in selected large cities

(USD per m³)



* National averages of the countries in which the cities analysed are presented.

Source: International Water Association (IWA), *International Statistics for Water Services*, 2010.

The rates charged by EPSs include a fixed charge in respect of the distribution cost, and a variable amount that depends on the volume of water consumed. The latter is organised in incremental block rates to provide incentives for water saving; these vary between PEN 1.5 per m^3 (USD 0.4 per m^3) for the "social rate" and PEN 6 per m^3 (USD 1.8 per m^3) for the normal-rate block, covering the use of drinking water, sewerage and wastewater treatment services.

The rates applicable to industries include a subsidy component in favour of residential users. One of the targets of the "Water for all" programme, implemented until 2012, was to halve the percentage of the population without access to continuous drinking water supply, sewerage and wastewater treatment services by 2015.[9] In 2011-2012 a total of PEN 1.1 billion (USD 400 million) was spent on achieving that target. In 2012, a subsidy from wealthier to poorer households (the "social rate") was also introduced (Table 8.7).

In 2008, more than 40% of water consumption was not billed; this calls for better detection of leaks and greater reduction of losses from clandestine use, inactive connections and faulty metering (Rojas-Ortuste, 2010). Farms make a special payment for use and exploitation (section 2.2).

Additional financing is needed to maintain or improve the drinking water supply and sanitation infrastructure, and to guarantee access to these services. In the last few years, investments in wastewater treatment infrastructure works have increased substantially, in both urban and rural zones. The amounts allocated grew from PEN 315 million in 2006 to PEN 2.313 billion in 2013; and urban zones received 60%-70% of the total in both periods (MVCS, undated).[10] Nonetheless, investment still falls short of the level needed to reduce the environmental impact of wastewater discharged into water bodies. The National Water Plan estimates that investments of around PEN 50 billion (USD 15 billion) would be needed to expand the coverage of drinking water supply and sanitation services up to 2035. Of that total, 25% would be destined for drinking water, 25% for sewerage and 50% for wastewater treatment.

Table 8.7. Water and sanitation charges, 2012

(Peruvian sol per m^3)

Category	Consumption range (m^3/month)	Tariff	
		Drinking water	Sewerage and wastewater treatment
Residential			
Social	0 or more	0.99	0.43
Domestic	0 - 10	0.99	0.43
	10 - 25	1.15	0.50
	25 - 50	2.55	1.11
	50 or more	4.32	1.89
Non-residential			
Commercial	0 - 1 000	4.32	1.89
	1 000 or more	4.64	2.03
Industrial	0 - 1 000	4.32	1.89
	1 000 or more	4.64	2.03
State	0 or more	2.42	1.06

Source: INEI (2014), *Perú. Anuario de estadísticas ambientales 2013*.

As noted by Cox and Borkey (2015), the combination of consumption tariffs, budgetary transfers, and Official Development Assistance (ODA) transfers, known as the "3 Ts", could help to bridge the funding gap. The authors argue that a sustained flow of funds from these sources would make it easier to provide reimbursable assistance in the form of loans, bonds, and shares. Nonetheless, this "sustainable cost recovery" approach should be viewed as an intermediate step in achieving the long-term goal of "total cost recovery". This reflects the belief that the tariffs, alone, should be sufficient to recover costs. Until an acceptable level of infrastructure is attained and household access improved, Peru could make use of public budget resources and ODA to complement the rates charged.

Consumption-based rate subsidies ("social tariff") are granted to protect poor consumers; but lowering the price of water reduces the incentives to economise on its use. Moreover, sustainable cost recovery is impossible unless a balance is struck between access and financial sustainability. One way to achieve this would be to subsidise only part of the monthly consumption of the poorest households, which would have to pay the full rate if they exceed this amount. Chile, for example, uses this sort of scheme to avoid distorting price signals.

2. Management of water resources

2.1. Integrated management in the hydrographic basins

The Water Resources Act (Law No. 29338) was promulgated in 2009 with the aim of "regulating the use and integrated management of water" by hydrographic basin.[11] The law strengthens the State function, by assigning normative, decision-making and sanctioning powers to a single institution: the National Water Authority (ANA), which was created in 2008 as an agency of the Ministry of Agriculture and Irrigation. Until then, this ministry was involved only in quantitative management, while qualitative measurement was the exclusive preserve of the Ministry of Health.

The decentralised units of ANA are based on Peru's 159 hydrographic basins, which are grouped under 14 Water Administrative Authorities (AAA); and the Ministry of Foreign Affairs participates in the management of the 34 transboundary watersheds. These authorities co-ordinate their activities with the Local Water Boards (ALA). Three AAAs already have a local administration and 72 of these entities have been created thus far.

It should be noted that the jurisdictions of regional governments do not always coincide with those corresponding to the hydrographic units of the administrative authorities and local administrations. The National Tribunal for the Settlement of Water Disputes is the highest administrative level for resolving complaints and appeals filed against decisions issued by AAA and ANA. As of 2013, twenty-five water disputes had been registered in 13 of the country's departments (MINAM, 2014).

The Water Resources Act provides for the creation of the National System of Water Resource Management (SNGRH), with responsibility for integrated management in each hydrographic basin. System participants include the National Water Authority, as governing body; the Ministry of Agriculture and Irrigation; the Ministry of the Environment; the Ministry of Housing, Construction and Sanitation; the Ministry of Energy and Mines; the Ministry of Production and the Ministry of Health; along with regional and local governments; water-user organisations; operators; rural and indigenous communities, and public entities.

The law also provides for user participation in decision-making and planning, through watershed boards (*consejos de recursos hídricos de cuenca*), permanent bodies and agencies of ANA. These councils consist of representatives of the same entities that participate in SNGRH, except for the ministries and operating enterprises, plus academics. Representatives of the sector ministries related to special projects also participate in the councils, alongside the Ministry of Foreign Affairs in the case of trans-boundary watersheds.

In 2012, the State Policy on Water Resources, also known as "Policy 33", was approved, recognising the need for integrated management of water to benefit the entire nation, and containing guidelines on the subject. Subsequently, measures started to be adopted to implement the policy in accordance with the watershed management plans (PGRHC), which must be approved by the water resource councils. The plans are binding instruments for the management of water resources, and they must include a diagnostic assessment, a programme of measures, and a financing proposal. Thus far, six watershed boards have been created and have plans approved.

In October 2015, the Regional Water and Sanitation Fund (FORASAN) was created to finance the application of the management plan in the Chira-Piura river basin, which is inhabited by over 1.7 million people. The fund, which received an initial capital contribution of USD 300 000 from the Swiss Agency for Development and Cooperation, is a long-term financial mechanism with potential to pool efforts and combine financial resources from different institutions for integrated water management, such as for the conservation of ecosystems and the development of a water culture.

The Ministry of the Environment is leading the preparation of environmental recovery plans, to complement the watershed management plans. In 2009, five priority watersheds were selected to start the recovery work, those of the rivers Rímac, Mantaro, Quilca, Vítor and Chili; along with Lake Titicaca and El Ferrol bay. In 2010, a further five watersheds ware prioritised.

In its capacity as governing body of the National Water Resource Management System, ANA formulated the National Water Resource Policy and Strategy (PENRH), as a binding planning instrument that came into force in May 2005 (Supreme Decree 006-2015 MINAGRI), and the National Water Plan, approved in July 2015 (Supreme Decree 013-2015-MINAGRI). The plan establishes five public policy pillars: management of quantity, quality and timeliness; a water culture; and adaptation to climate change. It also sets targets for 2035, along with the entities responsible for the activities, and the investments and financing sources.

As regards quantity, the National Water Plan proposes programmes to control and measure demand, improve water distribution networks, mechanise irrigation, and expand the agricultural frontier by increasing efficiency. In the case of quality, the aim is to expand the coverage of the drinking water, sewerage and wastewater treatment networks. "Timeliness management" should lead to better distribution of water throughout the year, based on an expansion of irrigation and sanitation in poor areas. To promote the development of a water culture, the aim is to foster the establishment of mechanisms of participation and consultation, communication and awareness-raising related to the integrated management of water resources. In terms of adaptation to climate change and other extreme events, it is necessary to increase knowledge on the effects of climate change; improve the management of flood risks, *huaicos* (mud and rock slides) and landslips, and adopt measures in situations of drought alert.

The National Water Plan contains guidelines on the investments that regional and local governments can undertake, assisted by the National Water Authority, taking account of the relevant development plans; the National Investment Plan of the Sanitation Sector of the Ministry of Housing, Construction and Sanitation, and irrigation projects. Under the National Water Plan, the aim is to invest PEN 89 billion (USD 26 billion) by 2021, and PEN 65 billion (USD 19 billion) by 2035, which will make a total of PEN 154 billion (USD 45 billion).

2.2. Payment for use and discharge

Peru does not have a market in water rights. The rights in question (licences, authorisations and permits) are non-transferable and are granted for an indefinite period, as long as the activity for which they were granted continues to be undertaken; but they can be revoked if sanctions are applied. Under current regulations, water is a good in the public domain, the use of which is prioritised for population consumption. The watershed management plans (PGRHC) must stipulate the ecological flows[12] that must be available to all users in a given watershed and cannot be diverted to any consumptive use. According to the provisions of the Water Resources Act, ecological flows are defined on the basis of specific studies of all segments of the rivers.

Payment for water use has increased significantly since it was introduced in 2009, following the entry into force of the Water Resources Act (Table 8.8). The rates charged have evolved on the basis of the conclusions of technical studies on aquifer volumes, and they vary according to water availability, which reflects its scarcity, and use. The tariff on water for human consumption is much lower than the rates charged on other uses; and, since 2013, the highest rate has been levied on the mining sector. The rate payable by the agriculture sector is equivalent to that charged for the consumption of surface water, approved by the technical administration of irrigation districts, the current Local Water Administrations (ALA). This is extremely low, at just PEN 1 to PEN 5 per 10 000 m^3.[13] It should be noted that the payments are applicable only to surface water, and no tariff has yet been set for the exploitation of groundwater (Rojas-Ortuste, 2010).

Table 8.8. Water consumption payments

(Peruvian sol per m^3)

Year	Water availability	Sector			
		Industrial	Mining	Population	Other
2009	High	0.045	0.030	0.0042	".
	Medium	0.055	0.040	0.0130	"
	Low	0.070	0.050	0.0220	"
2015	High	0.070	0.090	0.0046	0.030
	Medium	0.140	0.180	0.0180	0.060
	Low	0.220	0.280	0.0330	0.090

Source: National Water Authority (ANA).

In 2011, new payments were introduced for wastewater discharges, and by 2012 the only distinction made was between the charges for domestic and industrial wastewater, which were 0.0040 and 0.010 PEN per m^3, respectively.[14] Since 2013, wastewater discharge payments have been set in line with the categories of the environmental quality standards for water, so as to represent the social, economic and environmental cost of pollution of the recipient water body. The rate varies from one sector to another (Table 8.9). As with water consumption payments, the mining sector pays the highest rate for discharges, while human consumption pays the lowest. In 2015, the sanitation sector, which includes wastewater treatment plants, was brought into this scheme.

Table 8.9. Wastewater discharge payments, 2013-2015

(Peruvian sol per m^3)

Environmental quality standards	Sector					
	Industrial	Mining	Energy	Agribusiness	Population	Sanitation [a]
1	0.026	0.058	0.050	0.013	0.0063	0.0032
2	0.023	0.053	0.048	0.012	0.0060	0.0030
3	0.021	0.048	0.042	0.010	0.0053	0.0027
4	0.022	0.050	0.045	0.011	0.0055	0.0028

Note: a) As from 2015.
Source: National Water Authority (ANA).

Under the provisions of article 95 of the Water Resources Act (LRH), the payments must cover the cost of integrated water management (for which ANA is responsible), along with its recovery and the repair of environmental damage caused by the discharges. The revenue received by ANA in 2011 and 2012 was insufficient to cover its ordinary operating costs. In 2012, its total budget was PEN 130 million, so the annual deficit was around 60% (Table 8.10).

Table 8.10. Revenue obtained from the payments

(PEN millions)

Year	Non-agricultural uses	Use of groundwater	Agricultural uses	Discharges of treated wastewater	Total
2011	34	1	10	6	51
2012	37	2	11	7	57

Source: National Water Authority (ANA).

Although the system of payments for consumption and discharges was set up to offer incentives to users to treat water as a scarce resource, it basically seems to finance ANA management expenses. This allocation of the payments to finance ANA, and possibly also the local water administrations, is governed by the "water pays for water" principle and is problematic. The earmarking to specific purposes of amounts obtained in respect of pollution contravenes the "polluter pays" principle, whereby the polluter must, at least, cover the marginal cost of the pollution and, in the best of cases, all related externalities.

As there is no market for water use rights, the application of extraction charges could help make resource allocation more efficient and water supply more sustainable. The base and rate of the charge should be identical across all water uses, and preferential rates for specific user categories should be avoided. In particular, it is hard to find an economic justification for granting preferential rates to parties in collective management agreements, who are mostly farmers. Nonetheless, if agreements of this type encourage the adoption of more environmentally-friendly practices, they could help to progressively integrate the external costs. To provide appropriate market signals in relation to water use, extraction charges must be consistent with the cost of the environmental externalities caused, which requires geographical and seasonal adaptation to enable them to reflect water availability.

The calculation of the pollution charges applied to the firms, whether or not these are connected to the sewerage network, can either be based on real (measured) pollution or be estimated by applying technical coefficients to specific emissions. The payment can be reduced if abatement measures are adopted (or determined or estimated on a fixed basis). The setting of the pollution payment under these criteria makes it possible to offer a real incentive to reduce the pollution, provided no exemptions or discounts are granted to certain industrial uses or certain categories of polluting discharges.

It is practically impossible to establish non-pollution incentives for residential users. It would be too costly to measure the volume of household polluting discharges, since the sanitation tariffs are generally calculated on the basis of water consumption, assuming that the cost of treatment of wastewater is proportional. In France, the basic rates per pollutant, which are the same as those applied to firms, are based on a uniform municipal estimation of the daily volume of pollution produced per person per cubic metre of water consumed. In the cases of both firms and households, a geographical adaptation needs to take account of the pollution-vulnerability of the immediate environment.

With the exception of large livestock farms, which can receive the same treatment as firms, it is difficult to set water pollution fees for units in the agriculture sector, whether the pollution is produced by livestock or by crops. Firstly, water pollution attributable to crop farming is inherently diffuse. Secondly, the alteration of the quality of water caused by fertilisers and manure varies according to climate, the hydrological characteristics of the water course, the nature of the soil, the type of crop and farming practices.

Accordingly, individual measurement of pollutants, which would be needed to establish incentives, would be too costly.

It is relatively easy to tax the nitrogen content of fertilisers, but such taxes would be poorly targeted since the link between fertiliser use and leaching depends on the aforementioned factors. Moreover, they would only partially address the pollution problem, because they do not include nitrogen of animal origin. The only way to solve this is to measure the nitrogen entering farming units and the nitrogen produced in them, such as that incorporated in harvest residues, and tax the difference between the two (the nitrogen balance). This would correspond to the quantity that remains in the soil and could end up in the water. A tax of this type would be the first step towards internalising the costs of pollution caused by agriculture, and it would have to be differentiated by zones, based on environmental risk. Nonetheless, the costs of administration and of collecting data to establish, control and tax the nitrogen balance could be significant; and the net benefits associated with this tax need to be compared with those of a system in which a tax on fertilisers is combined with a tax on pollution caused by livestock activities.

2.3. Risk-based approach

In many regions of Peru, water security is at risk owing to growing demand, water stress, and the steady expansion of polluting sources. Accordingly, there is an urgent need to speed up efforts to control better the risks of water scarcity, floods, poor quality, and reduction of the resilience of freshwater bodies (rivers, lakes and aquifers). The adoption of an approach that prioritises explicit control of water hazards increases the chances that a country will achieve its water-related economic, environmental and social objectives, without excessive costs for society (OECD, 2013b).

Application of a risk-based approach focuses on water security, first and foremost by determining acceptable risk levels, and striking a balance between these and the expected benefits. Consequently, an approach of this type can help ensure that the implicit risk level of the different policy actions reflects the social costs. It is also flexible, so the acceptable risk level can be adapted relatively quickly if efficient mitigation measures are applied, or if new economic development possibilities justify the implementation of activities aimed at reducing the risk level. A risk-based approach makes it possible to move from reactive to proactive policies. Instead of simply responding to water crises, which tends to be very costly for society, Peru could embark on a process of evaluation and appropriate management and anticipation of risks, along with periodic evaluations. Many of the country's regions have available water resources that have been overallocated, so a better understanding of the risks could help identify alternatives for improving the allocation of water between agricultural and urban users, and environmental uses.

Water security has to do with tolerance of an acceptable level of risk. For example, the risk of exploiting an aquifer is evaluated in order to determine how much recharge can potentially be allocated. For this purpose, social, environmental and economic risks are classified as high, medium or low (Table 8.11), according to the likelihood of abstraction affecting the values of the aquifer (or the sensitivity to those values to abstraction), as well as the consequences of that impact (i.e. how important particular values are). For example, a groundwater-dependent ecosystem may be highly sensitive to water table changes, but of low environmental value, so the risk rating in this case would be low. The highest risk ratings for on-site and economic development risks (respectively) are used to identify the initial risk values.

Table 8.11. Valuing the risk of exploitation of an aquifer

Risk	Values	Sensitivity	Consequences of inaction	Risk rating	Total risk
On-site	Aquifer properties	What is the critical point beyond which the aquifer's adaptation capacity would be exceeded (and thus its resilience damaged)? How sensitive is aquifer integrity to abstraction?	If aquifer integrity were impacted, how significant would that be?	High, medium or low	Highest risk rating
	Groundwater-dependent ecosystems	How dependent are the ecosystems on groundwater? What is the likelihood that ecosystems would be impacted if water was abstracted?	How significant are the ecosystems in terms of environmental value?	High, medium or low	
	Social and cultural	How dependent are the cultural and social values on groundwater?What is the likelihood that these values would be impacted if water were abstracted?	How significant are those ecosystems in terms of social and cultural values?	High, medium or low	
Economic development	Current and future water use	How important is the resource for meeting current and future development needs?Are there alternative water sources or alternative production approaches that do not need to use groundwater?	How significant is the current and future productive use/ development for the community?	High, medium or low	Highest risk rating

Source: Government of Western Australia (2011), "Groundwater risk-based allocation planning process".

A risk matrix is used to convert on-site and development risks into a proportion of the exploitable recharge (Table 8.12). This proportion is then applied to the recharge volume estimated to establish the allocation limit. The risk matrix can be used to estimate the advantages and disadvantages between the two risk groups. For example, in a maximum allocation of 70% of the recharge —in other words excluding at least 30% of the estimated recharge— account is taken of the opportunity cost of not allocating water to a development objective, while also avoiding possible overallocation. Using this matrix also helps protect the integrity of the aquifer, among other things by reducing the risk of salt water intrusion. The allocation limit can be reconsidered when more information is available. Drawing up a risk matrix is consistent with the recommendation contained in the PNRH strategic environmental assessment that the risk of overexploitation be reduced by limiting extractions and continuously monitoring the reaction of the aquifers.

Table 8.12. Determination of an acceptable risk level in exploiting an aquifer

(Percentages of estimated recharge)

On-site risk	Economic development		
	High	Medium	Low
High	5	25	50
Medium	25	50	60
Low	50	60	70

Source: Government of Western Australia (2011), "Groundwater risk-based allocation planning process".

If appropriate, the final ratings shown in Table 8.12 can be revised on the basis of the proposed mitigation measures. If the risk mitigation strategies reduce the global risk to on-site values, then the reduced risk value is used in the risk matrix.

Notes

1 Unless indicated otherwise, the information presented in this section is based mostly on data from the National Water Authority (ANA, 2013).

2 PLANAA Peru envisages 25% of farming areas being irrigated using sustainable techniques by 2021.

3 Gravity irrigation is about 40%-50% efficient, compared to 75% efficiency in the case of spray irrigation and 90% in the case of drip irrigation.

4 Excessive irrigation of agricultural land is one of the main causes of salinity.

5 For ease of presentation, the official map of Peru's hydrographic basins identifies only 115 of the most important basins, although there are over 1 200 in all.

6 See [online] http://www.ana.gob.pe/sites/default/files/plannacionalrecursoshidricos2013.pdf.

7 The quality of surface water is monitored by checking compliance with parameters relating to chemical oxygen demand, ammoniacal nitrogen, nitrates and phosphates, XICP metals and total metals (mercury) oils and fats, as well as total coliforms and faecal streptococci.

8 Law No. 26.338 makes the municipalities responsible for providing water-related services.

9 The programme was concentrated in regions with poverty rates above 30%.

10 In 2011, appropriations for sanitation from the public budget amounted to PEN 3.2 billion, of which 70% went to urban zones and 30% to rural areas.

11 The Water Resources Act (*Ley de Recursos Hídricos*) repealed the 1969 General Water Act (*Ley General de Aguas*), the provisions of which primarily addressed the agriculture sector, and under which a sector-based management scheme by irrigation district was set up, prioritizing coastal zones. The General Water Law (Decree Law 17 752) was issued to complement the Agrarian Reform Law.

12 The ecological (or environmental) flow is defined as the volume of water that needs to be maintained in natural water sources to protect or conserve the ecosystems involved, the aesthetics of the landscape, or other aspects of scientific or cultural interest (Article 153 – Supreme Decree No. 001-2010-AG).

13 Cultivation of one hectare of rice uses 20 000 m^3 per year.

14 No volumetric rate is applied for discharges of less than 100 000m^3 per year, but the total cost was considered.

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Chapter 9. Biodiversity

This chapter reviews the pressures on Peru's biodiversity, including agro-biodiversity, the number of species at risk, and the regulatory framework to promote the conservation and sustainable use of biodiversity. It also assesses progress (or lack of progress) in the use of direct regulations and economic instruments for the conservation and sustainable use of biodiversity, such as protected areas, land use planning, granting of property rights, public financial support and payments for ecosystem services.

Key findings and recommendations

As one of 17 countries recognised for their megadiversity, Peru has ecoregions ranging from the coastal desert to the Amazonian tropical forest. Of the 117 types of biomass recognised in the world, 84 are present in Peru. Of its nearly 129 million hectares of land, just over 73 million hectares (57%) have forest cover. The loss of original forest ecosystems has continued into this century; in the Amazon region, an average of 119 000 hectares was lost every year in 2003-2013, equivalent to 1.8% of the Amazon forest. The bulk of that loss is due to conversion on properties smaller than 5 hectares. Peru has two main marine ecosystems: tropical and temperate-cold. The first has a great diversity of species, but in small volumes; while the second has little diversity but large volumes per species. Along its 3 080 km of coastline, Peru has major industrial and artisanal fisheries, of which anchovies are the most important.

The main pressures on land-based ecosystems arise from changes in land use, primarily deforestation for lumber; expansion of the agricultural frontier through traditional or mechanised crop farming; livestock-raising; real estate and industrial projects; and the construction of large infrastructure works. Also significant is the overexploitation of flora and fauna through illegal hunting and trading. Recently, remote sensing technologies have shown that forest loss as a result of selective felling is a serious problem, along with the advance of the agricultural frontier. The chief causes of deforestation include the lack of property rights and the absence of land-use planning; the low market value of forest land compared to other land uses; sector development policies that run counter to the preservation and sustainable use of biodiversity; large-scale highway, hydroelectric or mining infrastructures that lead to changes in land use and to the influx of settlers; and shortcomings in governance capacities.

Agriculture occupies around 38.7 million hectares of Peru's land area (30% of the total), comprising 2.2 million farms, almost all of them smaller than 10 hectares and only 25% capacity utilisation. The vast majority of farmers are smallholders growing traditional crops. Only 28.8% of farmers have title to their land, while the remainder farm communal lands or are tenants or squatters. The land has been occupied haphazardly, as exemplified both in subsistence farming, which is practised in areas that should be set aside for forestry or watershed protection, and in export agriculture, which is heavily practised in water-deficit zones that cannot guarantee the activity's sustainability. Peru's agrobiodiversity is among the richest in the world and represents one of its most valuable natural and cultural assets. Of the four most important crops for human consumption — wheat, rice, maize and potatoes— Peru has great genetic diversity in the latter two. It also has 128 species of domesticated native plants, and its domesticated animals include the alpaca, the llama and the native duck (*pato criollo*). Peru's indigenous peoples and its cultural diversity represent an important reservoir of knowledge on the uses and properties of flora and fauna species, as well as the use of genetic resources (4 400 plants of known uses, and thousands of varieties). Nonetheless, this diversity has been shrinking over time. Policy efforts to promote agrobiodiversity will be put to the test by the heterogeneous nature of the agriculture sector, in terms of technological differences, market linkages, and access to financial services, compounded by the country's geographical and climatic diversity.

Development of the forestry sector falls far short of its potential in terms of surface area and biological diversity. Peru is in fact a net importer of forest products, thanks to the low levels of industrialisation and value added. The area under commercial plantation is still very small; and less than half of the exploitable forest area is under operating concession.

The extent of land-use changes is reflected in the high level of greenhouse gas (GHG) emissions in this category. Peru also exhibits seven of the nine characteristics of vulnerability recognised by the United Nations Framework Convention on Climate Change; and it could be exposed to even greater losses of biodiversity as this problem becomes more acute.

The Constitution of Peru declares natural resources to be part of national heritage; and it tasks the State with setting environmental policy and determining the sustainable use of those resources. The State is explicitly obliged to promote the conservation of biological diversity and protected natural areas, and to promote the sustainable development of the Amazon region. In 1993 Peru ratified the Convention on Biological Diversity (CDB) and to date has submitted five national reports under the Convention. Within the Ministry of the Environment (MINAM), the Biological Diversity Branch of the Vice-Ministry for Strategic Development of Natural Resources is responsible for policies on biodiversity. There is also a National Commission on Biological Diversity (CONADIB), which is an advisory and co-ordination body on the sustainable use of biodiversity, charged with monitoring fulfilment of the commitments emanating from the Convention and related treaties (the Ramsar Convention, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on the Conservation of Migratory Species of Wild Animals, etc.), as well as the design, update and implementation of the National Strategy on Biological Diversity (ENDB) which extends to 2021. Pillar 1 of the National Environmental Policy provides for the conservation and sustainable use of natural resources and biological diversity. The Conservation and Sustainable Use of Biological Diversity Act, and its regulation, make ENDB, along with its 2014-2018 Action Plan of November 2014, the primary instrument for managing biodiversity in Peru, and for halting the loss and deterioration of the components of biological diversity, improving their management, and boosting opportunities for sustainable use and fair and equitable distribution of their benefits.

With a view to conserving and making rational use of the country's megabiodiversity, as well as placing due value on traditional knowledge, ENDB sets out six general objectives for environmental policy, with targets to be attained by 2021. The National System of State-Protected Natural Areas (*Sistema Nacional de Áreas Naturales Protegidas por el Estado* – SINANPE) has been steadily expanded; and in June 2015 it embraced a total of 64 protected natural areas (ANPs), versus 40 in 2003, covering 16.6 million hectares (17% of national territory). There are also 17 regional conservation areas administered by the regional governments, and 82 private conservation areas. Of the 16.6 million hectares included in ANPs, 97.6% are on land and just 2.4% are in marine zones. Conditions are improving, as can be observed in the fact that, while only 33 ANPs were staffed and 17 had master plans for their management in 2003, the corresponding figures were 61 and 41 by 2015. Nonetheless, only 12 of the country's 21 terrestrial ecoregions are represented in ANPs (CDC-WWF MINAM); and the master plans do not necessarily ensure governance for their sustainable use. Eco-tourism has been growing in importance, and in 2013 there were more than 1.3 million visits to ANPs in the national system.

Most of the funding for biodiversity conservation comes from the public treasury: that contribution rose by 500% between 2004 and 2010, but it still falls short of needs. A study by Universidad del Pacífico points to an annual budget shortfall of PEN 115 million, or roughly USD 35 million. Supplementary contributions come from the private sector and international co-operation, and also from projects that involve payment for ecosystem services. The conservation and sustainable use of biodiversity and natural resources and the integrated and sustainable management of ecosystems ranked second and third among environmental expenditure items for the period under analysis, jointly accounting for roughly a third of the total. The economic instruments applied include the entry fee to ANPs, of which 70% of the proceeds are reinvested in the conservation of those areas, and the incipient introduction of a system of payments for ecosystem services. There are also direct transfers to indigenous and rural communities for forest conservation.

Recommendations

- Step up efforts to improve, update, and manage scientific knowledge on ecosystems and species (inventories of flora and fauna, endangered species) and on the genetic diversity of domesticated species of flora and fauna, in order to contribute to the better design of policies for the protection and sustainable use of biodiversity and to the monitoring of, and regular reporting on, its status.
- Strengthen interministerial co-ordination mechanisms, such as the National Commission for Biodiversity, so they can contribute to the effective incorporation of the sustainable use of biodiversity into economic and sectoral policies. Support the full consideration of the impact on land and marine biodiversity in EIA and SEA processes, in the granting of environmental permits and in territorial governance, through the development and use of technical guides.
- Establish a clear legal framework for access to genetic resources and traditional knowledge in order to encourage research into, and a greater understanding of, biodiversity; and to allow possible commercial developments with transparent mechanisms for the distribution of benefits, in accordance with the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization. Lay the foundations for scientific and biotechnological developments related to the sustainable use of biodiversity within the established legal framework.
- Strengthen the technical and financial capacities of the National System of Protected Natural Areas (SINANPE) and develop an integrated view of the complementary roles of public and private protected areas, for the development of an interconnected and coherent network of core areas, buffer zones and biological flows and corridors.
- Assign political priority and the necessary means for the implementation of the National Strategy and Plan of Action for Biodiversity towards 2021 (EPANDB), as a key tool for the conservation and sustainable use of biodiversity in Peru, including agrobiodiversity. Complete the Regional Biodiversity Strategies and Action Plans (EPARDBs) that are still pending, and ensure their implementation with the necessary technical and financial support.
- Continue with ongoing efforts to capitalise on the economic potential of the sustainable use of biodiversity and agrobiodiversity, through such activities as ecotourism, biotrade, gastronomy, establishment of world-class research centres, traditional medicine, etc. Develop the regulations to the Payments for Ecosystemic Services Act to strengthen the provision of those services (regulation of water in river basins, the maintenance of biodiversity, carbon sequestration, scenic beauty, soil formation and the provision of genetic resources) and, as applicable, sustainable related economic activities.

1. Current situation and main trends

1.1. Current situation

Peru is recognised as one of 17 "mega-diverse" countries which between them hold over 70% of the planet's biodiversity, represented by a wide variety of ecosystems, species of flora and fauna and genetic diversity. Of its land area of 128 521 560 ha, 57% has forest cover (MINAM, 2011).

Biodiversity makes a decisive contribution to the national economy through different goods and services, such as regulation of the water cycle, which provides water for human consumption, agriculture, and hydroelectric power generation, income from ecotourism and the commercialisation of native species and their by-products. Trade in native species, including biotrade, has been expanding; and in 2013 it involved 46 species of native flora and fauna and generated earnings in excess of USD 218 million. The concept of investing in biological diversity is starting to gain traction in Peru and to generate wealth for certain less well-off sectors (MINAM, 2010).

Ecosystems

Peru's wide range of ecosystems, largely determined by the cordillera of the Andes that spans the length of the territory and at some points rises above 6 000 m in altitude, consists of a complex combination of climate, soils and micro-environments that sustain extensive biological diversity. The main continental ecosystems are the planes, including tropical forests; mountains, and forests that are dry for part of the year. The "fragile ecosystems", defined as such in the General Environment Act (Law No. 28611), encompass deserts, semiarid zones, mountains, swamps, marshes, bays, islets, wetlands, high Andean lakes, coastal hills, cloud forests and relict forests, which are also important (MINAM, 2014c).

The forest (*selva*) region contains over 94% of the country's forested land. The Amazon forest contains a wide variety of flora and fauna species, some of which are economically important. The coastal region accommodates algarroba forests, including riparian forests; mangrove swamps and dry savannah forests. Peru has around 73 million ha of natural forest, most of which are in a good state of conservation, but they have been shrinking owing to intensive deforestation (MINAM, 2014c).

The coastal marine ecosystem extends for 3 080 km and spans a marine area of 790 000 km², encompassing 77 islands. This ecosystem contains mangroves that provide a habitat to large numbers of aquatic and migratory birds. There are 92 wetlands, five of which have been declared of international importance (RAMSAR sites), and macroalgae meadows containing a wide variety of species. The continental water ecosystems consist of 62 hydrographic units along the coast, 74 in the Amazon basin and 13 in the Lake Titicaca watershed. The strongest flowing rivers form part of the Amazon system, while most of the lakes and lagoons are in the high Andean area (MINAM, 2014c).

Species

Peru is home to over 20 375 species of flora, 523 species of mammal, 1 847 species of birds, 446 species of reptile and 1 070 marine fish species, (MINAM, 2014a); it also has 84 of the planet's 117 life or biomass zones, also known as "biotic areas" (ONERN, 1976). Although the biological communities of the continental waters have been little studied, the composition and distribution of fish species is well-known. Of the 1 070 species recorded in late 2013, 50 lived in rivers that drain into the Pacific Ocean, from Tumbes to Tacna; 30 live in Lake Titicaca, and 980 in the Amazon basin. It is estimated that the number of new species to be discovered in the near future will be equivalent to 20% of the current total (MINAM, 2014c).

Peru belongs to the group of like-minded megadiverse countries, which co-operate in identifying common interests, to promote conservation and the sustainable use of biological diversity. This group has acted as a negotiating bloc adopting common positions on access to genetic resources and the distribution of their benefits.

1.2. Pressures on ecosystems and species

Pressures affecting ecosystems

The greatest threats to terrestrial ecosystems stem from land-use change, as the agricultural frontier expands to devote land to traditional or mechanised cropping, lumber or livestock production for export; pollution of water and soil; extractive activities such as oil drilling, hydropower generation —including the construction of high tension lines— and mining; large infrastructure works, and climate change. These processes have resulted in haphazard land occupation which affects biodiversity.

Box 9.1. Desertification

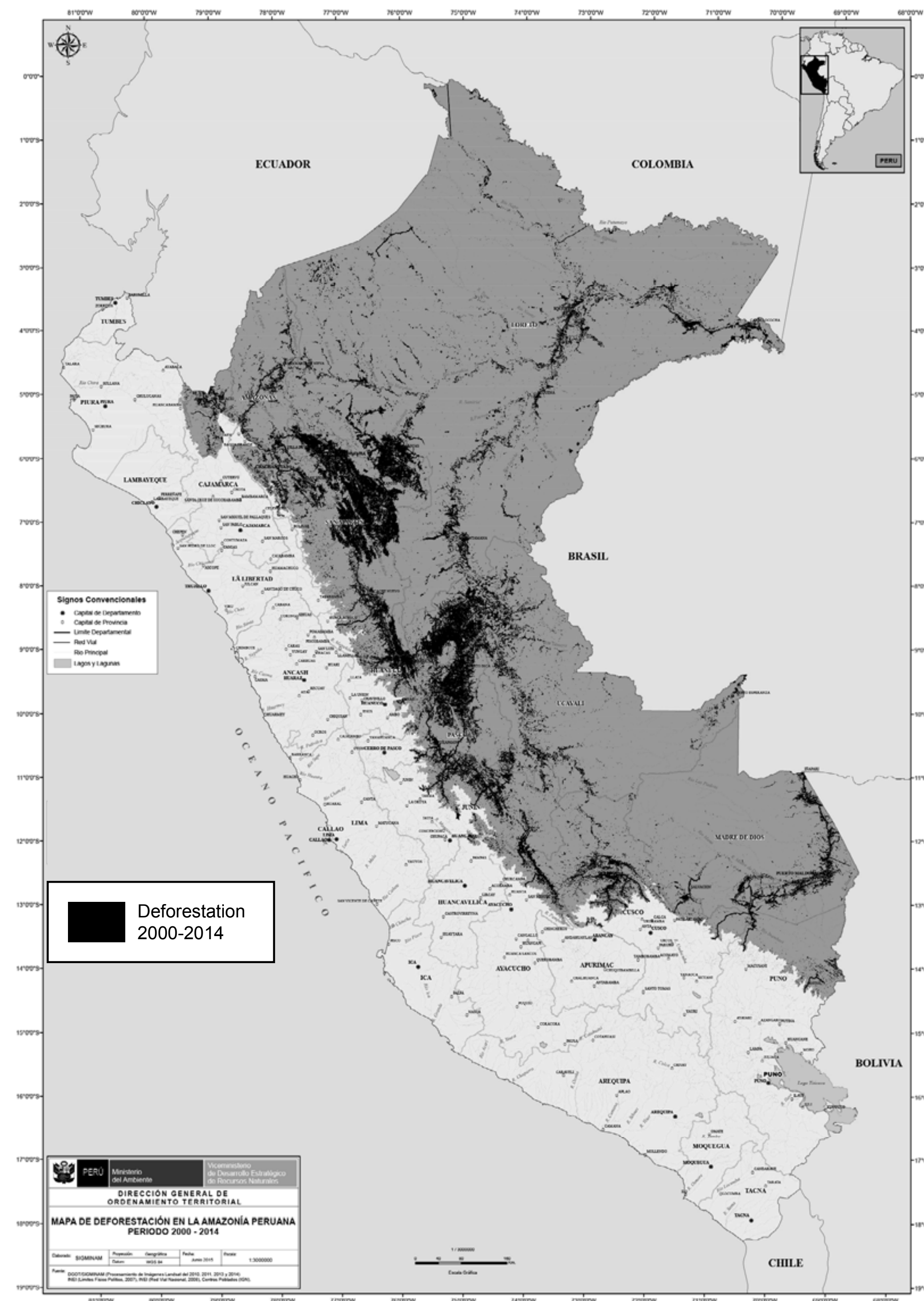
Peru is one of the countries that is now facing water stress problems, since it has less than 2 000 m^3 of water per capita per year, which does not satisfy demand (MINAM, 2011). Moreover, soil degradation, of high-to-medium intensity, affects 61.31% of the territory; the most exposed areas being the central coast and highland (sierra) zones, and the department of Madre de Dios in the forest (selva) region.

Agriculture and deforestation are the main causes of land degradation, which takes different forms in the various zones of the country. On the coast, this is largely due to salinisation, which is particularly intensive in the northern coastal zone (Piura-Lambayeque), a large area of export-oriented agricultural production. In the highland zone it is basically caused by inefficient water use; and in forest areas it is due to deforestation and pollution from mining activity.

Most desertified areas, along with those in the process of desertification, are inhabited by population groups with medium to low development indices; and this is compounded by the fact that in arid zones climate change has accentuated their deterioration (MINAM, 2011).

Source: Dascal (2012) and MINAM (2011), "Mapa del patrimonio forestal nacional" [online] http://sinia.minam.gob.pe/sites/default/files/archivos/public/docs/1731.jpg.

Figure 9.1. Deforestation in the Amazon region, 2000-2014



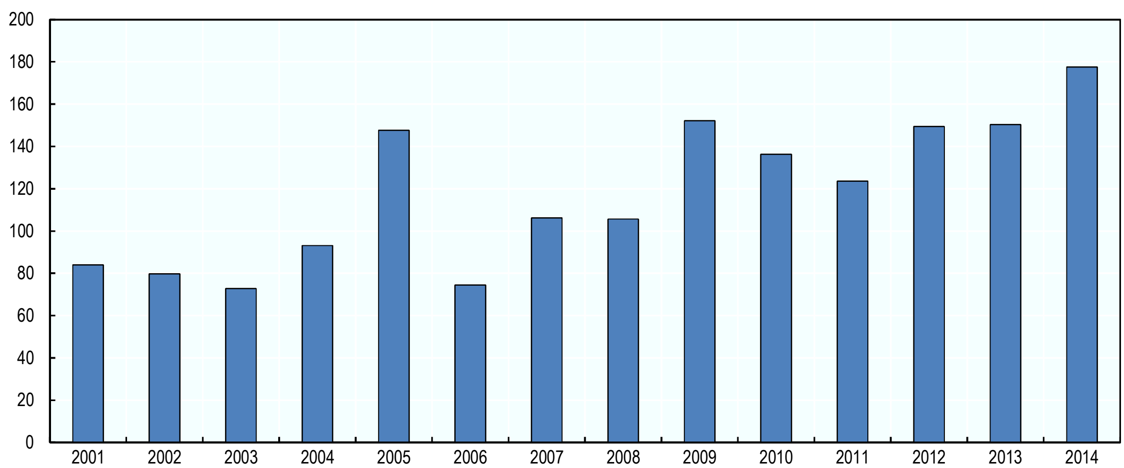
Source: MINAM (2015), Mapa nacional de cobertura vegetal. Memoria descriptiva.

Of the over 70 million ha of different types of forest that exist in Peru, over 90% are Amazon forests. Between 2001 and 2014, these declined by roughly 1.7 ha (Figure 9.1, Figure 9.2 and Box 9.1), which implies an average annual loss of 150 000 ha.

Agricultural expansion remains the chief cause of deforestation in the Peruvian Amazon region; and, in fact, it is estimated over 90% can be attributed to this process. A large proportion of land conversion, which mostly occurs haphazardly, reflects the slash-and-burn practices of smallholder farmers with land areas of less than 5 ha. This is exacerbated by inappropriate cropping techniques which leach soils and undermine fertility. For that reason, 60% of occupied land (about 5 million ha) is abandoned (Chapter 10). The absence of property rights and the relatively low market value of forestry land, contribute to unplanned land occupation. In addition, the first of these factors gives rise to conflicts in indigenous areas.

Figure 9.2. Loss of forests, 2001-2014

Thousand hectares



Source: Ministry of Environment (MINAM), on the basis of National Programme for the Conservation of Forests, "Plataforma de monitoreo de los cambios en la cobertura de los bosques" [online] http://geobosques.minam.gob.pe:81/geobosque/view/perdida.php.

The coastal region is also exposed to deforestation and degradation caused by the conversion of land to crop farming and livestock and lumber activities. In the Andean region, biodiversity is affected by several factors, particularly land-use change or inappropriate land use. Cropping in protected zones and overgrasing have caused serious land erosion, which leads to its desertification (MINAM, 2014c).

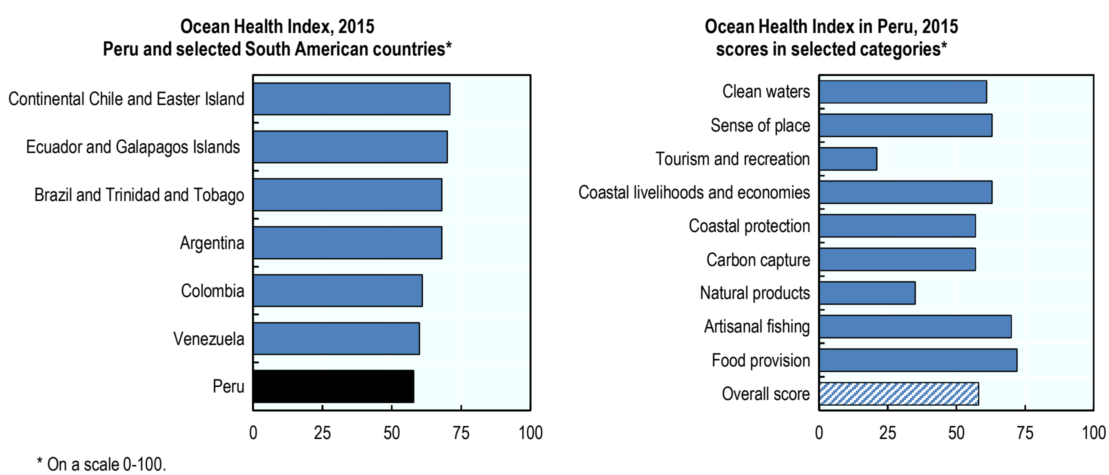
The application of remote sensing technologies in the last few years has revealed that large swathes of forest are being lost through selective felling. In years of serious drought, or owing to malicious human action, forest fires have compounded the pressures on forestry ecosystems and biodiversity (MINAM, 2014c). The scale of these phenomena is reflected in the fact that, unlike what happens in the emerging and industrialised economies, land-use change is the main source of GHG emissions in Peru, representing 35% of the total. Mechanised agriculture and intensive livestock breeding constitute the second largest emission source, accounting for 21% of total emissions (MINAM, 2014d). Consequently, over half of all emissions in Peru come from the agriculture and forestry sectors (MINAM, 2010).

In the marine environment, one of the greatest pressures stems from fishing activity (Chapter 11), which has been identified as one of the chief threats to biological diversity, because there are signs that certain species are being overfished. This is compounded by water pollution associated with urban and agricultural development in the coastal zone, where most of the population lives (Figure 9.3). Coastal land-use change owing to the expansion of aquaculture has irreversible effects, particularly in mangrove swamps (MINAM, 2014c).

The proportion of fish populations that live within secure biological limits is declining; and the marine trophic index[1] decreased by 0.15 per decade in 1950-2008 owing to fishing activity. The volume of marine resources brought to shore also declined between 2001 and 2010. Apart from pelagic species (tuna, mackerel, *samasa* or anchovy nasus and shark) and demersal species (*ayanque*, *coco* and *tollo*), for which catches have been increasing since 2004-2005, catch volumes of all other species have declined (Office of the President of the Council of Ministers, 2013).

The continental water ecosystems provide important provisioning and regulation services (MINAM, 2014c). Their biological communities are very important in the Amazon region, owing to the protein contribution for human consumption and to the use of constituent species for ornamental purposes. Knowledge of these communities is growing, supported by scientific collections and studies that have found that the water quality deterioration caused by waste discharge and pollution generated by illegal mining are the chief threats to the species of the Lake Titicaca watershed. In addition, in Peru's three river basins, introduced and invasive fish species have been identified (particularly poeciliids, cichlids and trout), along with algae.

Figure 9.3. Ocean Health Index 2015



Source: Ocean Health Index, "Annual Scores and Rankings" 2015 [online] http://www.oceanhealthindex.org/region-scores/annual-scores-and-rankings.

Compounding this, the impact of climate change is set to intensify even more in the future, including the El Niño phenomenon, to which Peru is highly exposed. The most vulnerable Andean zones are those in which human intervention is most recent, such as moorlands and cloud forests. The first is subject to the invasion of woody plants, and the localised elimination and lack of land on high slopes that can be colonised by other species. Secondly, conservation of cloud forests depends on fragile atmospheric conditions, which can change rapidly as a result of global warming (Herzog et al., 2011). The relict forests are also highly vulnerable owing to their small size.

Pressures affecting species

Many of the species existing in Peru are included in the CITES appendices. The index of species of wild flora consists of 2 629 taxa or related organisms, including subspecies and varieties of plants grouped in six botanical families, including the *Orchidaceae* family (88%) and the *Cactaceae* (10%) (MINAM, 2011). Peru's wild fauna consist of about 500 species, grouped in 66 families; 26 of these are *Trochilidae* (hummingbirds) and 11% correspond to *Psittacidae* (parrots or macaws) (MINAM, 2016a).

The Ministry of Agriculture is tasked with preparing and updating the official classification of species of wild flora and fauna by conservation status. Supreme Decrees 004-2014-MINAGRI and 43-2006-AG approved the lists of endangered species of flora and fauna, in which there was an increase in the number of birds, plants and amphibians included on the red list (Table 9.1) (MINAM, 2014a).

Table 9.1. Endangered species of flora and fauna

Status	Species of fauna	Species of flora
Critically endangered	64	194
Endangered	122	73
Vulnerable	203	391
Near threatened	103	119
Total	492	777

Source: Government of Peru, "Supreme Decree No. 004 2014 MINAGRI" [online] http://www.serfor.gob.pe/wp-content/uploads/2016/09/DS-N%C2%B0004-Especies-amenazadas-de-fauna-silvestre.pdf, for fauna and "Supreme Decree No. 43-2006- AG" [online] https://www.senace.gob.pe/download/senacenormativa/NAT-3-3-03-DS-043-2006-AG.pdf, in the case of flora.

The overexploitation of flora and fauna for hunting or illegal trade changes the distribution, abundance and composition of wild populations. This affects both genetic diversity and the flows of energy and resources in natural trophic chains. The forestry species of greatest relevance for timber use include the caoba and cedar, which command the highest prices on national and international markets. It is estimated that between 40% and 60% of the species are felled without respecting the required minimum diameter or allowing for sufficient natural regeneration of the populations. Nonetheless, genetic diversity of these and other species is deemed to be adequately represented in the protected areas.

2. Policy objectives and biodiversity conservation

The value of Peru's great natural wealth is recognised in article 68 of the Political Constitution, which refers to the importance of biological diversity and tasks the State with promoting its conservation. This mandate was corroborated in 1993, when Peru ratified the United Nations Convention on Biological Diversity (CDB), through Legislative Decision 26.181. The CBD objectives are the conservation of biological diversity, sustainable use of its components, and the fair and equitable share in the benefits arising from the use of genetic resources. This legal instrument served as the basis for approval in 1997 of the Biological Diversity Conservation and Sustainable Use Act (Law No. 26839), which reiterates the principles and definitions contained in the Convention.

2.1. National objectives and international commitments

The National Strategy on Biological Diversity (ENDB) (MINAM, 2014a), formulated in response to the decisions adopted at the 10th meeting of the Conference of the Parties to the Convention on Biological Diversity, and in consonance with the provisions of the Biological Diversity Conservation and Sustainable Use Act (Law No. 26839), is the main legal instrument governing biodiversity in Peru.

Table 9.2. Objectives and targets of the current National Strategy on Biological Diversity

Strategic objectives	Targets
1. Improve the status of biodiversity and maintain the integrity of the ecosystemic services it provides.	1. Consolidate the sustainable management of biodiversity in at least 17% of the land environment and 10% of the marine environment, according to the different modalities of conservation and on-site management.
	2. Prepare and implement 15 conservation plans for endangered species.
	3. Develop at least 10 programmes of conservation and sustainable use of the genetic diversity of species of which Peru is the centre of origin and diversification.
2. Increase the contribution of biodiversity to national development, by improving the country's competitiveness and sharing the benefits equitably.	4. Recognise the value of ecosystemic services; promote five bio-businesses; commercialise two new biotrade products with value-added.
	5. Implement access to, and the distribution of, benefits from the use of genetic resources in accordance with the Nagoya Protocol.
3. Reduce direct and indirect pressures for biological diversity and its ecosystemic processes.	6. Raise citizen awareness and valuation of the contribution of biodiversity to national development and welfare by 20%.
	7. Reduce the rate of degradation of ecosystems, particularly forestry and fragile ecosystems, by 5%.
	8. Improve the effectiveness of the control, supervision and inspection of biodiversity use; increase regulatory mechanisms on endangered species and invasive exotic species.
4. Strengthen the capacities of the three levels of government for sustainable management of biodiversity.	9. Strengthen institutional capacities at all government levels for the effective and efficacious management of biological diversity.
5. Improve knowledge and technologies for the sustainable use of biodiversity, and give greater value to indigenous peoples' traditional knowledge on biodiversity.	10. Increase scientific knowledge, technological development and innovation, through the integration of the first and traditional knowledge relating to the conservation and sustainable use of biodiversity.
	11. Generate new knowledge on genetic diversity and the territorial distribution of 10 species of which Peru is the centre of origin and diversification, for their conservation and the equitable distribution of their benefits.
	12. Improve the protection, maintenance and recovery of the traditional knowledge of indigenous peoples.
6. Strengthen co-operation and participation by all sectors of the population, for the governance of biological diversity.	13. Strengthen the decentralised governance of biodiversity, under a participatory and intercultural approach at the national, regional and local levels, in the framework of international treaties.

Source: MINAM (2014a).

The new national strategy on biological diversity, which is an update of the version adopted in 2001, establishes six general objectives for environmental policy, each of which is subdivided into targets for 2021. These include the strengthening of the ecosystemic approach in domains such as participatory governance and intersectoral management; the fair and equitable distribution of benefits; and the management of biodiversity "with a landscape and watershed view". Another very important aspect of the strategy is the "prioritisation of on-site conservation with participation by the local population in centres of origin of agrobiodiversity, and the systemisation and monitoring of more efficient control measures to reduce the adverse impact of economic activities". This strategy also establishes quantifiable commitments that facilitate the monitoring and evaluation of the implementation process, thus distinguishing it from its predecessor.

Box 9.2. Biotrade potential of native species: the case of sacha inchi

Peru's foreign trade figures show that between 2006 and 2011 exports of biodiversity products totalled USD 1.121 billion (MINCETUR, 2014b). Significant progress has been made on policies on this subject in the ENDB framework, and the creation of the National Biotrade Commission, consisting of representatives from the public and private sectors (CAF/PROMPERU, 2014). Also worthy of mention are the activities included in the Perúbiodiverso (PBD) and Biocomercio Andino projects, among others.

One of the products for which trade has been promoted in the Biocomercio Andino project is a native plant of the Amazon forest region known as sacha inchi. This is catalogued in Law No. 28477 and in the regional biotrade programme as a native crop that forms part of Peru's natural heritage. The plant is one of the main sources of omega-3-rich oils and low in saturated fats; and it is used in the pharmaceutical, cosmetic and food industries. Most of the output of sacha inchi (Plukenetia volubilis) in 2013 was exported to Canada (26.24%) and the United States (19.97%) (MINCETUR, undated). It is mainly grown in the San Martín zone and to a lesser extent in the departments of Amazonas, Cusco, Junín, Loreto, Pasco and Madre de Dios, in tropical rainforests or in low-lying land no higher than 900 m above sea level.

The cultivation of sacha inchi has had positive environmental effects in areas that had previously suffered from human intervention and degradation (Department of San Martín, 2009), since it helps to revitalise depleted soils and reduce the compacting and erosion, while also increasing the volume of organic matter.

In general, the pilot activities implemented in the Andean Biotrade Project (MINCETUR, undated) have been beneficial. These have included the creation of 20 value chains in 15 regions; the production and marketing of over 20 products (including cacao, Physalis peruviana (aguaymanto), lucuma, quinoa, native potato, Caesalpinia spinosa (tara) and chestnut), and the development of gastronomy and ecotourism activities. In all cases, technical assistance was provided, and training was provided to participating firms on sustainable resource use, and the application of environmental sustainability standards and related practices. Although some producers have been accorded organic certification, which gives them access to specialised markets, further progress needs to be made in defining and enhancing supply quality parameters and promoting certification.

Source: Prepared by the author on the basis of CAF/PROMPERU (2014), Department of San Martín (2009), MINCETUR (2014b)and MINCETUR, "Sacha Inchi", Biocomercio Andino [online] http://www.biocomercioandino.pe/cadenas-de-valor-priorizadas/sacha-inchi.aspx.

Peru has submitted five national reports on compliance with the Convention on Biological Diversity, which facilitated the application of the green agenda. In addition, as the agreements of the "Rio Summit" of 1992 apply to Peru's ecosystems and interdependent issues, a synergetic approach is being prioritised. This is fundamental for achieving the national objectives, optimisation of resources and the fulfilment of international commitments.

In 2015, the National Wetlands Strategy (ENH) was updated in line with the Strategic Plan of the Convention on Biological Diversity. The Ministry of Production, MINAM and MINAGRI were tasked with jointly implementing CITES. In the case of reducing direct and indirect pressures on biodiversity (ENDB Strategic Objective 3), the lines of action of the National Climate Change Strategy, relating to the conservation of forest carbon resources, strengthen the synergy of the activities envisaged. In addition, the National Action Programme to Combat Desertification, which is currently being updated, coincides in scope with ENDB Strategic Objective 1 (Improve the status of biodiversity and maintain the integrity of its ecosystemic services).

2.2. Institutional framework

The General Directorate of Biological Diversity of the Vice Ministry of Strategic Development of Natural Resources is responsible for national policies on biodiversity, a domain in which it acts in co-ordination with the Office of International Cooperation and Negotiation, attached to the MINAM General Secretariat.

Pursuant to the provisions of Supreme Decree 007-2009-MINAM, the National Commission on Biological Diversity (CONADIB) serves as a consultative body on the sustainable use of biodiversity. The Commission, consisting of representatives from the public and private sectors, monitors the implementation of the commitments arising from CDB and related international agreements, including the Ramsar Convention, CITES, and the Convention on Migratory Species. It is therefore responsible for formulating and updating ENDB and making sure it is applied.

The General Directorate of Forestry and Wild Fauna of the Ministry of Agriculture and Irrigation regulates and promotes the sustainable use and conservation of forestry and wild fauna resources (Forestry and Wild Fauna Act, Law No. 27308, and the regulation governing the organisation and functions of the Ministry). The regulation requires the official classification of species of wild flora and fauna to be updated according to their conservation status every three years. This makes it possible to impose bans on hunting, capture, holding, transport or exportation for commercial purposes; and it also makes it possible to identify needs for protection or restoration, and the feasibility of sustainable use of the species.

International co-operation

International co-operation is one of the aspects of environmental management in which major progress has been made. Peru's affiliation to the most important international conventions and treaties provides a basis for continuing to strengthen the development of public policies on the environment, and for the conservation and sustainable use of biodiversity, in relation to species (wild flora and fauna), ecosystems (recognition of the economic value of the services they provide, including the carbon sink function), and genes (origin and diversification of agrobiodiversity and many other still unexploited resources).

The National Forest Conservation Programme for Mitigation against Climate Change, of 2010, aims to mitigate GHG emissions, by preserving a total of 54 million ha of forests by 2021. Under this commitment, the government started the preparation process for the United Nations Programme on Reducing Emissions from Deforestation and Forest

Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries (REDD+) at the national and subnational levels. In addition, a national REDD+ register was created, and several pilot projects have begun and many others are being formulated, all of which have foreign and domestic financing and certification of compliance with international standards.

For satisfactory execution of the REDD+ projects, legal problems need to be resolved, and clarity be given to territorial management and landholding rights. Although the approval of the Indigenous or Originating Peoples' Right to Prior Consultation Act (Law No. 29785) represents progress in terms of equity and protecting the rights of those peoples, it would also be necessary to consolidate application of the principle of free, prior and informed consent (CIFOR, 2013).

In 2013, MINAM drew up a proposal for Peru's preparation for the REDD+ program, approved in 2014, with the aim of acceding to the Forest Carbon Partnership Facility (FCPF). In the latter part of that year, a start was also made on formulating the National Strategy on Forests and Climate Change (ENBCC), which is a comprehensive legal mechanism for addressing deforestation, and will serve as the framework instrument for the activities and investments envisaged in the Forestry Investment Programme and preparation proposal for the REDD+ program, among others. In 2014, representatives of the National Forest Conservation Programme for the Mitigation of Climate Change (PNCBMCC), the National Forestry and Wild Fauna Service (SERFOR) and regional governments participated in the definitive formulation of ENBCC, which contains measures to reduce the rate of deforestation and forest degradation, under an integrated management approach for landscape and development with minimal emissions, with a view to reducing GHG emissions from the land-use, land-use change and forestry (LULUCF) sector.

Policy tools and the effects of their application

To meet the challenge of reversing the problems of environmental pollution and degradation, along with the consequent loss of biodiversity, Peru has pursued a series of legislative and institutional reforms over the last few years, particularly since 2008. Alongside these reforms, which have enabled major progress in establishing baselines on the status of ecosystems, there is a serious lack of information on the trends arising from the failure to adopt corrective measures, which would facilitate analysis of the viability of the objectives proposed in the new general proposal.

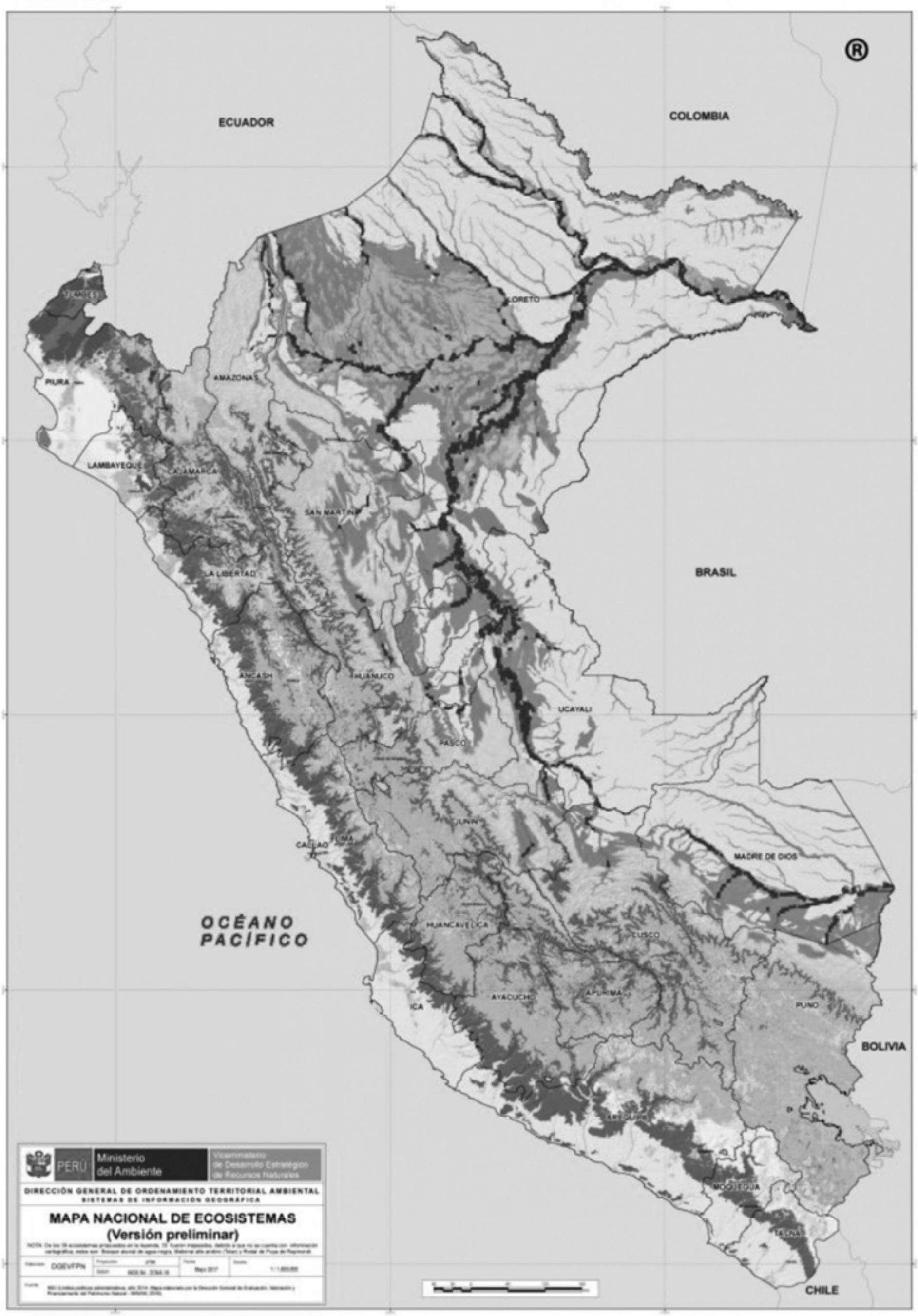
It is also recognised that sector-level public policies to promote production are contrary to the preservation and sustainable use of biodiversity (MINAM, 2014c). This situation has been exacerbated by institutional weakness to halt deforestation, and the low valuation placed on standing forests and environmental services that they provide (Chapter 10).

Classification of ecosystems

There is currently no national map of ecosystems considered as functional units, which would make it possible to classify, manage and monitor them; although a start has been made on developing the methodology to design this. The identification and classification of ecosystems has drawn on the following sources among others: the Holdridge life zone classification system, *Mapa ecológico del Perú*, (ONERN, 1976), *Mapa de las regiones naturales del Perú* (Pulgar Vidal, 1981), *Mapa de ecorregiones del Perú* (Brack, 1986, cited in MINAM, 2014c), *Mapa forestal del Perú* of the Ministry of Agriculture (MINAG, 2006, cited in MINAM, 2014c) and *Mapa de nacional de cobertura vegetal.*

Memoria descriptiva, published by MINAM in 2015. None of these documents use the category "ecosystem" (MINAM, 2014c).

Figure 9.4. Plant cover



Source: Ministry of Environment on the basis of "GeoServicios" [online] http://geoservidor.minam.gob.pe/intro/geoservicios/intercambio-de-base-de-datos-12.html.

To formulate various legal instruments and produce the latest reports on CBD compliance, use was made of the classification contained in *Mapa nacional de cobertura* *vegetal del Perú. Memoria descriptiva* (MINAM, 2015b), on the types of natural plant cover (Figure 9.4). The map of wetlands and protected natural areas was also used to assist in the analysis of ecosystem and biodiversity status. The National System of State-protected Natural Areas (SINANPE) applies the classification used in *Mapa de ecorregiones del Perú*, which is based on the ecoregion typology proposed by Dinerstein et al. (1995) (MINAM, 2014c).

National System of State-protected Natural Areas

Protected natural areas (ANPs) are essential for biodiversity conservation.[2] The National System of State-protected Natural Areas (SINANPE) is one of the five national systems of interministerial environmental management in Peru; while the Protected Natural Areas Master Plan is the instrument that defines policy guidelines and strategic planning, and the conceptual framework for their effective management, constitution and adequate operation, by formulating measures for the conservation of priority ecosystems. Current regulations require the Master Plan to be updated every 10 years; the most recent version was adopted in 2009.

Data from SINANPE reveal a sustained increase in permanent protected natural areas, of which there were 40 in 2003 and 64 by late 2013. These areas cover 16.6 million ha, equivalent to 16.9% of national territory. According to MINAM data, at end-2013 there were 10 protected marine areas, 15 conservation areas administered by regional governments, and 69 private conservation areas. The latter have been the fastest-growing (MINAM, 2014c). Management of the areas has been improved, as shown by the fact that in 2003 only 33 had staff assigned and 17 were governed by management master plans, compared to 61 and 41, respectively, in 2015. Nonetheless, of the 21 terrestrial ecoregions identified in Peru's ecoregions map (*Mapa de ecorregiones del Perú*), only 12 are protected natural areas, and the provisions of the respective master plans do not ensure the governance needed for their sustainable use.

Under current regulations, natural resources can be exploited, either directly or indirectly, in protected areas classified accordingly. In areas of direct exploitation, use or extraction is allowed, particularly by the local population, in the zones indicated in the respective management plan, which also lists the exploitable resources. Any other uses and activities undertaken must be compatible with the objectives of the area. In the second case (indirect use), scientific research without manipulation is authorised, along with recreational and tourism uses in zones designated and managed for those purposes. The removal of natural resources and changes to the natural environment are prohibited in these areas.[3]

Recently, the Office of the Comptroller General of the Republic analysed the performance of services involving participatory management and control and surveillance of the protected areas. The study found that the actions envisaged were only partially implemented, and that methods to identify actors and monitoring were applied on a discretionary basis. It also found that the coverage of the control areas was insufficient, and that there were inadequate resources (park rangers, control posts and communication equipment) for routine patrols. Although activities to record biological data are carried out in most of these areas, this does not amount to the monitoring of biological diversity, strictly speaking; and priority research needs to be promoted more forcefully (Office of the Comptroller General of the Republic, 2014).

Peru is currently ranked as the third most preferred ecotourism destination in Latin America, following Costa Rica and the Galapagos Islands (Drumm and Moore, 2002).

Recent years have seen a sustained increase in this type of tourism, which can benefit the sustainable use and valuation of biological diversity. In 2013, over 1.3 million people visited the SINANPE protected areas. Outside these, the vast majority of ecosystems and landscapes —Andean, Amazonian and coastal marine— also have huge and largely unexploited potential.

Management of species and genetic resources

The Regulation governing Access to Genetic Resources (Supreme Decree 003-2009-MINAM) specifies the conditions and mechanisms for exercising user rights, which are complemented with the provisions of the Intellectual Property Rights Act. These instruments authorise the signing of contracts enabling access for commercial and other purposes, framework access contracts, and agreements for the transfer of materials by foreign conservation centres. Thus far, only 11 access contracts have been signed, all of which relate to terrestrial genetic resources, in other words none concern marine species or continental waters.

Law No. 29811 has imposed a 10-year moratorium (2012-2021) on the production and entry into national territory of live genetically modified organisms. Its main purpose is to avoid the potential risk of transgenic contamination of the rich genetic diversity heritage of Peru, which is considered one of the main territories of origin and domestication of many food species and species of other types.

The Agrobiodiversity Technical Group, which supports CONADIB and is co-ordinated by the National Institute of Agrarian Innovation (INIA), updates the list of domesticated species and identifies their areas of origin and diversification. The group played an active role in promulgating Supreme Decree 020-2016-MINAGRI, which approved the regulation formally recognising Agrobiodiversity Zones. The construction of a platform for recognising the economic value of domesticated species and genetic resources, to ensure their sustainable use, is currently at the final stage. Thanks to the country's cultural heritage and originating peoples, Peru has domesticated five species of wild fauna and 182 plant species (Brack, 2003). In addition, national gastronomy has boomed in the last decade, as several Peruvian celebrity chefs have started to make commercial use of native species, with great success, and this has fuelled beneficial demand for agrobiodiversity.

In general terms, the heterogeneity of Peru's agriculture sector, and its geographic and climate diversity, pose major challenges that need to be addressed through policies on agrobiodiversity.

Forestry and wildlife management

The forestry sector displays productive development well below its potential, both in terms of land area and in terms of biological diversity. Owing to this sector's low level of industrialisation and scant value-added, Peru is a net importer of forestry products. The land area devoted to commercial plantations is still very small, and less than half of all timber forests are operated under concession.

Box 9.3. Diversity of native potato species

The potato, which originates and was first domesticated in the Andean mountains, is the world's third most important food species, after rice and wheat. Over 4 000 varieties of native potato are recognised; and there are 151 species of wild potatoes that are naturally resistant to pests, diseases and adverse climate conditions (International Potato Centre).

Peru has the world's second-largest agricultural area sown with potatoes, accounting for 8.8% of the total (Fourth National Agricultural Census, 2012). Roughly 96% of this area is in the highlands region, where the crop is the staple food of its inhabitants. Potato production in 19 of Peru's 24 departments involved 600 000 small farms; it is the main income source for Andean producers, and generates over 110 000 jobs.

Native potatoes offer multiple benefits in terms of consumption and sale: the income stability permitted by the sowing of multiple varieties as a strategy to guard against climate events, pests or diseases, that vary from one year to another, along with the food provided at different times of the year, in which farmers combine early varieties ("chauchas" and improved) with late varieties, thereby contributing to the economic well-being of potato-cropping families.

Production conditions vary, both in terms of productivity and in crop yields and production zones. In Chugay, growers still maintain the tradition of ploughing with oxen on flat land or gentle slopes. This practice is applied in 80% of potato fields, and the farmers of the zone make preferential use of organic fertilisers to control pests and diseases.

Potato production increased sharply in 2001-2013, with average annual growth of 2.6%. The cultivation of all varieties has been promoted by specific government policies, but greater attention should also be paid to the depletion of soils used for sowing and the use of fertilisers. Since 2008, which was declared the International Year of the Potato, numerous studies have been published, which include classifications of the native potato varieties and information on their morphology, agronomic characteristics, nutritional value and culinary uses. This information, which is included in the national register, can serve as a reference to monitor the conservation status of the crops and study potential new attributes or crop varieties.

Source: Prepared by the author on the basis of CGSpace, "Catalog of ancestral potato varieties from Chugay, La Libertad – Peru" [online] https://cgspace.cgiar.org/handle/10568/69083 and INEI (2013), IV Censo Nacional Agropecuario 2012. Resultados definitivos.

The sustainable use and conservation of forestry resources and wild fauna are governed by the Forestry and Wild Fauna Act (Law No. 27 308) and respective regulations. Use permits are issued on a decentralised basis by the respective regional authorities. One of the main commercial activities linked to forestry ecosystems is timber extraction, the current benefits of which are considered well below their estimated potential. For this reason, the Government has proposed a comprehensive reform of the current legal framework, to strengthen the capacity of public institutions and civil society for the conservation and sustainable use of forests. This is expected to involve management practices based on an ecosystemic approach, together with management modalities that consider cultural diversity and promote active participation by indigenous peoples and local populations. In this domain, there are very positive examples of certified forestry concessions and community forestry operations that satisfy the conditions needed to contribute to the sustainability of Amazonian forests (Cordero, 2012).

Measures of exploitation of hydrobiological resources

Fishing is one of the key economic activities in Peru, and the most important in terms of the exploitation of wild species. This has led to the adoption of fishery management measures aimed at improving control and sustainable management of the sector, in accordance with the Fisheries Management Regulation (Chapter 11). To that end, related legal instruments have been designed such as the National Plan of Action for conservation and Management of Sharks, Rays and Related Species in Peru (*Plan Tiburón Perú*), and the Plan of Action for the Conservation of Coastal Marine Biodiversity (Chapter 5).

The very few taxonomies that exist of Peru's marine fauna and flora show large knowledge gaps; and, although data compilation has helped, it is not a sustained process.

There are 10 protected natural areas in marine and coastal zones, including the recently created National Reserve System of Islands, Islets and Guano Capes (RNSIIPG), consisting of 22 islands and 11 guano capes. This reserve is home to a large number of endemic species and allows for the protection of fish spawning zones, bird nesting, reproduction of marine mammals and refuge for many other species. The creation of this reserve is highly beneficial for the conservation of biodiversity and also for the fishery sector (MINAM, 2014c).

The extraction of hydrobiological resources in continental waters, fishing in the Amazon zone, in rivers and lakes, and aquaculture activity in protected areas are all regulated by the General Fisheries Act (Law No. 25977). Aquaculture must also abide by regulations on category, objectives of creation and zoning, and the corresponding master plan. Moreover, Supreme Decree 016-2009-MINAM requires the use of hydrobiological resources to be specified in the Fisheries Management Programmes (MAPEs), which have precautionary status, and respond to a socioeconomic need that justifies the extractive activity, either for commercial purposes or for subsistence. The operations are monitored in co-ordination with the Regional Fishery Directorates (DIREPE) and the respective administrative entity.

The Standing Committee of the South Pacific is currently evaluating the effects of pollution on marine biodiversity and the risks this represents for human health, as part of the Action Plan for Protection of the Marine Environment and Coastal Areas of the South-East Pacific. These evaluations are being co-ordinated with the Institute of the Sea of Peru (IMARPE) (MINAM, 2014c).

Land management

Land management is an important environmental policy tool, in which the MINAM General Directorate of Land Management (DGOT) is responsible for promoting balanced management based on orderly occupation and sustainable use of natural resources, in accordance with the natural, social and economic potential of the different zones of the country. The Directorate also offers guidance and assistance to regional and local governments in relation to land management processes, through technical instruments such as ecological and economic zoning, specialised studies, the comprehensive diagnostic assessment of the territory and territorial management plan. In some areas, ecological and economic zoning is required to authorise land-use change

(DGOT/MINAM, 2014). The MINAM geoserver, which is freely accessible to all interested persons, is an important technical mechanism for the dissemination and exchange of geospatial information and information on the territorial and environmental situation of the country, which enables the downloading of images and consultation of specialised maps and reports, among other functions.

Recently, the stages of design, data collection and structuring of basic information for territorial management were concluded, with little progress having been made. It is illustrative that 46% of deforestation occurs in areas that are not regulated in any way (Chapter 10).

In recent years, investment promotion laws have been passed governing different aspects of the granting of permits for undertaking production activities under the National Environmental Impact Assessment System (SEIA). Under Laws Nos. 30230, of July 2014, and 30327, of May 2015, simplified permit mechanisms were established, and the sanctions imposed by the Agency for Environmental Assessment and Enforcement (OEFA) were relaxed. In particular, Law No. 30230 stipulates that the Council of Ministers will assume the functions of declaring reserve zones, formulation of the national policy on land management, and adoption of environmental quality standards (EQS) and maximum permissible limits (MPL). The functions were previously performed by MINAM. It is also clarified that "neither economic-ecological zoning nor land management assign uses or use exclusions," thereby reaffirming their indicative nature.

2.3. Economic instruments

The economic instruments currently in force, or in process, include those relating to the payment for ecosystem environmental services, which includes direct conditional transfers for forest conservation made by the Fund for the Promotion of Protected Natural Areas of Peru (PROFONANPE). In June 2014, the Ecosystemic Services Payment Mechanisms Act (Law No. 30215) was passed, which provides for the conditional payment to contributors to these systems for undertaking of activities of conservation, recuperation and sustainable use of their sources. The activities in question can include the conservation of natural spaces, recovery of areas that have suffered deterioration or environmental degradation, and the conversion of sources of ecosystemic services to a sustainable use. This Act defines the payer as "the natural person or legal entity, public or private, who, obtaining an economic, social or environmental benefit, pays taxpayers for the ecosystemic service." The State is explicitly tasked with promoting payment mechanisms and designing a system for monitoring compliance with the law. Nonetheless, the implementation of the relevant activities has to be financed "out of the institutional budget of the entities involved, without requiring additional resources from the public purse."

2.4. Expense and financing

The Peruvian Treasury provides most of the financing for institutional development and the implementation of policies for the preservation and sustainable use of biodiversity. The remaining funds come from the private sector, international co-operation and payment for ecosystemic services. The sustainable conservation and use of biodiversity and natural resources had the second largest allocation of funds for public environmental expenditure in 2002-2012 (USD 946.6 million), followed by the integrated and sustainable management of ecosystems (USD 531.0 million) (MINAM, 2015). Nonetheless, owing to budgetary constraints, few public funds have been allocated to the protection of protected natural areas. An analysis of the contribution these areas make to Peru's economy (León, 2007) stresses the need to invest more in them; so, as from 2009, the allocation of public funds to SINANPE was increased under a financial plan that involves various sources of financing and the monitoring of its management results. In 2009-2013, funds assigned to SERNANP were increased considerably, from USD 2 216.8 to USD 14 004.6 (Sanclemente, Ruiz and Pedraza, 2014).

2.5. Scientific research

Investment in scientific and technological studies on natural resources has also been increasing, reaching a level of PEN 61.3 million in 2013 —a relatively large sum compared to environmental public spending in 2012. Several specialised institutions, including the National Council for Science, Technology and Technological Innovation (CONCYTEC), have conducted basic and applied scientific research on biodiversity (MINAM, 2014c).

In November 2013, CONCYTEC relaunched the process of formulating the National Crosscutting Programme of Science, Technology and Technological Innovation for the Valuation of Biodiversity, 2015-2021. To that end, institutions which undertake related activities were convened, and a Formulation Technical Committee was set up, consisting of specialists drawn from academic and government institutions, and international co-operation. Although few in number compared to indexed scientific publications from other South American countries, particularly Brazil, the number of scientific studies conducted in Peru has increased, and those related to biodiversity represent roughly 30% of the total. Of the 5 344 articles published between 2011 and 2014 and included in the *Scopus* database, 1 514 are devoted to this topic (CONCYTEC, 2015).

Notes

[1] The marine trophic index, mentioned in the Convention on Biological Diversity, contains information on fish catches and the average trophic level of the species brought to land.

[2] Protected Natural Areas Act (Law 26.834).

[3] For further information, see [online] http://www.legislacionambientalspda.org.pe/index.php?option=com_content&view=article&id=79&Itemid=3213.

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Part III. Use of natural resources base

Chapter 10. Farming and forestry

This chapter presents the main characteristics and trends of the Peruvian agricultural sector and the institutional framework for the implementation of agricultural policies. It provides information on the use of nutrients and pesticides in agriculture and reviews the negative impacts of farming on deforestation, greenhouse gas emissions, soil and water. The chapter points to the lack of monitoring of agri-environmental performance and emphasises the need for environmental education of farmers.

Key findings and recommendations

Strategy, the policy for restoring agrobiodiversity has been strengthened: this is an essential consideration, as Peru is one of the centres of origin for farming in the Americas. Other encouraging signs are the growing demand for organic farm products and payment for environmental services, as well as initiatives on sustainable forest management, a reduction in deforestation, and the restoration of degraded areas. However, policy initiatives for the protection of agrobiodiversity have yet to bear fruit. There is still scant support for the development of germplasm banks of native crops, and there is too little research on native and introduced species with respect to adaptation to climate change. Funding for the protection of biodiversity, including agrobiodiversity, is also inadequate. For example, the Andean region is the second largest centre of maize diversification, and there are currently 66 recognised varieties of maize in Peru (compared with 69 in Mexico). Overall, the country has a wealth of native plants that are important food sources. These plants utilise C4 and CAM metabolic processes and are highly water-efficient, and are thus of strategic importance as genetic resources for the adaptation of agriculture to climate change.

While environmental management institutions and instruments have been created within the agricultural sector, deforestation and land-use changes owing to the expansion of farming, and conflicts over land ownership because of a lack of titles, continue to pose a problem. During the period under review a significant number of environmental management institutions and instruments were set up. The principal milestones include the creation of the National Water Authority, the Regulation on Environmental Management of the Farming Sector, the creation of environmental regulatory tools, and the strengthening of agricultural and sectoral policies. However, the expansion of farming in Amazonia continues to be the main direct cause of deforestation in the country: it is estimated that more than 90% of deforestation stems from the expansion of agriculture by approximately 3.3 million hectares over the last two decades. This process has resulted from the uncontrolled expansion of industrial crops for export, rising levels of migration and, in general, a lack of land use planning, and has been further facilitated by weak institutional arrangements to halt deforestation and by the low value placed on the standing forest and on the environmental services it provides. Moreover, research on the adaptation of crops introduced in regions where they were previously not grown is virtually non-existent, and conflicts on indigenous lands owing to the lack of ownership titles are ongoing. As a result, socioenvironmental conflicts are spreading, limiting the efficient use of agroforest resources and holding back research because of legal uncertainty. There are also shortcomings in territorial governance and in economic and ecological zoning, which are important for promoting the orderly development of farming and extractive activities. Limitations with respect to clear land rights, a comprehensive rural cadastre and territorial governance are one of the main indirect causes of the advancing frontier of deforestation in Amazonia. It is estimated that 95% of deforestation in Amazonia stems from the use of slash-and-burn techniques to convert forest into farmland, mainly in scattered and small-scale (less than 5 ha) operations.

Although climate change presents an opportunity to improve environmental management in agriculture, there is still very little in the way of an "environmental culture" in the farming sector. The Land Use, Land-Use Change and Forestry (LULUCF) component is estimated to be the biggest contributor to greenhouse gas emissions, accounting for 35% at the national level, owing primarily to deforestation (cutting and burning of forests) for the expansion of farming, particularly in Amazonia. This is seen as an opportunity to improve environmental management in agriculture, both through adaptation efforts to enhance resilience, and through mitigation and synergies between adaptation and mitigation. Priorities of Peru’s nationally determined contribution under the United Nations Framework Convention on Climate Change include the agriculture and fisheries sectors or systems, together with water, health and forests. Within agriculture, priority is given to small-scale and subsistence farmers, as they are the most vulnerable. Yet farmers still have little understanding of environmental issues, and are therefore unlikely to incorporate them into production decisions. Poverty and low education levels among farmers, along with the absence of comprehensive agricultural extension services and technical assistance, are exacerbating the environmental problem in the sector. There are also other constraints to the development of an environmental culture in agriculture which are evident in the public sector, including the shortage of technical personnel from relevant institutions in the field and the lack of alignment between sectoral policies and between the different levels of government.

Recommendations

- Bolster governance of forests and improve capacity for the sustainable management of natural resources (particularly forests) and soil recovery and conservation, by: (a) ensuring greater co-ordination between the Ministry of the Environment and the Ministry of Agriculture in the definition and execution of environmental policy for the farming sector, (b) strengthening the role of national institutions in assisting regional and local governments, (c) building formal co-ordination mechanisms and stronger linkages between different sectoral initiatives (e.g., agriculture and the forestry sector, agriculture and water, agriculture and agrobiodiversity) and the different levels of government and (d) strengthening decision-making instruments with integration potential, such as the forest land registry, zoning studies, land-use records and, in general, georeferenced information systems on the use and state of natural resources.
- Strengthen agricultural research and extension, considering the challenges posed by climate change to Peru's different agricultural systems, particularly those which involve the highest levels of family and small-scale farming. Promote greater alignment in research priorities and stronger linkages in programmes of work. Ensure the incorporation of ancestral knowledge and practices into research and agricultural extension processes in order to restore and preserve the country's agrobiological wealth and genetic resources.
- Evaluate the harmful environmental effects of productive incentives. Align non-productive incentives (direct payments per hectare) with environmental protection objectives. Prevent the dispersion of funding projects in the forestry and agroforestry sectors and of those targeting environmental objectives in the agricultural sector; promote the incorporation of environmental criteria into agricultural credit assessments, in order to encourage adaptation and mitigation activities and greater productive diversification to help increase resilience; bolster agricultural insurance as a means of adapting to climate variability; and advance towards the inclusion of payments for environmental services among suppliers and users.
- Strengthen monitoring of environmental quality in the farming sector and the technical capacities for diagnostic assessments, particularly at the regional and local levels; improve mechanisms for disseminating and communicating the proper handling of pesticides and the efficient use of water resources; ensure that laboratories are adequately equipped; promote the inclusion of members of the public in monitoring environmental quality (for example, monitoring networks); and bolster environmental education.
- Strengthen the institutions responsible for land titles and speed up the titling process, particularly in indigenous territories, in order to promote a more organised development of agriculture and proper management of forest and biodiversity resources.

1. Characteristics of the farming sector

In Peru there are four distinct types of agriculture, based on socioeconomic, climatic, geographical and technological characteristics, access to services and market linkages. These include: (i) non-traditional export agriculture (crops such as mango, avocado, olives, asparagus and grape), which tends to be practised on large tracts of land and is technologically advanced and highly profitable; (ii) extensive agriculture dedicated to growing traditional crops, which tends to be practised on small areas of land, has a variable level of technology and serves both the domestic market (crops such as potato, rice, yellow maize, sugar cane and onion) and overseas markets (crops such as coffee and cocoa); (iii) agriculture specifically linked with traditional Andean crops, such as quinoa, kiwicha *(Amaranthus caudatus)*, cañihua *(Chenopodium pallidicaule)*, tarwi *(Lupinus mutabilis)*, palm heart, sacha inchi *(Plukenetia volubilis)* and tara (*Caesalpinia spinosa*), whose export potential has not been fully exploited; and (iv) subsistence farming (crops such as wheat, barley, ulluco *(Ullucus tuberosus)*, broad bean, oca *(Oxalis tuberosa)*, yucca, plantain, haricot bean, sweetcorn and maize) (MINAGRI, 2012b).

1.1. Contribution of the farming sector to gross domestic product, exports and employment

The farming sector continues to be important to Peru's economy owing to its economic contribution to gross domestic product (GDP) and exports; its social functions, chiefly the creation of jobs and livelihoods in general; and its contribution to food security and to protecting agrobiodiversity, as it belongs to a region that is the centre of origin of crop plants currently known worldwide.

The combined GDP of the agriculture, hunting, forestry and fisheries sectors was estimated at USD 11.3 million in 2014 (at constant 2010 prices), or 6.2% of Peru's GDP (ECLAC, n/d). Over the 2003-2014 period, real sector GDP grew at an average annual rate of 3.8%, below the total GDP rate of 6%. The fastest-growing subsector was livestock (5.4%), followed by agriculture (3.2%) and fisheries (2.0%) (Central Reserve Bank of Peru, n/d).

In 2014, agricultural exports, including agribusiness exports, totalled USD 7.978 billion, or 20.7% of total export value. The main exports were unroasted coffee, onions, fresh grapes, fish oil (except liver oil) and fresh and chilled asparagus. In the same year, the biggest markets for Peru's agricultural and agribusiness exports were the European Union (32.1%), the United States (22.4%), Latin America and the Caribbean (14.8%) and China (13.2%) (United Nations, n/d). The main agricultural export is coffee, and Peru is the world's leading exporter of asparagus, quinoa and organic bananas. In recent years, there has been a significant increase in export sales of dairy products, citrus fruits, avocados and cocoa. While ecological diversity offers potential for crop diversification and for specialisation in products with a high unit value, the existing constraints on mass production should not be overlooked.

In 2014, a total of 26.6% of Peru's employed population was working in the farming sector, down from 35.2% in 2001 (ECLAC, 2015). In absolute terms, the sector employed around 4 million people in 2014 (INEI, n/d).

1.2. Dual development

According to Peru's latest agricultural census, in 2012 there were more than 2.2 million production units, spanning 38.7 million hectares (or 30.1% of Peru's total area) (INEI, 2013). The highland region accounted for the largest proportion of this total, with 57.5% (22.3 million hectares), followed by the rainforest region, with 31.1% (12 million hectares) and, lastly, the coastal region, with 11.5% (4.4 million hectares).

In the period between the last two agricultural censuses (1994 and 2012), the number of farms increased by 26.8%, considerably more than the 9.5% increase in agricultural area. This gap reflects the increasing dualism of agriculture throughout the inter-census period, which is even more evident when examining the data on farm size, and allows three conclusions to be drawn. First, there was a rise in the number of smallholdings, with the number of production units under 5 hectares in size rising much more than the area they covered. Second, concentration in large farms intensified, with the number of large farms decreasing in parallel with an increase in the area they covered. While the number of medium-sized farms (5 hectares to 49 hectares) and the area they covered decreased, their average size remained largely unchanged (Table 10.1). Growth in the number of smallholdings creates environmental pressure because of the more intensive use of land, while growth in large farms has an environmental impact because of the increased use of agrochemical inputs typically associated with commercial farming.

Table 10.1. Indicators of the farming structure 1994-2012

	Farms (thousands of units and hectares)				Variation(percentage)		Average area(hectares)	
	1994		2012		Units	Area	1992	2012
Area	Units	Area	Units	Area				
Total	1 745.8	35 381.8	2 213.5	38 742.5	26.8	9.5	20.3	17.5
Less than 5 hectares	1 228.3	2 072.0	1 754.4	2 268.8	42.8	9.5	1.7	1.3
5-49 hectares	465.8	5 845.2	412.3	5 112.6	-11.5	-12.5	12.5	12.4
50 hectares or more	51.6	27 464.7	46.8	31 361.1	-9.35	14.2	531.8	669.9

Source: INEI (2013), *IV Censo Nacional Agropecuario 2012. Resultados definitivos*; INEI (1994), *III Censo Nacional Agropecuario 1994*.

1.3. Growth in agricultural area

A total of 18.4% (7.1 million hectares) of all farmland is used for cultivation (compared with 15.5% in 1994), including temporary crops (4.9 million hectares), permanent crops (2 million hectares) and associated crops (230 000 hectares). The remaining 81.6% (31.6 million hectares) includes natural pastures (18 million hectares), woodland and forest[1] (10.9 million hectares) and other types of land use (2.7 million hectares).

Most of the arable land is found in the highlands (46.3%), followed by the Peruvian Amazon region (30.1%) and the coastal region (23.7%). The average size of farms is 4.8 hectares on the coast, 4.7 hectares in the Amazon and only 2.3 hectares in the highlands. A comparison of the data collected for the last two agricultural censuses (1994 and 2012) shows that arable land increased by 30% (rising by a total of 1 648 000 hectares, from 5 477 000 hectares in 1994 to 7 125 000 hectares in 2012).

The most important permanent crops in terms of area are: coffee (425 400 hectares); plantain (145 700 hectares); cocoa (144 200 hectares); avocado (65 700 hectares); grape (43 800 hectares); asparagus (39 600 hectares); mango (39 000 hectares); oil palm (26 700 hectares); orange (22 500 hectares) and cherimoya (18 100 hectares). The main temporary crops are: potato (367 700 hectares); hard yellow maize (261 600 hectares); soft maize (240 800 hectares); rice (167 100 hectares); sugar cane (141 600 hectares); yucca (94 600 hectares); sweetcorn (66 000 hectares); fodder oat (51 300 hectares); broad bean (45 800 hectares) and barley grain (45 400 hectares). The main managed pasture crops are: signal grass *(Brachiaria decumbens)* (170 200 hectares); alfalfa (156 000 hectares); bread grass *(Brachiaria brizantha)* (139 300 hectares); rye grass (44 400 hectares) and elephant grass (22 300 hectares). These 20 crops and 5 grasses cover 41.9% of the agricultural area and include temporary, permanent and associated crops.

In the inter-census period, the biggest increase in planted area was for coffee, which grew by 109.6% (222 400 hectares), and cocoa, which grew by 195.5% (95 400 hectares). This means that, in 2012, more than 50% of the coffee-growing area and more than 66% of the cocoa-growing area had been planted after 1994. This increase occurred mainly at the expense of forest cover.

Although the Peruvian agricultural census collected no data on the area allocated to livestock production, this may have expanded considerably because livestock has been a fast-growing subsector over the past decade (section 1.1). What the census does provide is information on the number of livestock per species. The following changes were recorded between the last two censuses: (i) a variation in the stock of the main species, specifically a 12% increase in cattle, a 32% decrease in sheep and a 2% decrease in pigs; (ii) a variation in camelid stock (a 49% increase in alpacas and a 26% decrease in llamas); (iii) a significant increase in small livestock (the guinea pig population increased by 80% and the poultry population, by 58%).

1.4. Structure of land tenure

The structure of land tenure in Peru points to great inequality. At one extreme, 67.9% of all farms occupy an area of less than 3 hectares and cover only 3.5% of all farmland. At the opposite extreme, 1% of units exceed 100 hectares and cover 77% of the total. The situation is much the same with arable land: 68.4% of farms are smaller than 3 hectares and cover 15% of the cultivated area, while 0.5% of farms are larger than 100 hectares and cover 34% of area. Inequality is evident in terms of the average size of arable farms: 68% occupy an area of less than 1.1 hectares (22.6% are less than 0.2 hectares), while 0.5% cover an average area of 211.6 hectares (Table 10.2).

Table 10.2. Land tenure, 2012

Size (hectares)	All farms			Arable farms			As a proportion of all farms (percentage)
	Units (thousands)	Area (thousands of hectares)	Average (hectares)	Units (thousands)	Area (thousands of hectares)	Average (hectares)	
Total	2 213. 5	38 742.5	17.5	2 128.1	7 125	3.3	18.4
Under 0.5	507.1	99.7	0.2	480.1	85.1	0.2	85.3
0.5-2.9	996.3	1 272.8	1.3	973.9	1 040.9	1.1	81.8
3-4.9	251.0	896.3	3.6	246.8	679.0	2.8	75.8
5-9.9	218.6	1 418.3	6.5	213.8	956.6	4.5	67.4
10-19.9	118.3	1 522.1	12.9	113.5	805.8	7.1	52.9
20-49.9	75.4	2 172.2	28.8	69.6	766.7	11	35.3
50-99.9	23.4	1 519.8	65.1	18.8	366.7	19.5	24.1
More than 100	23.5	29 841.3	1 272.3	11.5	2 424.3	211.6	8.1

Source: INEI (2013), *IV Censo Nacional Agropecuario 2012. Resultados definitivos*.

This land tenure structure favours intensive farming, thus causing a range of environmental effects, especially on soil. In addition, the smaller the unit, the higher the percentage of area used for agriculture: 80% of units cover an area of less than 3 hectares and only 8% cover more than 100 hectares.

1.5. Importance of common land tenure

Common ownership of land by officially recognised indigenous communities and farming communities (comunidades campesinas) is the most widespread form of land tenure, accounting for 60% of the total, while 36% is owned by individuals. Only 11% of total arable land is communally owned, while 83% is owned by individuals. In contrast, 71.7% of land not used directly for growing crops is communally owned, as compared with 25.9% owned by individuals. In addition, more than 95% of the land owned by farming communities and nearly 100% of the land owned by indigenous communities is not used for growing crops (Table 10.3).

Table 10.3. Ownership of farmland, 2012

Title holder	Land use (thousands of hectares)			Distribution (percentages)		Composition (percentages)	
	Total	Agricultural	Non-agricultural	Agricultural	Non-agricultural	Agricultural	Non-agricultural
Total	38 742.5	7 125.0	31 617.5	100	100	18.4	81.6
Farming communities	16 359.1	774.4	15 584.7	10.9	49.3	4.7	95.3
Indigenous communities	7 106.8	10.0	7 096.7	0.1	22.4	0.1	99.9
Individuals	14 112.2	5 909.6	8 202.6	82.9	25.9	41.9	58.1
Companies and cooperatives	693.3	360.2	333.1	5.1	1.1	52	48
Other	471.1	70.8	400.3	1	1.3	15	85

Source: INEI (2013), *IV Censo Nacional Agropecuario 2012. Resultados definitivos*.

1.6. Participation of women and older persons in agriculture

The number of women working in the agricultural sector doubled over the 1994-2012 inter-census period, while the number of men increased by only 14.2% (INEI, 1994). This growth in the agricultural population was accompanied by an improvement in some sociodemographic variables, including education, although women and some age groups continue to suffer shortcomings. Over the same period, the number of farmers having completed secondary education increased from 7% to 15%, although the level of education varied widely according to age. Farmers aged 24-35 have more years of education than those aged 45-54, and many more years than those over the age of 65. In addition, there is a severe imbalance between the educational levels of men and women: 28% of women working in the agricultural sector are illiterate, compared with only 9% of men.

The agricultural population has aged in recent years. In 2012 it was composed primarily of people aged 45-54 and over 65, while in 1994, the largest age cohort was 35-44. This reflects the general pattern of demographic change in rural Peru over the past two decades. There has been an increase in the number of farmers over the age of 65, who currently account for 19% of the total.

1.7. Use of technology and interregional differences

There are marked differences in technological advancement between arable farms growing crops for export and other types of farm, as well as between regions, especially between the coast and the highlands. On the coast, greater use is made of certified seed and seedlings, chemical fertilisers and insecticides, herbicides and fungicides than in other regions, as coastal farmers practise a more modern form of agriculture with heavier reliance on agrochemical inputs. In contrast, biological pest control and organic manuring are used much more widely in the highlands, which is associated with more traditional, organic agricultural practices. In the rainforest, much less use is made of chemical fertilisers, insecticides and fungicides than in the other regions. Little use is made of electrical power in any of the regions, although it is greatest on the coast (Table 10.4).

1.8. Development of the forestry sector

Forests are Peru's main terrestrial ecosystem and cover approximately 57% of its surface area. According to the national vegetation cover map,[2] the Amazon tropical rainforest is the most extensive type of forest, covering 53.9% of Peru's total area, followed by dry forest (3%) and Andean forest (0.2%). The Amazon tropical rainforest covers an area of 69 million hectares and is found in 15 of Peru's 24 departments, as well as in the constitutional province of Callao.

Peru has the second largest area of Amazonian forest in the world, the fourth largest area of tropical forest and the ninth highest cover of forest in general. Forest ecosystems provide services of great economic and social importance. Much of the Amazon tropical rainforest is inhabited by indigenous communities (11.5 million hectares) or is a protected natural area (18.2 million hectares). Around 27% of Amazonian forests have no recognised legal status, nor have rights been granted, thus limiting the potential for legal and sustainable harvesting.

Development of the forestry sector falls far short of its potential in terms of surface area and biodiversity. In fact, Peru is a net importer of forest products, thanks to low levels of industrialisation and value added in the sector. The area under commercial plantation is still very small, and less than half of the exploitable forest area is under an operating concession.

Table 10.4. Technology and inputs used in the farming sector, 2012

Thousands of farmers and percentages

	Total		Coast		Highlands		Rainforest	
	Used	Not used	Used	Not used	Used	Not used	Used	Not used
Certified seed or seedlings								
Total	270.5	1 928.7	141.3	205.9	79.7	1 318.5	48.6	405.3
Proportion	12.3	87.7	40.7	59.3	5.7	94.3	10.7	89.3
Biological pest control								
Total	123.2	2 076.1	34.0	313.2	5 676.6	1 333.9	23.6	430.2
Proportion	5.6	94.4	9.8	90.2	81.0	19.0	5.2	94.8
Organic manuring								
Total	1 363.5	835.7	187.9	159.4	1 069.6	328.6	105.7	348.1
Proportion	62.0	38.0	54.1	45.9	76.5	23.5	23.3	76.7
Electrical power								
Total	33.0	2 166.3	11.5	335.8	14.0	1 384.2	7.7	446.1
Proportion	1.5	98.5	3.3	96.7	1	99	1.7	98.3
Chemical fertilisers								
Total	965.5	1 233.8	252.1	95.1	623.6	774.6	90.3	363.5
Proportion	43.9	56.1	72.6	27.4	44.6	55.4	19.9	80.1
Chemical insecticides								
Total	831.3	1 367.9	234.7	112.5	521.5	876.7	74.4	379.4
Proportion	37.8	62.2	67.6	32.4	37.3	62.7	16.4	83.6
Herbicides								
Total	519.0	1 680.2	192.7	154.5	194.3	1 203.8	131.2	322.7
Proportion	23.6	76.4	55.5	44.5	13.9	86.1	28.9	71.1
Fungicides								
Total	598.2	1 601.0	179.2	168.1	353.7	1 044.4	64.4	389.4
Proportion	27.2	72.8	51.6	48.4	25.3	74.7	14.2	85.8

Source: INEI (2013), *IV Censo Nacional Agropecuario 2012. Resultados definitivos*.

In recent decades, economic activity in the forestry sector has focused mainly on primary processing of wood products to produce low-value-added sawn wood (575 261.5 cubic metres).

Although Peru has an estimated reforestation potential of 9 463 251 hectares, no major progress has been made to date. As of 2013, the reforested area totalled 1 042 080 hectares (MINAM, 2014a).

2. Environmental pressures and problems affecting the farming sector

2.1. Greenhouse gas emissions

According to the 2009 inventory, the farming sector is the direct cause of 19.5% of greenhouse gas (GHG) emissions, two main sources of which are methane generated by enteric fermentation (42.6%) and nitrous oxide (N_2O) and other pollutants from soil cultivation (47.2%) (MINAM, 2014b). In addition, GHG emissions attributed to land use, land-use change and forestry accounted for 40.8% of registered emissions in 2009, revealing the scale of deforestation taking place in Peru.

2.2. Deforestation

Despite the importance of Peru's forests, they have shrunk in size and are suffering degradation. In 2000, Amazon rainforest covered 55.1% of the country's total area but, by 2013, this had fallen to 53.9% (MINAM, 2014a). The cumulative loss of Amazonian forest over the 2000-2011 period is estimated at 1 172 648 hectares. Intensification of degradation led to annual average losses of Amazonian forest of 82 236 hectares in 2000-2004, 108 183 hectares in 2004-2008 and 136 913 hectares in 2008-2011 (MINAM, 2014b).

Farming is the main direct cause of more than 90% of deforestation. Between 1994 and 2012, there was a 9.5% increase in farmland (around 3.3 million hectares) (Table 10.5). This stemmed mainly from felling and burning of forests, especially in dispersed, small-scale operations close to transport routes. Forest degradation has not yet been properly quantified but is attributed largely to intensive illegal logging.

Table 10.5. Expansion of the agricultural frontier in five Amazonian provinces, 1994-2012

	Number of farms and area (thousands of hectares)				Variation (percentages)		Average area (hectares)				Variation (percentages)	
	1994		2012				1994		2012			
	Agricultural use	Non-agricultural use	Agricultural use	Non-agricultural use	Agricultural use	Non-agricultural use	Agricultural use	Non-agricultural use	Agricultural use	Non-agricultural use	Agricultural use	Non-agricultural use
Amazonas												
Units	45 574	38 363	67 014	48 919	47	27.5						
Area	159.9	815.1	252.8	1 513.5	58.1	85.7	3.51	21.25	3.77	30.94	7.5	45.6
Loreto												
Units	57 129	42 862	66 243	29 523	16	-31.1						
Area	173.6	3 042.5	247.6	3 002.7	42.6	-1.3	3.04	70.98	3.74	101.71	23	43.3
Madre de Dios												
Units	5 459	5 072	6 278	6 078	15	19.8						
Area	82.1	449.7	68.9	592.4	-16.1	31.7	15.04	88.67	10.97	97.47	-27	9.9
San Martín												
Units	62 554	42 604	89 548	54 209	43.2	27.2						
Area	485.2	622.2	497.8	825.2	2.6	32.6	7.76	14.60	5.56	15.22	-28.3	4.2
Ucayali												
Units	21 316	17 196	24 954	14 570	17.1	-15.3						
Area	121.8	1 789.3	187.4	2 134.5	53.9	19.3	5.71	104.05	7.51	146.50	31.5	40.8
Total												
Units	192 032	14 609	254 037	153 299	32.3	4.9						
Area	1 022.5	6 718.8	1 254.4	8 068.4	22.7	20.1	5.32	45.99	4.94	52.63	-7.3	14.4

Source: INEI (2013), *IV Censo Nacional Agropecuario 2012. Resultados definitivos*; INEI (1994), *III Censo Nacional Agropecuario 1994*.

Major indirect causes of deforestation include poorly defined land rights (section 1.5), coupled with an incomplete rural land register and lack of land-use planning mechanisms for land bordering with Amazon forest areas undergoing deforestation.

It is of great economic and legal importance to define land capability, which allows land titles to be granted only for land that is suitable for farming but not for land intended for logging or in protected areas, as titling such land makes it harder to preserve. It is estimated that around 35% of Peru's land is classified. There is thus a need for official maps to be updated to clearly identify areas suitable for titling.

2.3. Forest concessions

Law 27308 of 2000 on forestry and wildlife established the legal concept of forest concession, applicable to forests suitable for permanent production: 17 771 900 hectares were classified in this category, with concessions granted on a further 7 542 077 hectares (42.4%). Other types of forest concession were also granted, for the purposes of harvesting non-wood products, wildlife management, ecotourism, conservation and reforestation. In 2013, the total area exploited under some form of forest concession was around 10 million hectares, most of which was used for logging (74.8%). The average area of these concessions was 12 827 hectares. Conservation concessions accounted for 10.8% of the total and covered an average area of 28 600 hectares, while concessions for services and non-wood products (harvesting of Brazil nuts, ecotourism and wildlife) accounted for less than 10% (Table 10.6).

Table 10.6. Forest concessions, 2013

Purpose of the concession	Number of concessions		Area		
	Total	Percentage	Total (thousands of hectares)	Percentage	Average (hectares)
Brazil nut harvesting	983	49.5	863. 8	8.6	878.7
Conservation	38	1.9	1 086.8	10.8	28 600.2
Ecotourism	35	1.8	77. 7	0.8	2 219.3
Wildlife	4	0.2	12.8	0.1	3 208.1
Afforestation and reforestation	293	14.8	136.9	1.4	467.1
Logging (old contracts brought into line with the forestry and wildlife law)	20	1	343.9	3.4	17 194.3
Logging (public tender)	588	29.6	7 542.1	74.8	12 826.7
Exploitation of the shiringa (rubber) tree	24	1.2	16.1	0.2	673.2
Total	1 985	100.0	10 080.1	100.0	5 078.1

Source: MINAM (2016a), *Estudio de desempeño ambiental, 2003-2013*; National Forestry and Wildlife Service (SERFOR), 2013.

2.4. Land title

According to Peru's 2012 agricultural census, there are 5 895 farming communities of which 3 957 have land titles and are registered, 1 000 have land titles but are not registered and 734 neither have land titles nor are registered. There are 984 indigenous communities that have land titles and are registered, while 160 have land title but are not registered and 243 neither have land title nor are registered. Although there had been a 9% decrease in the number of untitled hectares since the 1994 census, 8.5 million hectares were still untitled. The situation varies widely from one region to another: in the coastal region, untitled land accounts for 26% of a total of 9.4 million hectares; in the rainforest region it accounts for 16% of 8.6 million hectares; and in the highlands it accounts for 48% of 16.8 million hectares. Lack of land titles discourages proper protection of both land and forests.

In the preceding decade, progress had been made with land titling, particularly in the coastal and highland regions, but far less in the Amazon. Legal authority for rural land titling, including indigenous and farming communities (section 1.5), was transferred to regional governments, which had limited capacity to fulfill this role. After several years of limited activity, the Ministry of Agriculture and Irrigation (MINAGRI) was re-designated as the lead agency for titling and has already embarked on this role by implementing a rural land titling and registration project in Peru (PTRT).

2.5. Use of agrochemicals

Between 2003 and 2012, agricultural production increased by 127%, while the livestock sector grew by 45% (INEI, n/d). The use of nitrogen and phosphorous fertilisers per hectare of arable land increased by 27% over the same period (World Bank, n/d) and the use of fertilisers in general averaged 104 kilograms (kg) per hectare in 2012. This is less than 122 kg per hectare used on average in OECD member countries and less than 126 kg per hectare used on average in Latin American and Caribbean countries.

The above data do not take into account the high use of organic manure from livestock. According to Peru's 2012 agricultural census, 44% of farmers reported using chemical fertilisers in 2012 (an increase of nearly 50% over 1994), while 62% (1.37 billion farmers) reported using some form of organic manure (Table 10.7). Organic manuring predominates in the highlands, while the use of chemical fertilisers predominates on the coast. Although fertiliser use per hectare is unknown, the Ministry of the Environment (MINAM, 2014b) believes that one of the problems in the sector is over-fertilisation.

According to the same source, 38% of farmers use chemical insecticides, while 5.4% use non-chemical or biological insecticides. Farmers in the coastal region rely the most heavily on pesticides. Of this total, 67% use chemical insecticides, 55% use herbicides, 52% use fungicides and only 12% use non-chemical or biological insecticides.

Table 10.7. Use of chemical fertilisers and pesticides in the farming sector

	1994	2012
Total number of farmers (thousands)	1 679	2 214
Percentage using chemical fertilisers	39	44
Percentage using a sufficient quantity of fertilisers	8	11
Percentage using pesticides		
Percentage using chemical insecticides	"	38
Percentage using herbicides	"	24
Percentage using fungicides	"	27
Percentage using non-chemical or biological insecticides	"	5

Source: INEI (2013), *IV Censo Nacional Agropecuario 2012. Resultados definitivos*.

2.6. Soil degradation

According to the global Land Degradation Assessment in Drylands (LADA) project, between 1981 and 2003, some 19.3 million hectares in Peru suffered degradation (15.3% of the country's total area). While no recent information is available on how this problem has evolved, the view is that, despite the increased attention paid to it, there is still a long way to go before it can be fully resolved.

A nationwide study on soil degradation conducted by the National Institute For Natural Resources (INRENA) in 2005 revealed that 99% of soils were experiencing mild to severe erosion, 27% were experiencing desertification (3% desertified and 24% desertifying) (MINAM, 2011) and 0.24% suffered problems of salinisation. A total of 65.7% of severely eroded soils were found in the highlands, 30.6% on the coast and 3.7% in the rainforest. Moreover, desertification affected 79.7% of soils in the highlands and 20.3% of those on the coast. All the land (100%) affected by salinisation was in the coastal region.

These problems have both anthropic and natural causes. Anthropic causes include unsustainable practices, such as land conversion, use of inappropriate irrigation technology and planting on sloped terrain. Natural causes include extreme weather events, such as frost or prolonged drought, which have contributed to desert expansion.

According to the 2014 national agricultural survey (ENA), 76% of farmers do not use good agricultural practices, such as methods to minimise soil degradation, good tillage practices, appropriate irrigation techniques and appropriate use of agricultural inputs.

Erosion problems are most evident in the Andean highlands, where at least 60% of farmland is undergoing moderate to extremely severe erosion from the use of inappropriate management techniques, the destruction of hillside vegetation and the practice of extensive livestock farming in the high rainforest. In the Amazon, 60% of occupied and settled land (around 5 million hectares) has been abandoned because of a dramatic reduction in fertility and erosion caused by inappropriate techniques. The same problem is evident on the coast, where farmers practise indiscriminate irrigation and, in many cases, flood irrigation. It is estimated that at least 40% of the cultivated area on the coast is suffering salinisation problems caused by irrigation techniques that build up salt deposits.

Agriculture is the economic activity worst hit by soil degradation, especially in the departments of Cajamarca, Áncash, Cerro de Pasco, Huancavelica, Ayacucho, Puno and Huánuco. MINAM recently unveiled a national strategy for 2016-2030 to combat desertification and drought (MINAM, 2016), and is progressing with the development of a national action programme to combat desertification and drought, as well as providing regional governments with technical assistance to develop and implement action plans. The impact of these and previous plans is as yet unknown.

2.7. Water consumption and quality

The biggest water user is the agricultural sector (87.5%), followed by households (10%), mining (1.5%) and manufacturing (1%) (MINAM, 2014b). In Peru, water consumption varies from one region to another. In the coastal region, where water is the most abundant and export crops are grown, the agricultural sector uses 83% of all surface water. The coast is also seeing overexploitation of groundwater for agricultural and domestic use. Irrigation efficiency is low, with only around 35% of the water supplied through irrigation being consumed by crops (MINAGRI, 2016) because of inappropriate practices and the poor state of water conveyance systems. Irrigation systems are used for only 12% of crops, with gravity irrigation used for the remainder. An estimated 15% to 20% of water is lost in the distribution system.

Water quality affects agriculture and vice versa, with water quality diminished by the use of agrochemicals, further compounded by the use of inefficient irrigation techniques, including flood irrigation. According to the National Water Authority (ANA), more than 40% of the watersheds where water quality measurements are taken fail to comply with environmental standards. Some of the main causes of their deterioration are untreated wastewater, industrial and mining pollution and agrochemical use (ANA, 2015a).

Twenty per cent of respondents to Peru's 2012 agricultural census believed that irrigation water was contaminated by mine tailings, while 26% believed it was contaminated by industrial or domestic discharges.

2.8. Waste production and management

Information on agricultural waste production is inconsistent, which might stem from data supply problems or from differences in coverage of the years considered. In 2013, 31% of all agricultural waste was classified as hazardous and largely comprised oils (81%).

Table 10.8. Non-municipal solid waste from the agricultural sector

Tonnes per year and percentages

	2010	2011	2012	2013
Farming sector	51 336	889 902	10 765.456	77 681
Percentage of total	30	55	98	8

Source: MINAM (2014c).

Under the current regulations, anyone producing non-municipal waste is obliged to dispose of it in accordance with technical criteria applicable to the different categories. In 2012, only 4% of the 1 279 companies that stated that they managed solid waste were in the agricultural sector, pointing to a lack of information on the destination of waste from the sector.

Legislation on hazardous waste disposal and management stipulates that packaging of toxic products used in agriculture must either be returned, placed in a special container or triple-washed. However, Peru's 2012 agricultural census revealed that under 5% of farmers using pesticides actually employed one of the three options. The lowest percentage was among farmers in the highlands (3.6%) and the highest percentage was in the rainforest (9.6%). In all regions, the most widespread practice is to place packaging in a special container. The most common means of disposal, especially on the coast and in the rainforest, is burning, or burial (mainly in the highlands). A total of 23.4% of farmers on the coast and 30% of farmers in the rainforest throw packaging into the garbage (Table 10.9).

The Peruvian agricultural census found that most livestock waste was used as fertiliser, although some was placed in an open dump, burned, buried, or dumped on the public highway or even into bodies of water. No figures are available on volumes.

3. Sectoral policies, regulatory framework and oversight

Under Article 66 of the political constitution of Peru, renewable and non-renewable natural resources are the property of the nation and the State has a sovereign right to use them. Article 8 of the Sustainable Use of Natural Resources Act (Law No. 26821) stipulates limits on the allocation and sustainable use of natural resources.

In this connection, the State has enacted standards to regulate resource use, protection and conservation. Those relevant to the farming sector include: the National Environmental Policy (MINAM, 2009); PLANAA, the National Environmental Action Plan 2011-2021 (MINAM, 2011B); and the National Climate Change Strategy (ENCC) (MINAM, 2014d).

Table 10.9. Methods for the disposal of empty pesticide packaging

Thousands of farmers and percentages

	Farmers using pesticides							
	Nation-wide (thousands)	Coast (thousands)	Highlands (thousands)	Rainforest (thousands)	Nationwide (percentage)	Coast (percentage)	Highlands (percentage)	Rainforest (percentage)
Total	1 107.3	285.7	662.6	159.0	100	100	100	100
Garbage disposal	278.1	66.8	163.7	47.7	25.1	23.4	24.7	30
Burning	373.4	129.7	193.7	50.0	33.7	45.4	29.2	31.5
Burial	354.7	53.4	262.8	38.5	32	18.7	39.7	24.2
Placement in a special container	43.6	11.8	18.1	13.8	3.9	4.1	2.7	8.7
Return	2.7	1.1	1.4	0.2	0.2	0.4	0.2	0.1
Triple washing	8.4	3.0	4.1	1.2	0.8	1.1	0.6	0.8
Reuse	12.6	3.8	7.1	1.7	1.1	1.3	1.1	1.1
Other	33.8	16.2	11.8	5.8	3.1	5.7	1.8	3.7

Source: INEI (2013), *IV Censo Nacional Agropecuario 2012. Resultados definitivos*.

MINAGRI is responsible for developing, implementing and monitoring national and sectoral policies for the agricultural sector, and it monitors compliance by all three levels of government. Its jurisdiction covers arable and grasing land, forest areas and land that is currently uncultivated (because of scarce or excess water) but that would be suitable for farming; forest resources and use; flora and fauna; water resources; agricultural infrastructure; irrigation and water use in agriculture; crops and livestock; health and research; extension and technology transfer and the provision of related services (law amending legislative decree 997 and approving law 30048 on the organisation and functions of the Ministry of Agriculture, which renames it Ministry of Agriculture and Irrigation).

The governing body for Peru's agricultural development is MINAGRI, whose attached agencies with environmental powers include the National Water Authority (ANA), the National Institute for Agricultural Innovation (INIA), the National Agricultural Health Service (SENASA), the National Forestry and Wildlife Service (SERFOR) and Sierra Exportadora. MINAGRI is empowered to channel resources into activities to support the achievement of environmental objectives via the State-owned agricultural finance institution, Banco Agropecuario (Agrobanco) and a number of programmes, including the Rural Agricultural Development Programme (AGRORURAL), the Agricultural Competitiveness Grant Programme (AGROIDEAS) and the Subsectoral Irrigation Project (PSI). As part of its remit, it has the power to carry out major environmental activities.

3.1. Water law

In March 2009, the new water resources law was enacted, repealing the general water law and related regulations. The repealed general water law had a strong focus on agriculture and failings that limited the use of water resources. The new water resources law establishes watershed management mechanisms, which provide for user involvement via the National Water Resources Management System (SNGRH), comprising public- and private-sector institutions, including farming and indigenous communities. The new law also reiterates that water is publicly owned, thus ruling out the possibility of privatising it, although private entities or individuals may handle some aspects of water management. The law clearly defines the role of the Executive, represented by ANA, thereby consolidating the one-stop shop principle. It also introduces improvements in management and administration. Specifically, it establishes planning instruments and improves mechanisms for such purposes as applying sanctions and managing information.

The following were adopted in this connection: the National Water Resources Policy And Strategy (ANA/MINAM, 2009); the National Water Resources Plan (ANA, 2015b); Law No. 30157 of 2014 on water user organisations; and the Fondo Mi Riego (2012) irrigation fund, which is designed to close gaps in the provision of services and infrastructure.

3.2. Forest law

The purpose of the National Forestry and Wildlife Policy (adopted by supreme decree 009/13/MINAGRI) (MINAGRI, 2013) is to contribute to Peru's sustainable development through proper management of its forest and wildlife heritage, in harmony with the nation's social, cultural, economic and environmental interests. Moreover, Law No. 29763 of 2011 on forestry and wildlife establishes the legal framework for regulating, promoting and overseeing Peru's forestry and wildlife activity. The law establishes SERFOR, the National Forest and Wildlife Management System (SINAFOR) and the National Forestry Congress (CONAFOR). These entities act in conjunction with the Agency for Supervision of Forest Resources and Wildlife (OSINFOR), which was established in 2008 under the Office of the President of the Council Of Ministers (PCM).

The laws on regionalisation and regional governments assign the role of forest administration and control to these entities, some of which act as regional forest and wildlife authorities. As collaborative management is essential, policy and implementation tools are being developed for this.

The bicentennial plan, which sets a zero net deforestation target by 2021, and PLANAA are also important forest instruments. A National Forestry and Climate Change Strategy (MINAM, 2016c) and Action Plan for Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+) are being developed under the joint supervision of MINAM and MINAGRI.

3.3. Land law

Land tenure is governed by the civil code and Law No. 26505 on private investment in the development of economic activities in the lands of the national territory and of farming and indigenous communities, which is designed to promote private investment in this sphere. The law provides maximum tenure security for agricultural landowners by regulating abandoned land, restricting entitlement to expropriation and creating mining easements in certain cases. It also defines a mechanism for disposing of common land.

With regard to soil conservation, MINAGRI implements budget programme 0089 on reducing degradation of agricultural soils. The aim of the programme, which must be implemented in co-ordination with the attached agencies and in conjunction with MINAM, is the sustainable use of soil resources in the farming sector. It is targeted at farmers in districts with the highest agricultural population, largest agricultural area, lowest human development index, lowest seeding rate with respect to land capability, highest intensity of land use and heaviest environmental liabilities. This population segment comprises around 1 million farmers.

For 2014, activities were planned to collect information on soils and measure their deterioration, to research suitable crops, and to train farmers on the use of agroclimatic and land capability information. The estimated budget for these activities was around PEN 10.2 billion.

3.4. Agrobiodiversity

The national biodiversity strategy to 2021 and its 2014-2018 action plan, based on Law No. 26839 of 1997 on the conservation and sustainable use of biodiversity and its implementing regulations (supreme decree 068-2001-PCM), recognises the importance of in situ conservation and respect for agrobiodiversity. In addition, the 2014-2018 action plan foresees activities in 2016 for developing technical and legal instruments to evaluate biodiversity, including agrobiodiversity, and to identify priority areas that can be classified as centres of origin of agrobiodiversity.

One of the objectives of the first national biodiversity strategy (supreme decree 102-2001-PCM) was to establish a national biotrade programme. The Peru National Biotrade Promotion Programme (NBPP) was established in 2004, along with a National Commission for the Promotion of Biotrade (CNPB), composed of public- and private-sector representatives. CNPB implemented and promoted programmes and projects that laid the foundations for biotrade (MINAM, 2015). They include:

- Biotrade facilitation programme
- PerúBiodiverso project (PBD)
- Capacity-building on biotrade project
- Project by the Global Environment Facility/Andean Development Corporation (CAF) Biocomercio Andino (BCA) on facilitation of financing for biodiversity-based businesses and support of market development activities in the Andean Region
- PerúBioInnova project

As a result of these initiatives, production and exports of agrobiodiversity products have grown rapidly in recent years. Between 2006 and 2010, the compound annual growth rate of agrobiodiversity exports was 39.6%, with a 64.1% rise in export sales of cochineal and 19.7%, of tara (SIICEX, n/d).

In an effort to protect Peru's biodiversity, Law No. 29811 (December 2011) imposed a 10-year moratorium on the import and production of living modified organisms (LMOs), in order to build national capacity and to establish baselines for native biodiversity to allow a proper assessment, prevention and management of potential impacts of releasing LMOs into the environment.[3] In November 2012, the law's implementing regulations were approved by supreme decree 008-2013-MINAM.

Since then, MINAM has carried out activities to achieve the objectives of the law, including: the establishment of a multisectoral advisory committee; the adoption of supplementary regulations to control LMOs, considering guidelines for the selection of detection laboratories; and drawing up a list of restricted goods subject to controls at points of entry (MINAM, 2013).

3.5. Climate change mitigation, risk management and adaptation

At the twentieth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 20), Peru unveiled its iNAMAzonia initiative. This nationally appropriate mitigation action (NAMA) for the agricultural sector was designed to increase sustainable production of coffee, cocoa, oil palm and livestock and to promote the restoration of deforested and degraded land in the Peruvian Amazon (Agroforestry World, 2014). Even though Peru has begun to adopt measures to mitigate emissions from the agricultural sector, hitherto none had been presented as a NAMA (NAMA Database, n/d).

Peru's farming sector is vulnerable to the impact of multiple weather events; the most common are frost, drought, bitter cold snaps and flooding. To address this condition, a climate change adaptation and disaster risk management plan for the farming sector (PLANGRACC-A) was developed for the 2012-2021 period (MINAGRI, 2012a). The aim of the plan is to prevent climate risks in line with national priorities by applying climate-change adaptation criteria in short- and medium-term investment and development activities in the agricultural sector. Another objective of the plan is to mainstream government spending and investment priorities that pursue a climate-change adaptation and risk-management approach into agricultural development programmes and projects.

Planned activities fall into five strategic areas: (i) research, information and technology on climate change adaptation and risk management; (ii) preparedness and response to emergencies caused by weather events; (iii) prevention and reduction of risks related to weather events; (iv) risk-management and climate-change adaptation planning; (v) relevant local capacity-building.

3.6. New agricultural policy

The national agricultural policy, adopted by supreme decree 002-2016-MINAGRI in March 2016, is binding upon the Government of Peru and regional and local governments. The policy is built around the following strategic priorities, several of which are linked directly with environmental management in the farming sector.[4]

- Priority 1: Sustainable water and soil management
- Priority 2: Forestry and wildlife development
- Priority 3: Legal certainty of land tenure
- Priority 4: Irrigation infrastructure and technology
- Priority 6: Agricultural innovation and technology

- Priority 7: Risk management
- Priority 8: Capacity-building
- Priority 11: Agricultural health and agrifood safety
- Priority 12: Institutional development

The other priorities are: agricultural finance and insurance (priority 5); production restructuring and diversification (priority 9) and market access (priority 10). The policy makes no mention of specific targets for each priority.

Notes

[1] Woodland and forest refers to land covered with such vegetation as trees, shrubs and scrub, which grow naturally in groups and may have some value as timber/fuelwood or for other purposes. Owing to the methodology and statistical units used in Peru's 2012 agricultural census, this figure should not be taken as a percentage of Peru's total woodland and forest because the census reported only its presence or absence in farming units, without delineating the area.

[2] The national vegetation cover map shows the geographical distribution and general characteristics of Peru's flora, which has been defined, classified and demarcated according to a set of criteria, including bioclimate, the physiognomy of vegetation, physiography and phytogeography. This information is complemented by existing inventories of wild flora and natural resources in general.

[3] See [online] http://www.minam.gob.pe/wp-content/uploads/2013/08/113252603-reglamento-ley-moratoria-ovm.pdf.

[4] See [online] https://www.unodc.org/documents/peruandecuador//DocumentosDA/PeruColombiaDA/10._POLITICA_NACIONAL_AGRARIA.pdf.

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Chapter 11. Fisheries

This chapter presents the main characteristics and trends of the Peruvian fisheries sector, including fish farming and freshwater fishing in Amazonia, as well as the institutional framework for fisheries policies. Despite the progress made in the management of some fisheries resources, such as anchovy, the creation of marine protected areas, and the environmental regulation of the fish industries, environmental performance suffers from a lack of information on endangered aquatic species and the presence of an informal economy. The chapter calls for a strategy for integrated management of the marine-coastal ecosystem.

Key findings and recommendations

Fishing and aquaculture activities in Peru are characterised as much by their natural variability (from maritime to Amazonian fisheries) as by their economic diversity (from industrialised to subsistence fishing). The Pacific Ocean along the Peruvian coast is one of the world's most productive seas. These conditions have favoured the establishment of an industrial-scale maritime fishery, focused primarily on pelagic species —anchovies account for 86% of the catch, although mackerel, horse mackerel and squid are also fished. Peru is the world's leading producer of fishmeal and fish oil, although production is affected by the great environmental variability, as the anchovy biomass fluctuates sharply with water temperature, which varies dramatically at times of El Niño and La Niña. Output fell from 6 million tonnes in 2006 to 3.5 million tonnes in 2010, although this was offset by higher prices for fishmeal (USD 810 per tonne in 2007 versus USD 1 360 in 2013). Aquaculture is now developing as an economic activity, focused on scallops and prawns along the coast and on trout, tilapia, *gamitana* or black pacu, and paiche or arapaima in inland waters. A new Aquaculture Act was recently adopted to promote this sector, given its importance in terms of food security.

The artisanal maritime fishery involves multiple species and low-tech methods, and is destined primarily for direct human consumption. There are landing and storage facilities all along the coast, but control and monitoring is less extensive. The most important inland fishery is in Amazonia. It is typically artisanal, and mainly for subsistence consumption. Much of the human diet in Amazonia relies on fish, and although the catch amounts to more than 80 000 tonnes, supply falls short of demand, with aquaculture now seeking to fill that gap. There is a Regulation on Fisheries Management in Amazonia, which is now under review.

Despite better inter-agency co-ordination on marine issues, fisheries policy still has a sectoral rather than an ecosystemic approach. Responsibilities for the ocean are divided among many agencies (Ministry of Production, regional governments, Ministry of the Environment, OEFA, SERNANP, SENACE, DICAPI, National Water Authority, SANIPES), and they have little representation in the only existing co-ordinating body (COMUMA, the Multisectoral Commission for Coastal-Marine Environmental Management). There is no comprehensive plan for the anchovy fishery that would establish a single science-based quota, nor is there any arrangement for joint stock management with Chile, which shares the fishery. Most of the remaining fish species have no catch quotas or maximum limits. The protection of marine and inland aquatic species is clearly inadequate: there are no lists of threatened species, no conservation plans, no specific measures to minimise illegal fishing or by-catch, and no control over environmentally harmful fishing methods. Some enclosed bays are being polluted by industrial activity, domestic effluents, and so forth. Studies conducted in Amazonia show alarming concentrations of heavy metals in fishery products for human consumption. One problem with relation to inland fisheries has to do with ornamental species, for which there are no data on stocks nor any effective supervision of catches. Peru's protected marine areas cover a total of 401 556 hectares, representing 2% of its total marine surface. These areas belong to the San Fernando, the Paracas and the Islands, Islets and Guano Capes National Reserves which, while very well managed, are insufficient to ensure protection of all of Peru's marine ecosystems. Nevertheless, the main challenge in the fishing sector is its informal nature, especially in artisanal fishing and aquaculture. Despite the efforts made, a significant portion of the marine and inland fisheries and aquaculture activities are pursued without supervision, owing to the shortage of human resources, the size of the territory and the inaccessibility of some areas.

Responsibility for scientific research and studies on the fisheries and their relationship with aquatic ecosystems lies with the Peruvian Sea Institute (IMARPE) and the Peruvian Amazon Research Institute (IIAP), as well as with the fisheries and aquaculture faculties of various universities. The Peruvian Sea Institute is the agency charged with recommending catch quotas for fish species, monitoring landings, by-catch and fish age criteria, assessing sea species and conducting carrying capacity studies in watercourses used for aquaculture. It is also responsible for reviewing Environmental Quality Standards for sediments, for regulatory approval.

The body of legislation governing the maritime fishery may be considered obsolete: the General Fisheries Act, No. 25977, dates from 1992 and its regulations (Supreme Decree 012-2001-PE) date from 2001. However, systems have been established concerning minimum size, fishing season limits and quotas, among other details, and these have contributed to progress towards the sustainability of the industrial fishery. A good example is the amendment to the anchovy quota, which was changed from an aggregate quantity (which ship owners promptly used up in the course of what was known as the "Olympic race") to a system based on catch quotas per vessel, established in light of the fleet's historic catch (Legislative Decree No. 1084 of 2008, Maximum Catch Limits per Vessel Act). This has had a positive impact on efficiency in the sector, reducing the size of the fleet and the number of processing facilities while maintaining output capacity. The measure has also had positive repercussions for stocks. The main responsibility for co-ordination, regulation and supervision of the fisheries sector lies with the Ministry of Production (PRODUCE), although there has recently been some decentralisation in supervision of the artisanal fishery toward the regional governments. It is the Ministry of Production that formulates fisheries policy and approves standards for the sector. It also performs oversight of the commercial fishing fleet, directly with its own 260 inspectors and indirectly by co-ordinating the work of the 700 inspectors belonging to certification firms and paid by the industry itself.

In the fisheries area, the Ministry of the Environment (MINAM) is responsible for establishing policy and specific regulations, for inspection and supervision, and for imposing penalties for breach of environmental rules. In 2012, OEFA (a specialised technical agency of the Ministry) took over environmental inspection of the fisheries sector. In the case of aquaculture and fishing in protected coastal and marine areas and inland waters, responsibility lies with SERNANP. In 2012, the Multisectoral Commission for Coastal-Marine Environmental Management (COMUMA) was established to co-ordinate the various administrative and technical agencies involved in protection of the sea. This Commission could become a very effective tool for designing a co-ordinated, coherent and integrated policy on the protection and sustainable management of the marine environment. The Strategic Plan for Management and Handling of the Coastal Marine Ecosystem and its Resources is currently in the public consultation process. It is an intersectoral policy guide and contains strategic objectives, targets and a short-, medium- and long-term implementation schedule.

Recent years have seen notable efforts in some areas to reduce the local environmental impact of processing plants by regulating emissions and discharges into the sea, for example in the bays of Chimbote, Samanco and Paracas. Generally speaking, the industrial fishery for indirect human consumption is quite well regulated and supervised. Since approval of Supreme Decree 026-2003-PRODUCE, Regulations of the Satellite

Monitoring System (SISESAT), the industrial fishery has been subject to remote tracking. Monitoring of fish landings has also been stepped up.

Recommendations

- Make progress towards an integrated policy for hydrobiological resources with comprehensive and coherent planning of the usage made of the ocean and inland water basins. This should take into account the conditions of ecosystems, combine the objectives of the different policies, establish clear guidelines based on the ecosystemic approach, provide for concrete actions and be equipped with mechanisms for monitoring compliance and the environmental, social and economic effects of the implementation of those actions. Raise the institutional and political level of the interadministrative co-ordination agencies, such as the Multisectoral Commission for Coastal-Marine Environmental Management (COMUMA), in order to make the planning process more effective. Where necessary, adopt specific instruments for places with identified problems, to facilitate the coherent management of marine areas and related inland water basins.
- Capitalise on the available scientific knowledge and strengthen the institutions responsible for providing information, such as IMARPE and IIAP, so they can provide suitable, independent and impartial advice for decision-making and policy design. Ensure transparency in fishery figures, including catches and landings, by-catches, discards, inspections, and so on. Assess the harmful environmental effects of aquaculture, such as escaping exotic species and excessive use of nutrients and pesticides, and of industrial processes to prepare feedstocks; as well as the pressures on fish populations. Promote the education and training of managers, inspectors and the productive sector.
- Encourage the work of the National Fish Health Service (SANIPES) in controlling pollutant levels in fishery and aquaculture products, as a preventive health measure and as a source of information for monitoring pollution in bodies of water. Make progress in the understanding and management of sources of pollution that affect aquatic ecosystems.
- Redouble surveillance and inspection efforts to eradicate illegal fishing and to formalise informal fishery activities. Design specific measures to discourage informal fishery activities and to bring all fishery workers into regulated management schemes. Promote fishery agreements with local communities and with small-scale fishing concerns within the total allowable catch (TAC), as applicable. Strengthen local capacities for joint management, in order to facilitate the sustainable extraction and management of hydrobiological resources from both the sea and inland waters.
- Further develop the catch quota system and analyse the effects of extraction on ecosystems, encompassing the entire sector (indirect human consumption, direct or small-scale human consumption) and allowing for the possibility of quota transfers between stakeholders and of extending the quota system to other at-risk commercial species, both maritime and inland, on the basis of the best knowledge available and keeping in mind climate change. Draw up lists of endangered and at-risk species and establish the closed seasons necessary for their survival, particularly in the Amazon. Develop specific extraction plans for ornamental species.

1. Sector description

1.1. General background

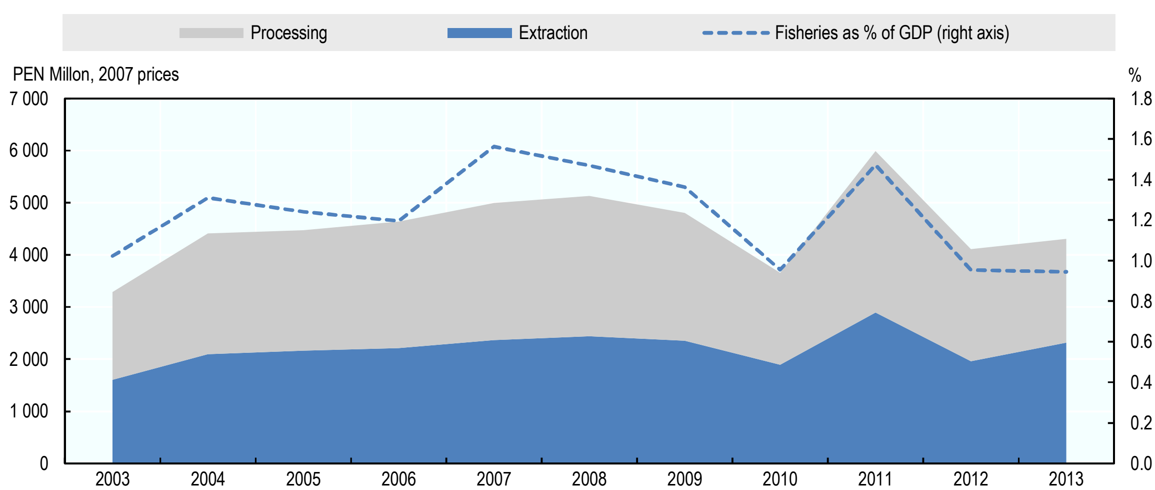
The Pacific Ocean, which washes the Peruvian coast, is one of the world's most productive owing to its deep, cold waters with abundant nutrients from the effects of the Humboldt Current. This favourable ecology has led to the emergence of a dynamic marine fishery industry that is equipped with modern infrastructure and that focuses mainly on exports of fishmeal and fish oil obtained from anchovies and, to a lesser extent, on processing for direct human consumption.

The aquaculture industry is a recent development in the country that has enabled the use of a variety of resources —both maritime (scallops and prawns) and inland (paiche and trout)— for both the export and domestic markets (including subsistence consumption).

The fisheries sector, including both extraction and processing, accounted for around 0.9% of the country's gross domestic product (GDP) in 2013 (Ministry of Production, 2015). Its real-term output remained relatively stable over the period under review, in spite of an initial increase and, subsequently, a degree of variability. Its share in total economic activity has followed a similar pattern, albeit with a recent downward trend. In 2007, fisheries accounted for a record level of 1.7% of GDP (Figure 11.1).

Figure 11.1. Fisheries sector GDP

(PEN millions, at constant 2007 prices, and percentages)



Source: Prepared by the authors on the basis of Ministry of Production (2015; 2013a).

The sector's exports totalled USD 2.8 billion in 2013. Products for indirect human consumption, primarily fishmeal and fish oil, accounted for 61%. Export earnings from both products grew between 2003 and 2012 owing to a rise in international prices. Similarly, exports of products for direct human consumption —canned, frozen and cured— expanded significantly, with a 5.5-fold increase in earnings.

Employment in the sector stood at around 160 000 workers in 2013, or about 1% of the country's workforce. This figure is broken down as follows: extraction, 59%; processing, 16%; aquaculture, 9%; and other related activities, 17%. Employment grew by 29% between 2003 and 2013, in line with the evolution of the sector's output.

1.2. The use made of hydrobiological resources

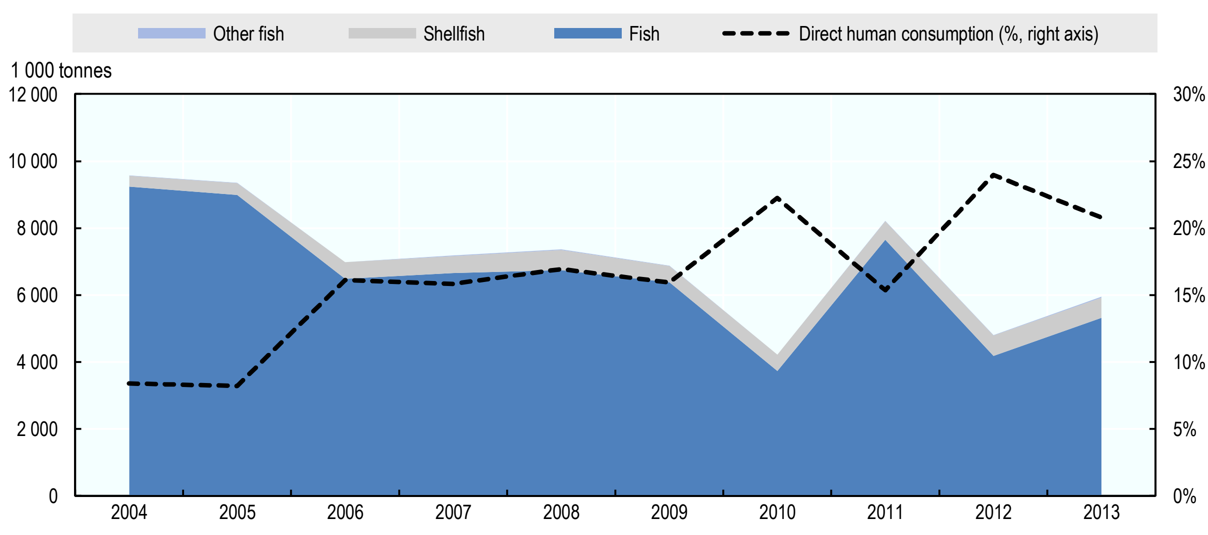
The extractive sector covers maritime fisheries, inland fisheries and aquaculture. Maritime fishing involves both industrial and artisanal activities. Inland fishing (which includes ornamental species) is mainly artisanal. Aquaculture involves industrial and artisanal operations, and is pursued in both maritime and inland waters.

Maritime fishery

Maritime fishing, predominantly of Peruvian anchovies (hereafter anchovies), takes place in two main fishery areas with distinct stocks: (i) the centre-north zone, and (ii) the southern zone. In the former, which extends down to latitude 16º south, industrial fishing takes place at a minimum of 10 miles from the coast, while smaller-scale operations are concentrated at a range of between 5 and 10 miles and artisanal fishing takes place within the first 5 miles. In the southern zone, the corresponding limits are 5 miles for large-scale fishing and 3.5 miles for medium-scale operations, with artisanal fishing taking place in the area closer to land. Here, artisanal fishing is authorised to operate in the other two areas, and medium-scale operations are allowed in the large-scale area (Heck, 2015).

Figure 11.2. Evolution of hydrobiological product landings by type

(Thousands of tonnes and percentages)



Source: Prepared by the authors on the basis of Ministry of Production (2015; 2013a).

Total fishery landings decreased over the period studied, chiefly on account of changes in fish catches. Extractions of shellfish and other species increased by factors of 2.7 and 2.4, respectively (Figure 11.2).

Most of the extracted resources are used to produce fishmeal and fish oil (indirect human consumption), a sector where Peru is the world's leading producer. In 2005, 92% of the total catch was used for fishmeal and fish oil and, in 2014, the share was 63%. That change was largely due to falling anchovy catches (Ministry of Production, 2013a and 2015).

Anchovy landing numbers are influenced by the pronounced environmental variations. The anchovy biomass fluctuates sharply with water temperature, which varies dramatically at times of El Niño and La Niña. In recent years, the anchovy catch has fallen (from some 6 million tonnes in 2006 to 4.9 million in 2013), which has been offset by rising fishmeal prices.

Landings used for direct human consumption (canned, frozen, cured and fresh products) accounted for 37% of the total in 2014 (compared to 12% in 2003). The evolution of this subsector has been interesting, with average annual growth rates of 5.3% (for a total of 77% over the period under review) as a result of policies for its development (Ministry of Production, 2013a and 2015).

Artisanal maritime fishery

Artisanal maritime fishing is a low-tech activity that almost exclusively serves direct human consumption. Official checks and monitoring of this sector are less exhaustive. The first National Census of Artisanal Maritime Fisheries (CENPAR I) revealed the existence of 116 landing sites along the coast (INEI, 2012). At the same time, according to information from the National Fisheries Development Fund (FONDEPES), in 2011 there were 45 artisanal landing facilities, of which 89% were operational. Although 31 landing sites have ice plants, only 10 of them are operational.

Recent years have seen significant increases in the numbers of both fishers and vessels dedicated to this activity. This growth can be attributed to low-resource populations migrating to coastal areas. Significantly, the recent expansion of the productive fleet occurred at a time when regulations prohibiting the construction of new fishing vessels were in force (Supreme Decree No. 020-2006-PRODUCE and Supreme Decree No. 018-2010-PRODUCE) (Table 11.1).

Table 11.1. Numbers of artisanal fishers and vessels[a]

	First ENEPA (1995-1996)	Second ENEPA (2004-2005)	First CENPAR (2012)
Number of fishers	28 098	37 727	44 161
Number of artisanal fishing vessels	6 268	9 667	16 045

Note: a) Information from the Structural Survey of Artisanal Fisheries (ENEPA) conducted in each region and the first National Census of Artisanal Maritime Fisheries (CENPAR).
Source: Prepared by the authors on the basis of IMARPE (2010), IMARPE (1997) and Ministry of Production (2013c).

Inland fishing

The most important inland fishery is in Amazonia. Typically artisanal, it is a major source of both revenue and foodstuffs. Subsistence consumption accounts for a significant proportion of its activities. Nevertheless, declining fish stocks have been observed in the region, the result of climate conditions and inadequate fishery management. In 2005, Amazonia produced 36 600 tonnes (FAO, 2010), which fell to 25 300 tonnes in 2013 (Ministry of Production, 2013c). Much of the food supply of the inhabitants of Amazonia comes from fishing, with 70 species that are commercially exploited for human consumption. Another 420 species are used for ornamental purposes. The Regulation on

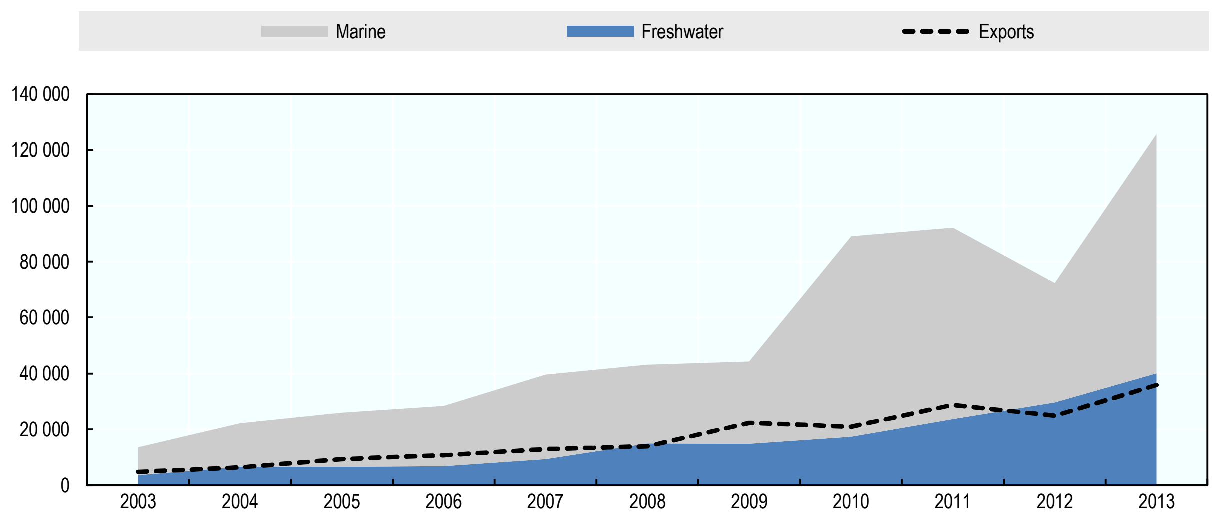
Fisheries Management in Amazonia (Supreme Decree No. 0015-009) is currently in force and undergoing review.

Aquaculture

Aquaculture has expanded significantly in recent years (Figure 11.3). Aquaculture harvests represented 2.1% of total maritime and inland fishing in 2013, with average annual growth rates of 25%, yielding an accumulated growth of 820% over the period studied. Scallops and prawns account for almost 100% of the maritime aquaculture harvest. In contrast, inland aquaculture makes up a third of the total and is focused on trout and tilapia, which accounted for 97% of the 2013 harvest, alongside other species such as *gamitana* (Colossoma macropomum), *paco* (Piractus Brachypomus) and *paiche* (Arapaima gigas) (Ministry of Production, 2013a and 2015).

Figure 11.3. Aquaculture harvest by type and total exports

(Gross tonnes)



Source: Prepared by the authors on the basis of Ministry of Production, *Anuario Estadístico Pesquero y Acuícola 2014*, Lima, 2015; and *Anuario Estadístico Pesquero y Acuícola 2012*, Lima, 2013.

Aquaculture products are sold on both local and overseas markets. Exports grew significantly between 2003 and 2013, rising from 4 700 tonnes to almost 36 000 tonnes. At the same time, the sector's earnings rose from USD 25 million to USD 300 million.

1.3. Processing industry

The processing sector covers the production of fishmeal and fish oil and the canning, freezing and curing industries. Of the total 2013 catch, 93% was processed and only 7% sold as fresh products (Ministry of Production, 2013c). The output of fishmeal and fish oil, which are used in animal feed and other foodstuffs, has evolved along similar lines as landings of anchovy (a species used almost exclusively for indirect human consumption). Most of these products are exported. International prices for fishmeal have evolved very favourably over the period, almost trebling between 2003 and 2014, when they approached USD 2 000 per tonne (Table 11.2).

Table 11.2. Production of fishmeal and fish oil

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Meal	1 225	1 971	1 931	1 342	1 399	1 415	1 349	787	1 638	854	1 114
Crude oil	206	350	290	280	310	293	288	174	336	196	175

Source: Prepared by the authors on the basis of Ministry of Production, *Anuario Estadístico Pesquero y Acuícola 2014*, Lima, 2015; and *Anuario Estadístico Pesquero y Acuícola 2012*, Lima, 2013.

Processing plants for fishmeal and fish oil are mainly found along bays. There are 74 facilities for fishmeal production, with an installed capacity of 6 635 tonnes per hour. Four regions account for 75% of the installed capacity: Ancash with 27%, Lima with 19%, Ica with 15% and La Libertad with 14% (Ministry of Production, 2013c).

The remainder of the processing sector produces canned, frozen or cured products. Of these, frozen goods account for the largest share: 77% of the total in 2013 (compared to 47% in 2003).

2. Pressures and main environmental problems of the sector

Fishery activities depend on the health of the habitats where they take place. They are vulnerable to impacts from other activities and, at the same time, can bring about various types of pressure on the environment.

In many cases, the environmental information available is incomplete and the effects can only be inferred. Most of the information available on stocks is limited to the main commercial marine species (e.g., anchovy, squid, horse mackerel, mackerel and hake). That is in line with the fact that the use of those species is more specifically regulated by Fishing Management Regulations (ROPs). There is no information on the state of stocks of non-commercial species and those found in inland waters. The protection of marine and inland aquatic species is clearly inadequate: there are no lists of threatened species, no conservation plans and no specific measures to minimise illegal fishing or by-catches. Given the absence of such information, actions and negative incentives that undermine the sector's sustainable development cannot be identified.

Anchovy is Peru's main hydrobiological resource and the one on which the largest amount of information is available. It is subject to a system of per-vessel catch quotas and closed seasons, which have helped the recovery of the species' biomass. However, additional work is needed to develop a comprehensive plan that sets a single quota, based on scientific observations and supported by an analysis of the effects that extraction for direct or indirect human consumption and artisanal fishing have on ecosystems. Neither is there any joint stock management with Chile, even though the anchovy resource is shared with that country and the two nations conduct joint scientific studies.

Hake, another resource managed by means of individual per-vessel quotas, has reported an uptick in landing volumes in recent years. The authorised fleet was reduced early in the first decade of the century in order to assist the recovery of the resource following the closure of the fishery. It currently comprises 43 vessels.

Mackerel and horse mackerel are straddling and migratory species. They are caught in both territorial waters and on the high seas, thus Peru is not solely responsible for the health of their populations. An overall catch quota is in place, and productivity depends on the environmental variations caused by El Niño and La Niña. As is the case with other species in Peru, squid fishing is a recent development and landings have increased significantly. It is estimated that the squid biomass is abundant, for which reason the Peruvian Sea Institute (IMARPE) has classified it as underexploited at the national level.

Informal activities are a major problem in the fisheries sector, chiefly in the areas of artisanal fishing and aquaculture. A significant proportion of fishing is not subject to controls in spite of the efforts made to manage the activity and its landings. This is primarily due to the shortage of personnel to cover the country's vast territory and the inaccessibility of certain regions.

In the north of the country, in the Tumbes and Piura districts, artisanal and small-scale fishers practice purse-seine fishing and trawling within five miles of the coastline. Despite being banned since 2005, these techniques are still practised. In 2013, the Ministry of Production amended the Tumbes Regulation on Fisheries Management (Supreme Decree No. 006-2013-PRODUCE) to require small-scale vessels engaged in purse-seine fishing and trawling to obtain a permit from the IMARPE and install a satellite tracking system to operate beyond the five-mile limit.

This action is intended to place these fishery workers under a specific legal regime, as a way to reduce the informality with which they operate and, in many cases, seem unwilling to change (Ministry of Production, 2013b). Purse-seine fishing in shallow waters and trawling have a major impact on marine ecosystems. However, there are no records of specific studies into the matter in these regions. The artisanal fishing sector feels that the government's actions have left it powerless, largely because informal or illegal activities remain unchecked.

Fishing in Amazonia has decreased notably in recent years because of drought. As a result, fishing activities concentrate in certain areas at times of scarcity, which causes levels of overexploitation from which some species do not recover. Poor management and interference with habitats also bear some responsibility in this. Fishery catches in Amazonia are only recorded at major landing sites, and so their true dimensions and impact are not fully understood.

Another key problem with the exploitation of inland fisheries has to do with ornamental species. Although the National Commission on Biological Diversity (CONADIB) has a technical group responsible for inland waters, led by PRODUCE, there is no information available about stock health and no effective control over catches.

Two species —silverside (*Odontesthes bonariensis*) and trout (*Oncorhynchus mykiss*) — were introduced into the inland waters of the high Andes in 1955 and 1939, respectively. They have become commercially important, and have consequently an impact on some native aquatic species (invertebrates, frogs and amphibians). The affected areas are the Río Abiseo National Park in San Martín, Lake Titicaca and the Mala and Cañete Rivers in Lima. Those introduced species reportedly brought parasites with them, and it is unknown whether any control measures have been adopted.

Also in the inland region, where the production of freshwater prawn is concentrated, there have been alarming falls in stocks on account of various pressures, including water pollution, water extraction for agricultural purposes and overexploitation. As a result, closed seasons have been imposed on the resource.

In some closed bays, one of the severest problems is water pollution caused by industrial activities. In particular, fishery processing plants emit large volumes of liquid residue into the sea, which is also contaminated with domestic effluents and by dockside refuelling activities. The bays at Callao and El Ferrol report high levels of total and faecal coliforms that, in many cases, exceed the maximums permitted for recreational activities and commercial fishing. At the Bay of Paita, the main sources of pollutants are domestic effluents and the processing industry. El Ferrol Bay is considered a critical zone because of marine pollution from domestic and industrial effluents and discharge from a steelworks.

In recent years, major efforts have been made in some areas to reduce the local environmental impact of factories. In 2008, maximum permissible limits (MPLs) were set for the fishmeal and fish oil industries (Supreme Decree No. 010-2008-PRODUCE). These allowed for the regulation of releases into the sea and emissions, including the installation of underwater outlets. This has been in the bays of Chimbote, Samanco and Paracas. The processing industry, which produces foodstuffs intended for direct human consumption, is not subject to MPLs.

In inland waters, too, habitats have been damaged by pollution. In those cases, the main causes are mining, including extractive wastes, and wastewater. Gold mining —chiefly artisanal gold mining pursued illegally or informally— is responsible for major mercury contamination in the Madre de Dios district of Amazonia. Studies carried out by the Carnegie Amazon Mercury Ecosystem Project (CAMEP) revealed that at markets in the city of Puerto Maldonado, 9 of every 15 fish species intended for human consumption exceeded the established limits for mercury content. Those levels rose between 2009 and 2012 in 90% of the species examined, which reflects the bioaccumulative impact of the pollutant and the expansion of illegal extractive activities in the area. In this locality, 78% of the adult population was detected to have an average of 2.7 ppm of mercury, almost three times higher than the maximum recommended concentration (1.0 ppm). Women of childbearing age are the worst affected segment of the population, on account of the risk of intrauterine transmission of the contaminant (CAMEP, 2013).

Aquaculture offers a good alternative for maintaining a stable supply of protein and contributing to food security. The effects of the newly enacted Aquaculture Act will have to be assessed, but at present there are still shortcomings in how aquaculture activities are managed. For example, no studies have been conducted into the carrying capacity for aquaculture of bodies of water (Samanco, Sechura, Puno), which is necessary to ensure the protection of the ecosystems where the facilities are installed.

Protected maritime areas account for a minor fraction of Peru's territorial waters (see the chapter on the context and trends). These areas include the National Reserves of San Fernando, Paracas and the System of Islands, Islets and Guano Capes which, while very well managed, are insufficient to ensure protection for all Peru's marine ecosystems. There is a proposal for a Tropical Pacific Ocean Reserve, in the Máncora Bank and the Cabo Blanco submarine canyons, which make up the habitat of 35% of Peru's maritime species. This proposal has been placed on hold because of the opposition of the hydrocarbons industry operating in the area, which underscores the need to balance the protection of ecosystems with productive endeavours, so that industry can continue to operate in a way that is compatible with the demarcation and management of protected areas.

The upwelling system of the Humboldt Current in Peru is a marine area of ecological and biological importance on account of its high levels of endemism and the rising of nutrient-rich waters, which make it one of the world's most productive marine regions (CBD, 2015). In keeping with the Aichi Biodiversity Targets, Peru should move ahead with the conservation of its marine and coastal areas, particularly given the presence in its territory of a marine ecosystem of ecological and biological importance.

3. Institutional organisation

3.1. Institutional framework of the sector

Chief responsibility for the co-ordination, regulation and supervision of the fisheries sector lies with the Ministry of Production (PRODUCE), through the Vice-Ministry for Fisheries. PRODUCE is responsible for framing fisheries policy and adopting regulations for the sector, as well as for inspecting the industrial fleet, which involves assigning inspectors on board vessels. Recently, there has been a movement toward decentralising oversight authority for artisanal fishing to the regional governments.

In the anchovy sector, the Vice-Ministry for Fisheries is responsible for: (i) devising management rules, policies and regulations, (ii) implementing oversight and control programmes and imposing sanctions for failures to abide by the management rules, and (iii) establishing and granting fishing rights. Different legal regimes apply to anchovy vessels depending on their storage capacity and the use made of their catches. The current legal framework provides that anchovies caught by artisanal and smaller-scale vessels can only be used for direct human consumption, while industrial fleet catches must be used exclusively for indirect human consumption (fishmeal and fish oil). However, failures to abide by those rules are frequent.

The Ministry of Production is supported by a number of institutions: (i) the National Fisheries Development Fund (FONDEPES), which is charged with promoting the development of fisheries and artisanal aquaculture through such methods as providing basic infrastructure, access to credit and training, (ii) the Technological Institute of Production (ITP), which promotes research, adaptation strategies and technological transfers for the use of fishery resources, together with sanitary and quality controls, and (iii) the Peruvian Sea Institute (IMARPE), which studies the marine environment and its biodiversity, including anchovy population levels, to inform decision-making on fishery matters. In addition, IMARPE conducts scientific and technical monitoring of fishery activities, landings, by-catches and age criteria, and it works on the study and evaluation of marine species (hammerhead shark, octopus, Chilean abalone, silverside, mullet, lorna, cabinza grunt, among others) and on studies into the carrying capacity of bodies of water for aquaculture (e.g. Sechura).

Scientific monitoring and studies of fisheries and their relationship with aquatic ecosystems are conducted by both the Peruvian Sea Institute (IMARPE) and the Peruvian Amazon Research Institute (IIAP), as well as by the fisheries and aquaculture schools of various universities.

IMARPE conducts studies into habitats, modelling and trophic ecology, and the potential use of macroalgae and new species. It is also revising the Environmental Quality Standards for sediments, with the aim of obtaining regulatory approval. It has a programmeof on-vessel observers to control minimum sizes, take trophic samples and collect information on mammals, birds and discards, which enables it to draw up recommendations for the Ministry of Production.

IMARPE also trains fishery inspectors and provides environmental training for fishers and ship owners. It has also developed a project that deploys observers on the artisanal fleet, expanding the information available on catches and fishing activities in around 50 landing sites along the Peruvian coast, as part of the "Strengthening artisanal fishing" budgetary programme.

Through the Marine-Coastal Functional Research Area (AFIMC), IMARPE carries out impact assessments for different activities in the coastal region and some inland water bodies. It analyses water and sediment quality in coastal land that is used for economic activities, such as artisanal fishing and aquaculture, as well as for use in urban and rural areas, industrial zones and other activities.

For inland fishing, the work of IMARPE involves such tasks as demarcating freshwater prawn river beds, estimating landings and conducting water quality studies. IIAP has taken charge of research efforts in inland waters, and has taken on the tasks of conducting genetic studies of flagship species, monitoring landings, undertaking repopulation work and drafting regulatory proposals for off seasons and minimum extraction sizes. In the field of aquaculture, IIAP has begun the cultivation and distribution of larvae.

3.2. Legal framework and instruments

Although the General Fisheries Act, No. 25977, dates from 1992 and its regulations (Supreme Decree 012-2001-PE) from 2001, amendments have been made over the years that have advanced the sector's sustainability. The main changes include the adoption of Supreme Decree No. 026-2003-PRODUCE, Regulation of the Satellite Monitoring System (SISESAT), which implemented the remote tracking of industrial fisheries.

Another significant improvement was a change in the anchovy quota system. Traditionally, the general catch quota for anchovy intended for indirect human consumption was a single amount. According to that plan, there were no individual allocations and ship owners competed in what was called the "Olympic race", and, as a result, the entire season's quota was reached in just a few days. In 2008, the Maximum Catch Limits per Vessel Act (Legislative Decree No. 1084) divided the catch quota by vessels, in line with historical rights. Under this scheme, fishing can take place at staggered times over each season, with proper human and material resource planning. This has had a positive impact on the sector's efficiency, in that it has led to reductions in the fleet and in the number of processing plants while maintaining the same levels of output. The measure has also had positive repercussions for anchovy stocks.

Supreme Decree No. 008-2012-PRODUCE imposed conservation measures on anchovy fishing. Under this decree, the Ministry of Production was given powers to limit access to resources and activities, procedures were established for ordering closed seasons and rationalising fishery activities and measures were established for the conservation of juvenile specimens and preventing discards. It also ordered the deployment of onboard inspectors and mechanisms to visually record vessels' activities to ensure compliance with those measures. Supreme Decree No. 005-2012-PRODUCE clearly demarcates the anchovy fishing grounds for the different fleets (artisanal, medium-scale and large-scale) and it increased the restrictions and requirements for the artisanal fleet which, in some cases, are now the same as those that apply to the industrial fleet.

In addition to the current legislation, Fishing Management Regulations (ROPs) are in force in certain specific areas with resource exploitation problems or under greater pressure, as well as with respect to fishery resources of particular interest. Thus, there are ROPs for anchovy, hake, mackerel and horse mackerel, tuna, eel, squid, macroalgae and the fishery products of Amazonia, Tumbes and Lake Titicaca.

The species-specific Regulations establish the requirements that must be met in order to exploit those resources (including fees), as well as put in place protective measures such as global quotas, fishing seasons and areas, closed seasons, the protection of juveniles, fishing tackle, vessel characteristics and the requirements for surveillance mechanisms. Per-vessel quotas are enforced for species such as anchovy and hake.

The Regulations for specific areas are intended to enhance capacities to manage the resources they contain. They aim to improve scientific knowledge and research, to strengthen the institutions involved, to help formalise fishing activities and the use of sustainable practices and, specifically, to impose restrictions to address specific problems in each area. While compliance with these rules has not been assessed, the available information suggests that, based on the capacity for management and oversight, there is a high rate of non-compliance.

Most of the remaining species of fish are not subject to quotas or maximum catch limits, and so further progress is still needed on the regulation of the fisheries sector. Knowledge about commercial species and their relationship with marine and inland ecosystems and about the impacts of fishery activities is still limited. This hinders the adequate planning of hydrobiological resource extraction.

The first sectoral law for aquaculture —the Aquaculture Promotion and Development Act (Law No. 27460-2001) and its Regulations (Supreme Decree No. 30-2001-PE)— was enacted in 2001 and defines the priority nature of the activity. This law instructs the Ministry of Production's General Aquaculture Directorate to draw up a national aquaculture development plan. Recently, by means of Legislative Decree No. 1195, the General Aquaculture Act was enacted. Its goals include promoting the development of aquaculture as a nationally important economic activity and furthering productive diversification, competitiveness and food security, in harmony with environmental protection, together with the conservation of biodiversity and the health and safety of hydrobiological resources and products. The Act plays an important role in generating quality products for consumption and industry, in addition to the creation of social goods such as jobs, revenues and productive chains.

Recently, efforts to promote aquaculture have been under way in order to increase the amounts of fishery products used for direct human consumption. One example of this is Supreme Decree No. 010-2010-PRODUCE, Regulations on Fisheries Management for Resources of Peruvian anchovy (*Engraulis ringens*) and Longnose Anchovy (*Anchoa nasus*) for Direct Human Consumption, which declares it to be an activity of national interest. In addition, a regulation was recently adopted whereby direct human consumption will be allocated a share of the general anchovy catch quota.

At the same time, and as described in the chapter on co-operation and international commitments, Peru has a series of agreements and plans that it has implemented —or is implementing— to protect, conserve and manage its resources. Most notable are following: (i) the FAO Port State Measures Agreement, (ii) the enforcement in Peru of the Permanent Commission of the South Pacific's Regional Plan of Action for the Conservation of Sharks, and (iii) participation as an acceding State in the Commission for the Conservation of Antarctic Marine Living Resources.

3.3. Co-ordination

The Multisectoral Commission for Coastal-Marine Environmental Management (COMUMA) was established in 2012 to co-ordinate the various administrative and technical agencies involved in protecting the sea. The aim was to establish an effective tool for designing an integrated, coherent and co-ordinated policy for the protection and sustainable use of the marine environment. The Commission could involve more agencies with competences in this area and increase the production of sectoral planning instruments.

COMUMA currently has seven specialised technical working groups (GTTEs) on: artificial reefs, integrated management of the maritime coastal zone, implementation of the beaching network, management of benthic resources, strategic plan, ocean health and breakwaters. The creation of a technical group for legally protected species has also been proposed.

There has generally been some distance between the sectoral authorities' vision and that of the actors who are concerned with the environmental impact. Although progress with institutional co-ordination on maritime matters has been made in recent years, fisheries policy is still defined with a sectoral approach and not with an ecosystemic perspective. This is further heightened by the proliferation of agencies with maritime responsibilities —the Ministry of Production (PRODUCE), the regional governments, the Ministry of the Environment (MINAM), the Environmental Assessment and Enforcement Agency (OEFA), the National Service for Government-Protected Natural Areas (SERNANP), the National Service of Environmental Certification for Sustainable Investments (SENACE), the General Directorate of Harbour Masters and Coastguards (DICAPI), the National Water Authority (ANA) and the National Fish Health Service (SANIPES)— and the low level of representation those agencies have in the only co-ordinating body that exists, the Multisectoral Commission for Coastal-Marine Environmental Management (COMUMA).

Each of these institutions draws up its own policies in accordance with its multi-year strategic plans. There is no general planning that takes into account the full range of objectives (economic, social and environmental) related to the use of the sea. In addition, policymaking does not appear to take into account the potential cumulative effect of individual and collective environmental impacts. In inland waters, the problem is the same: there are no strategic plans or co-ordination agencies with the institutional legitimacy to set forth an integrated policy for hydrobiological resources that takes account of both their exploitation and environmental and social values.

The relevant COMUNA working group is preparing a Strategic Plan for Management and Handling of the Coastal Marine Ecosystem and its Resources, which is currently at the public consultation phase. It represents an intersectoral policy guide, and it contains strategic objectives, targets and a short-, medium- and long-term implementation schedule. It is connected with the Guidelines for the Integrated Management of Marine and Coastal Areas and with the classification study of marine and coastal bodies of water carried out by ANA. The document includes principles for ecosystemic management, participatory governance and other mechanisms, and it could offer a basis for progress towards the effective co-ordination of marine protection in Peru.

3.4. Oversight

Oversight of the different aspects of the fishery sector's activities is carried out by a number of institutions. The Ministry of Production's General Directorate of Follow-up, Control and Oversight (DIGSECOVI) and the regional governments' Regional Production Directorates (DIREPROs) are responsible for control and oversight of compliance with the provisions of the current legal regime for fisheries, as applicable. The Ministry of the Environment is charged with overseeing environmental conservation in such a way as to encourage and ensure the sustainable, responsible, rational and ethical use of natural resources and of their supporting environments. In the fisheries area, its activities include setting policy and establishing specific regulations, oversight and control, and the power to impose sanctions for failures to abide by environmental rules.

In 2012, the Ministry of the Environment's Environmental Assessment and Enforcement Agency (OEFA) was made responsible for the environmental oversight of the fisheries subsector. The competences transferred to OEFA, exclusively for industrial processing plants and large-scale aquaculture facilities, were environmental supervision, oversight, control and sanction.

According to information from the Ministry of Production, the number of sanctions imposed was on the rise until 2010, after which it started to decrease. The sanctions that attract the steepest fines involve the extraction of resources from reserved areas or in amounts greater than the storage capacity, or fishing without the necessary permits. There is no information on how oversight activities have changed, on the new control and supervision powers or on the transfer of powers to OEFA. This last issue could be responsible for the falling number of sanctions in the latter part of the period in question. It is also unknown how many sanctions were actually enforced (Table 11.3).

Table 11.3. Sanctions imposed by the Ministry of Production

Year	Number	Fine (UIT[a])	Suspension of fishing permit (number of permits)	Seizure (units)	Suspension of plants (units)
2004	602	2 765	117	3	3
2005	1 329	5 380	384	3	9
2006	2 507	17 547	438	46	14
2007	3 251	43 262	1 396	184	11
2008	3 774	20 062	2 073	324	32
2009	4 238	17 553	2 339	256	42
2010	4 805	42 895	3 049	201	41
2011	3 046	28 319	1 322	322	62
2012	1 624	13 557	553	330	85

Note: a) UIT: tax unit; in 2012, equal to PEN 3 650.
Source: Ministry of Production, "Estado de sanciones" [online] http://www.produce.gob.pe/index.php/estado-de-sanciones.

In general, oversight of industrial fisheries for indirect human consumption has been adequate since the introduction of the satellite monitoring system. The monitoring of landings has also increased. The Ministry of Production has 260 inspectors of its own and co-ordinates 700 indirect inspectors from certification companies that are paid for by the industry itself.

As a result of the decentralisation process, regional governments have been given responsibility for managing artisanal fishing and for overseeing compliance with national rules within the first five nautical miles of the coast. However, they need to develop their technical and organisational capacity for discharging these functions. The artisanal sector is key for effective resource management and the protection of marine ecosystems. Without its direct involvement, commitment, acceptance of the rules and participation in overseeing compliance, properly managing hydrobiological resources will be impossible.

The level of informality and the rate of non-compliance with the current legal provisions (on such matters as closed seasons and minimum sizes) have not been measured. The sanctions system appears of be of limited effectiveness. Offenders continue their activities in the informal or illegal sector, which suggests that the sanctions imposed do not serve as a deterrent.

According to a metric prepared by OEFA to assess different aspects of oversight of artisanal fishing, the best performing regional governments, out of the 24 to which the metric was applied, obtained a score of 50 out of 100, while the worst received only 8 points (OEFA, 2015).

The Ministry of Defence, through the General Directorate of Harbour Masters and Coastguards (DICAPI), is responsible for registering, inspecting and monitoring fishers and the fishing fleet, for authorising fishing vessel departures, for authorising the use of coastal waters (for the installation of underwater outlets, for example) and for control and oversight to prevent and combat the pollution of the sea, rivers and navigable lakes.

SERNANP also has responsibilities over aquaculture and fishing in coastal, maritime and inland protected natural areas. The San Fernando, Paracas and Islands, Islets and Guano Capes National Reserves are combined areas of maritime and land territory, and the species protected in their coastal zones are chiefly those associated with the Humboldt Current (for example, birds, sea lions). The integrated management of these protected areas of maritime and land territory in a way that remains close to the traditional sectors and is co-ordinated with all the interested parties offers an example that could be exported to other locations.

The Ministry of Agriculture and Irrigation participates in the fisheries sector through the National Water Authority (ANA) which, pursuant to Article 79 of the Water Resources Act (Law No. 29338-2001), is the agency responsible for issuing the permits needed to discharge effluents into the sea, subject to a favourable ruling from the environment and health ministries regarding compliance with the Environmental Quality Standards for Water (ECA-Agua) and the maximum permissible limits (MPLs).

Finally, responsibility for monitoring environmental accidents and contamination of fishery and aquaculture products for human consumption lies with the National Fish Health Service (SANIPES).

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Chapter 12. Mining sector

This chapter presents the main characteristics and trends of the Peruvian mining sector, as well as the legal framework for the mining industry. It reviews the status of exploration and exploitation permits as well as the direct regulation of extraction and processing activities on air and water. It reviews conflict resolution mechanisms with local communities, environmental liability policy and the management of contaminated sites. The chapter discusses efforts to formalise the artisanal mining and avoid local mercury water pollution, which has led Peru to recently ratify the Minamata Convention on Mercury.

Key findings and recommendations

Peru is the biggest producer of gold in Latin America, and the sixth largest in the world. It is the world's third largest producer of copper, after China and Chile, as well as of silver, tin and zinc, and is an important producer of lead and molybdenum. Copper and gold are the most important products in the economy. In 2012, mining accounted for 12.2% of gross domestic product (GDP) and roughly 60% of exports. It is a capital-intensive sector, whose importance is reflected in the fact that investment rose from USD 1.086 billion in 2005 to USD 9.724 billion in 2013. In 2015 there were some 50 mining projects at various stages of development, representing investments of around USD 63 billion, primarily in copper mining. The mining industry makes a significant fiscal contribution as well: in 2013 it accounted for 9.4% of total government tax revenues.

Despite its reputation as a primary minerals producer, Peru has a number of foundries and refineries, including copper refineries at Ilo, a steel mill at Chimbote, a zinc plant at Cajamarquilla (near Lima) and a facility for lead and other metals at Oroya, along with the MINSUR tin foundry and refinery at Pisco (Ica), some of which have been linked to local pollution problems. At the artisanal scale, gold-mining is the most important: 85% of artisanal miners are engaged in this activity, which in 2006 produced an estimated 24 tonnes of gold, representing roughly 10% of national production with an estimated value of USD 390 million.

One of the main problems with small-scale and artisanal mining is the growth of informal and illegal activities that have major consequences, both social and environmental (destruction of vegetation and soils and irresponsible release of mercury into waters and the environment), driven by the high prices obtained for minerals in recent years. As a result, the government is actively promoting a programme to formalise small-scale and artisanal mining and to eradicate illegal mining (Supreme Decree No. 045-2010-PCM). Law No. 30011 gave the Agency for Environmental Assessment and Enforcement (OEFA) authority to conduct environmental audits of mining activities of this kind, which are pursued without any operating or environmental permit. The corrective environmental management instrument, created by Supreme Decree No. 004-2012-MINAM, applies to existing small-scale and artisanal mining operations that are in the process of formalisation, to bring them into line with legally determined environmental obligations.

In Peru, natural resources in the ground are the property of the nation, and the State governs access to them, granting rights for their exploitation through concessions, which in the case of mining give their holder the right to explore and exploit these resources. The General Mining Act (Supreme Decree No. 014-92-EM) regulates mining activity in the country. Supreme Decree No. 020-2008-EM establishes environmental regulations for all mining exploration activities. Supreme Decree No. 040-2014-EM approves environmental protection and management regulations for mining activities, including operations, profits, general work, transportation and storage, replacing the former regulations that were in place for nearly 21 years. Currently, some 15% of the territory is covered by mining rights, and roughly 64% is closed to mining.

In general terms, the preservation of air and water quality is covered by the respective environmental quality standards, Supreme Decree No. 002-2008-MINAM and Supreme Decree No. 006-2013-MINAM, while air emissions and mining effluents are covered by specific maximum permissible limits. In 2013, environmental quality standards for soils were issued (Supreme Decree No. 02-2013-MINAM). In order to reduce discharges into the water from metal mining operations, mining companies were required to submit a comprehensive adjustment plan and to implement the maximum permissible limits and environmental quality standards (Ministerial Resolution No. 154-2012-MEM/DM). The deadlines initially set between 2012 and 2015 for delivery of the comprehensive adjustment plan and compliance with the respective maximum permissible limits and environmental quality standards have been repeatedly extended.

In terms of socioenvironmental concerns, Supreme Decree No. 042-2003-EM, which regulates the previous commitments, was amended in 2010. This is binding on all mining permit holders; it relates to sustainable development, environmental and social excellence, compliance with social accords, responsible relationships, local employment, economic development and ongoing dialogue.

There has been a notable increase in conflicts between mining project developers and the communities or populations affected by these initiatives. The main cause of these conflicts is the concern of local people for their lands, waters and environment, which are nearly always their only means of livelihood. Prior consultation (Law No. 29785, its regulations, Supreme Decree No. 001-2012-MC and the principles of ILO Convention No. 169), participatory workshops and public hearings are instruments for informing the public about mining projects and mitigating potential environmental impacts, as well as for preventing social conflicts. The active participation of the populations of mining areas, through negotiations and adjustments to the project, makes it easier to obtain their approval in the respective regions. The Government of Peru is addressing the management of social conflicts through Ministerial Resolution No. 161-2001-PCM. In 2012, the government established the National Office for Dialogue and Sustainability (ONDS) to help resolve the great number of mining-related disputes.

To address the problem of the environmental liabilities from mining, Law No. 28271 recognises the risks and hazards they pose for the country, particularly in the Andean region. Since 2003, the law regulating mine closures (Law No. 28090 and regulations of 2005 and 2006) holds mining companies liable at the time their operations are closed, and stipulates the measures to be taken to avoid risks to people and the environment. Peru keeps an inventory of mining operations' environmental liabilities, with 8 616 such operations identified in 2015 by the Department of Mining, Ministry of Energy and Mining), which includes an estimate of the risk to people and the environment. According to that inventory, 50% of these environmental liabilities pose a high or very high risk. Peruvian legislation on the treatment and clean-up of these environmental liabilities is a model for Latin America. In 2006, the government established the enterprise Activos Mineros S.A.C to oversee the environmental remediation of sites abandoned by the former State-owned mining enterprises, CENTROMIN. Those environmental liabilities that cannot be attributed to a responsible party will be treated and mitigated by the Peruvian State at the central and regional levels, under Law 28271. Of all the environmental liabilities identified, only 10% of instances have remediation instruments, and responsible parties have been identified for only 12%: in other words, there are 7 531 environmental liabilities (as of 2015) for which no responsible party has been identified and for which there is no mitigation plan.

Peru has just ratified the Minamata Convention, which establishes strict measures for the production, import, export, use and disposal of mercury. That ratification will be an important step toward reducing environmental pollution and risks to human health.

Recognising the importance of tax revenues from mining, and in a bid to make mining taxation more transparent, Peru was the first country in Latin America to adopt the related standards of the Extractive Industries Transparency Initiative (EITI), setting an example to other major mining countries in the region. Peru's experience shows that considerable progress can be made through EITI in terms of bringing transparency to payments from mining companies and determining the extent to which those payments flow back into the development of mining areas. A growing number of OECD countries are now implementing this standard (for example Norway, the United Kingdom and the United States).

Recommendations

- Continue with policies aimed at resolving the problem of mining environmental liabilities, generating more in-depth information on risks, capitalising on their economic potential (secondary mining), identifying ownership and responsibilities, and designing and implementing monitoring mechanisms. Increase remediation efforts, with particular emphasis on abandoned sites and those that pose the greatest risks. Establish responsibilities and funding needs for the remediation of abandoned mining environmental liabilities and make use of international technical co-operation. Ensure that environmental liability remediation plans are adopted and overseen by the National Environmental Certification Service for Sustainable Investment (SENACE) and OEFA, respectively.
- Continue and step up efforts to eradicate illegal mining and to formalise informal mining activities. Pay particular attention to small-scale and artisanal mining, by means of technological assistance and marketing promotion schemes, to allow them to attain economies of scale and to formalise and adopt environmentally sustainable technologies and practices.
- Move towards artisanal mining methods that use internationally accessible techniques and standards to prevent environmental degradation and repercussions for the health and quality of life of people in the affected areas, particularly in the case of gold-mining.
- Within the scope of their responsibilities for the mining sector, decentralised governments should strengthen the role of regional governments in the area of environmental permits and oversight, and ensure implementation and funding, staff training and co-ordination with the Ministry of the Environment and Mines and OEFA.
- Ensure the full implementation of the principle of internalising costs or requiring polluters to pay. Ensure that the revenue from mining activities contributes to the country’s sustainable development through long-term investments in other forms of capital (human, physical or natural), giving fairer consideration to social and geographical realities.
- Continue to promote greater transparency regarding the impact of mining activities on the environment and people’s health. Strengthen effective access to information and broad active participation in licensing processes. Promote the inclusion of environmental topics in different transparency initiatives, such as the Extractive Industries Transparency Initiative.

1. Characteristics of the sector

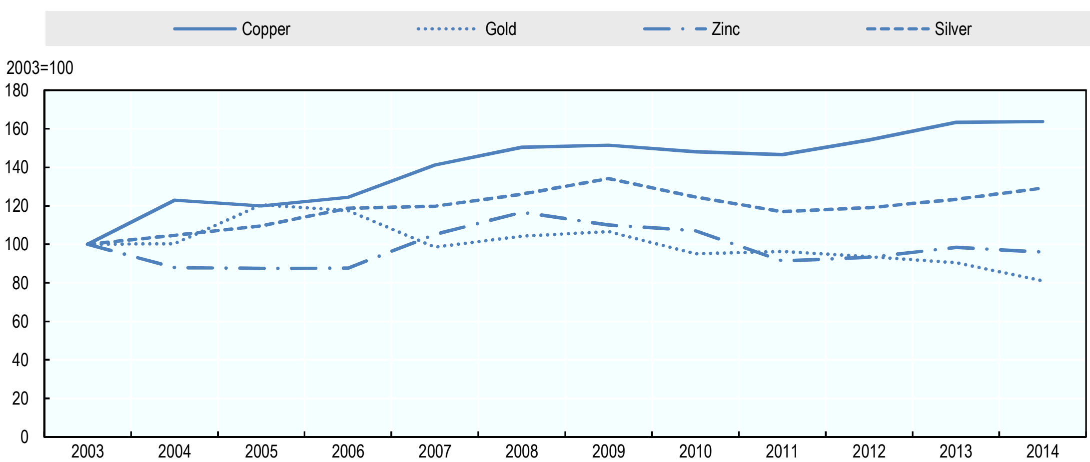
Mining is a very important sector for Peru’s economy. Between 2003 and 2013, extraction of oil, gas and minerals generated around 14% of GDP, although in recent years it has contributed around 12%. The mineral extraction subsector is particularly noteworthy. In 2007-2013, it contributed more than 11% of GDP at constant 2007 prices (National Institute of Statistics and Informatics (INEI) online) and accounted for around 60% of Peru’s total exports (MINEM/IIMP, 2010). The main destinations for mineral exports are Canada, China, Switzerland and the United States of America.

Peru is the world's second largest producer of silver and the third largest producer of copper and zinc. It is Latin America's leading producer of tin, gold, lead, selenium and zinc and its second producer of copper, silver, molybdenum, cadmium and rock phosphate. Copper and gold account for around 75% of mining exports. In 2013, domestic copper production totalled 1.4 million fine tonnes, or 7.5% of world production, while gold production was 5 million fine ounces, or 5.7% of world production (MINEM, 2015a).

During the 2003-2013 period, copper and silver production increased, zinc production remained stable and gold production decreased (Figure 12.1). According to the Ministry of the Environment and Mines (MINAM, 2014), mining is concentrated in the following Peruvian departments: (i) copper: Áncash, Arequipa and Moquegua; (ii) gold: La Libertad, Cajamarca and Madre de Dios; (iii) silver: Pasco, Áncash and Junín; (iv) zinc: Áncash, Pasco and Junín; (v) lead: Pasco, Lima and Junín.

Figure 12.1. Mining production

(Base: 2003 =100)



Source: Prepared by the authors on the basis of MINEM (2015), *Anuario Minero 2014*.

Investment in mining grew by 814% between 2005 and 2013, from USD 1.086 billion in 2005 to USD 9.724 billion in 2013, reflecting the sector's current importance, which is projected to continue to grow in the future (MINEM, 2015b). The regions that have received the most investment in recent years are Arequipa, Apurímac, Junín and Cusco, which absorbed more than 50% of the total. In 2015, there were some 50 mining projects, representing investments of USD 63 billion, primarily in copper mining.

The mining sector is highly capital-intensive, but it is also a major source of employment. In 2013, more than 183 000 direct and contract jobs were created in the sector. That same year, 93% of jobs were performed by men and only 7% by women, and around 20% were in the Arequipa region. On average, 45% of mining jobs in each region were performed by workers from other regions. For example, a full 78% of mining jobs were held by migrants in the Amazonas region. Mining makes a significant contribution to government tax revenues, contributing an average 15% of the total in 2003-2013. A peak year was 2007, when mining contributed just under 25% of revenues, compared with 9.4% in 2013.

Table 12.1. Mining share in tax revenues

PEN millions and percentages

	2003	2004	2004	2006	2007	2008	2009	2010	2011	2012	2013
Total internal tax revenues	21 349	24 018	28 002	36 941	43 616	46 956	45 420	53 521	64 206	72 463	76 683
Taxes from mining	1 092	1 741	3 123	7 731	10 761	8 985	4 859	8 132	11 258	10 633	7 181
Mining’s share of total	5.1%	7.2%	11.2%	20.9%	24.7%	19.1%	10.7%	15.2%	17.5%	14.7%	9.4%

Source: J. Korinek (2015).

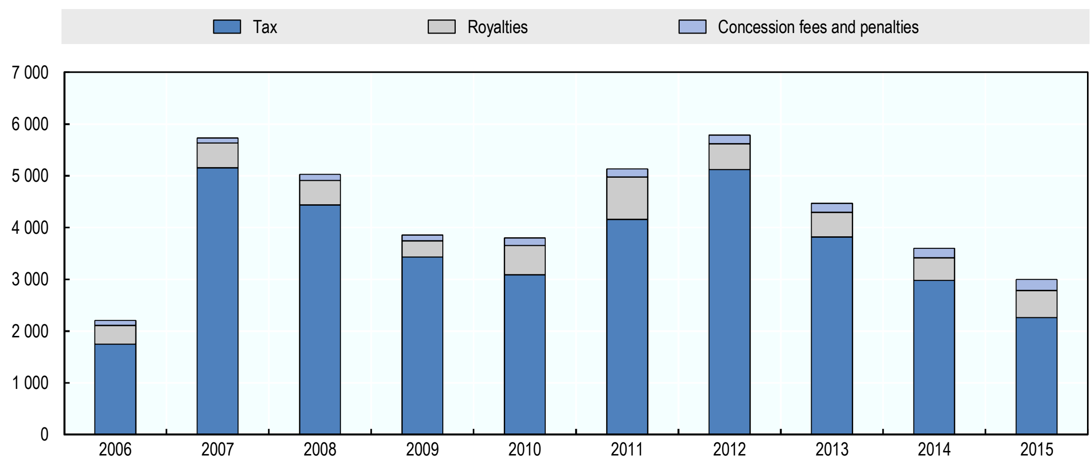
During the period covered by this environmental performance review, new provisions were adopted on tax collection and the allocation of mining revenue. During that period, the mining sector paid taxes and royalties and made other transfers via a number of mechanisms, including: (i) corporation tax (Supreme Decree No. 179-2004-EF); (ii) mining levy (Law No. 28322 of 2004)[1] (iii) royalties applicable to large- and medium-scale mining operations (Law No. 28258 of 2004);[2] (iv) “works for taxes”,[3] provided for in the law promoting regional and local public investment with private-sector participation (Law No. 29230 of 2008); (v) special mining tax (Law No. 29789 of 2011); (vi) special mining levy (Law No. 29790 of 2011).

In recent years, a more direct relationship has been established between the tax regime and mining companies’ operating profits and income. Although taxation is relatively high, the mining sector still contributes a modest share of government tax revenues. The mining levy has become an important tool for promoting the development of mining areas. It accounts for 50% of the corporation tax paid by the sector and is distributed among the regions, provinces and localities where mining is carried out. Figure 12.2 shows transfers to the regions from the mining levy, royalties, the annual mining good standing fee (allowing mining and mineral prospecting concerns to continue operating) and its associated penalty. Over the 2006-2013 period, these transfers averaged around USD 4.26 billion, of which 85% came from the mining levy. The regions that received the largest amount of transfers were Áncash, Arequipa, Cajamarca, La Libertad and Tacna.

Although progress has been made with the distribution of mining revenues, further action is needed to promote their contribution to Peru’s sustainable development via long-term investment in human, physical and natural capital, with the adoption of more equitable criteria that take into consideration different social and geographical situations.

Figure 12.2. Contribution of mining to the regions

(PEN millions at current prices)



Source: Prepared by the authors on the basis of MINEM (2016), *Anuario minero 2015*.

Peru's underground natural resources are the property of the nation and are administered by the State, which grants exploitation rights, consisting of concessions for exploration and exploitation. In 2015, the relevant activities covered 1.22% of the country's surface area. As around 14% of the total surface area is subject to mineral rights, there is thought to be great potential for further exploration and extraction. In addition, mining is banned across 65% of the country's area, due to restrictions aimed at protecting natural areas (core and buffer zones), areas for special projects, archaeological sites and other areas (MINEM, 2016). The Metals Economic Group reported that, in 2007-2014, investment for exploration averaged USD 646 million per year. This peaked at USD 1.035 billion in 2012, before dropping again.

Mining operations in Peru fall into four categories according to the size of the concession and the installed production capacity: large-scale, medium-scale, small-scale and artisanal (Table 12.2). Large-scale mining is highly mechanised, comprises mainly opencast mines and includes prospecting, exploration, development, extraction, concentration, refining and transportation activities. Medium-scale mining is concentrated in some 100 companies, is mechanised and consists of mineral extraction and concentration activities. Small-scale mining consists mainly of extracting and processing gold from underground mines and alluvial deposits (MINEM, 2016).

Of the 10 200 mineral rights holders registered by the Ministry of Energy and Mining (MINEM) in December 2015, a total of 6 946 were engaged in artisanal mining, 2 093 in small-scale mining, and 1 661 in large- and medium-scale mining.

Over the 2006-2015 period, artisanal and small-scale mining produced 13% of the gold mined in Peru, 2.4% of the silver, 1.8% of the lead, 0.6% of the zinc and 0.2% of the copper. A total of 85% of artisanal miners are engaged in gold-mining, producing around 10% of domestic output, with an estimated value of USD 390 million.

Table 12.2. Classification of mining operations

Category	Concession size	Installed production capacity
Large-scale mining	Unlimited	More than 5 000 tonnes/day
Medium-scale mining	Unlimited	350 metric tonnes/day to 5 000 tonnes/day
Small-scale mining	Up to 2 00 hectares	Up to 350 tonnes/day
Artisanal mining	Up to 1 000 hectares	Up to 25 tonnes/day

Source: MINAM (2015), "Estudio de desempeño ambiental 2003-2013", Documento de Trabajo, Lima.

Peru has a number of foundries and refineries, including copper refineries at Ilo, a steel mill at Chimbote, a zinc plant at Cajamarquilla (near Lima), a facility for lead and other metals at Oroya and the MINSUR mining company's tin smelter and refinery at Pisco (department of Ica), some of which are currently causing local pollution problems. In 2014, the country was the world's thirteenth biggest producer of cast copper and the sixteenth biggest producer of refined copper.

2. Environmental pressures and problems

While the mining sector is a major contributor to Peru's economy, it is also a source of environmental pressures that often lead to social conflicts of varying intensity.

The environmental pressures exerted by mining include: (i) emissions and contamination of air, water and soil; (ii) mercury pollution; (iii) environmental impact of informal and illegal mining; (iv) risks and hazards associated with environmental liabilities; (v) socioenvironmental conflict.

2.1. Emissions and pollution

The Ministry of the Environment distinguishes different types of impact according to the four categories of mining operation. The Ministry reported (MINAM, 2014) that large-scale mining companies had improved their processes to meet international environmental requirements. In contrast, medium- and small-scale mining operations still use environmentally unfriendly production methods. In addition, illegal mining places an enormous pressure on the environment and has undesirable effects on human health.

Water pollution

The mining sector is one of the biggest water users and produces large volumes of wastewater. A high proportion of the sector's effluent discharges is authorised, provided that they are treated first. According to the national water authority (ANA), in 2012 mine wastewater made up 81% of all authorised discharges and mine discharges were concentrated in the departments of Cajamarca, Áncash and Junín. In addition, there is unauthorised dumping of inadequately treated or untreated waste from informal mining operations.

Water quality monitoring has been carried out in areas of influence of mining operations to assess compliance with maximum permissible limits. Between 2007 and 2010, Peru's energy and mining investment regulator (OSINERGMIN) performed several watershed monitoring inspections. Those carried out between 2010 and 2013 revealed significant non-compliance with environmental quality standards for pH, arsenic, cadmium, copper and lead (Table 12.3).

Table 12.3. Non-compliance with environmental quality standards on surface water, 2010-13

Element	Cases of non-compliance	Samples analysed	Percentage of non-compliance
pH	75	287	26
Weak acid dissociable(WAD) cyanide	0	7	0
Arsenic	10	127	8
Cadmium	8	48	17
Copper	60	119	50
Lead	9	42	21
Total	162	630	26

Source: MINAM (2015), "Estudio de desempeño ambiental 2003-2013", Documento de Trabajo; and information provided by the Agency for Environmental Assessment and Enforcement.

Air and soil pollution

Unsustainable environmental practices contaminate soil and air with heavy metals and other chemicals. Of particular concern in the cities of La Oroya and Pasco is pollution from mining and metallurgy facilities, which exposes workers and local residents to lead emissions (Astete et al., 2009). High mercury levels have also been detected in different areas of Peru, including the Amazonian department of Madre de Dios, where the government was forced to declare a state of emergency in 2016 for that reason.

Soil and air quality studies of mining areas have shown pollution above permitted levels. Soil contamination stems from high levels of non-compliance with emission standards for cadmium, arsenic, lead and mercury, which, in many areas, exceed the limits laid down in national legislation. With regard to air emissions, non-compliance is particularly marked in the case of sulphur dioxide and, to a lesser extent, lead (Table 12.4).

Table 12.4. Non-compliance with environmental quality standards on soil and air, 2010- 13

	Element	Cases of non-compliance	Samples analysed	Percentage of non-compliance
Soil	Arsenic	41	76	54
	Cadmium	53	80	66
	Mercury	23	65	35
	Lead	36	75	48
	Total	153	296	52
Air	Sulphur dioxide	379	894	42
	Lead	1	65	2
	Particulate matter(PM_{10})	0	433	0
	Total	380	1392	27

Source: MINAM (2015), "Estudio de desempeño ambiental 2003-2013", Documento de Trabajo; and information provided by the Agency for Environmental Assessment and Enforcement.

The figures in Table 12.4 show high levels of non-compliance with environmental regulations, making it important to conduct more frequent and extensive monitoring. As environmental quality standards were set fairly recently, the analysis of cumulative effects prior to their adoption needs to be expanded. While increased environmental monitoring by OEFA and the introduction of comprehensive environmental assessment plans are positive, there is still a long way to go in this area. OEFA is responsible for overseeing large- and medium-scale mining operations, whereas regional governments are responsible for overseeing artisanal and small-scale mining, for which no systematised information is available.

Further measures should be implemented to ensure the full application of the principle of internalising costs and the polluter-pays principle, in order to reduce the harmful environmental and social effects of mining. In addition, information on measurements and concentrations of contaminants should be made more widely available to the public.

Mercury pollution

Mercury pollution is one of the most serious problems associated with small-scale informal and illegal gold-mining. Misuse of mercury in gold-mining is extremely harmful to both human health and the environment.

Domestic demand for mercury fuelled growth in imports, which rose from 34 tonnes in 2000 to 194 tonnes in 2011. However, since 2011, mercury imports have decreased significantly as a result of government controls, especially in the wake of Peru's signature and ratification of the Minamata Convention on Mercury (MINAM, 2016a).

Mercury is a bioaccumulative neurotoxin, meaning that direct and indirect exposure can have critical consequences, the severest of which are damage to the brain and central nervous system, miscarriage, congenital malformations and psychological and physical developmental disorders, especially in children. Bioaccumulation stems mainly from methylmercury contamination of fish, with indigenous communities living near gold-mining areas in the Amazon (for which fish is a staple food) presenting the greatest exposure to this pollutant, with levels far exceeding those recommended by the World Health Organization (Brack et al., 2011).

One of the areas most exposed to pollution, and which exhibits the highest mercury concentrations, is the department of Madre de Dios, where around 10% of Peru's gold is mined, mainly by the artisanal mining sector, which is characterised by a high level of informality. An estimated 2.8 kilos of mercury are used for every kilo of gold mined, which is a very high ratio (Brack et al., 2011).

Recent studies in Puerto Maldonado (capital of the department of Madre de Dios) found that 78% of adults had an average hair mercury concentration three times higher than the benchmark dose limit and that the highest-risk group was women of childbearing age (MINAM, 2014). Moreover, 60% of the most consumed fish species contained mercury levels above international reference limits. In May 2016, the government declared a state of emergency in the department of Madre de Dios, owing to high levels of mercury contamination of river water, live aquatic species and the general public.

In spite of Peru's efforts to control mercury discharges from mining operations, these have been inadequate. At the time the environmental performance review was conducted for the 2003-2013 period, strict trade controls on mercury had not been implemented. Furthermore, not enough is yet known about its source and the amount of mercury used in gold production. Further information is also required on the existence of gold mines whose metallogenic structure might mean that they contain natural mercury. In short, it is necessary to ascertain the precise amount of mercury generated as a by-product and where this metal is stored or disposed of.

2.2. Environmental impact of informal and illegal mining

Informal and illegal mining is practised in most regions of Peru, including protected natural areas and buffer zones (Figure 12.3). Such mining activities have proliferated in different areas of the country in response to soaring international prices for metals, particularly gold (SPDA, 2014).

Around 70 000 miners are involved in informal and illegal mining operations, where they process alluvial deposits using highly rudimentary techniques (Gestión, 2014). The use of such techniques has a heavy impact generally and causes irreversible harm to humans and the environment. Brack et al. (2011) mention a number of unregulated extractive practices that cause environmental damage, including: (i) the use of dredgers to extract tonnes of material from the riverbed; (ii) the indiscriminate dumping of mercury into water.

One of the areas most affected by informal and illegal mining is the department of Madre de Dios, where gold is extracted from rivers, causing immense damage. Apart from the effects mentioned above, this practice has led to the mass destruction of vegetation and soil. Such mining activities are carried out in a highly problematic social environment, characterised by the emergence of a large number of totally unplanned settlements whose residents lack basic services.

Control of small-scale and informal mining operations, including environmental monitoring, was transferred to regional governments in line with a decentralisation policy. The delegation of powers from the Ministry of Energy and Mining to regional governments took place in 2006 (Ministerial Resolutions Nos. 179-2006-MEM/DM and 550-2006-MEM/DM).

The State has adopted a number of measures to eradicate illegal mining and formalise informal mining, including the enactment of several laws in recent years. Nonetheless, the measures are still inadequate and should be strengthened. Marketing schemes and technical assistance programmes should also be reviewed, in order to facilitate economies of scale and the formalisation and adoption of sustainable technology and practices to prevent environmental degradation and protect people’s health and quality of life.

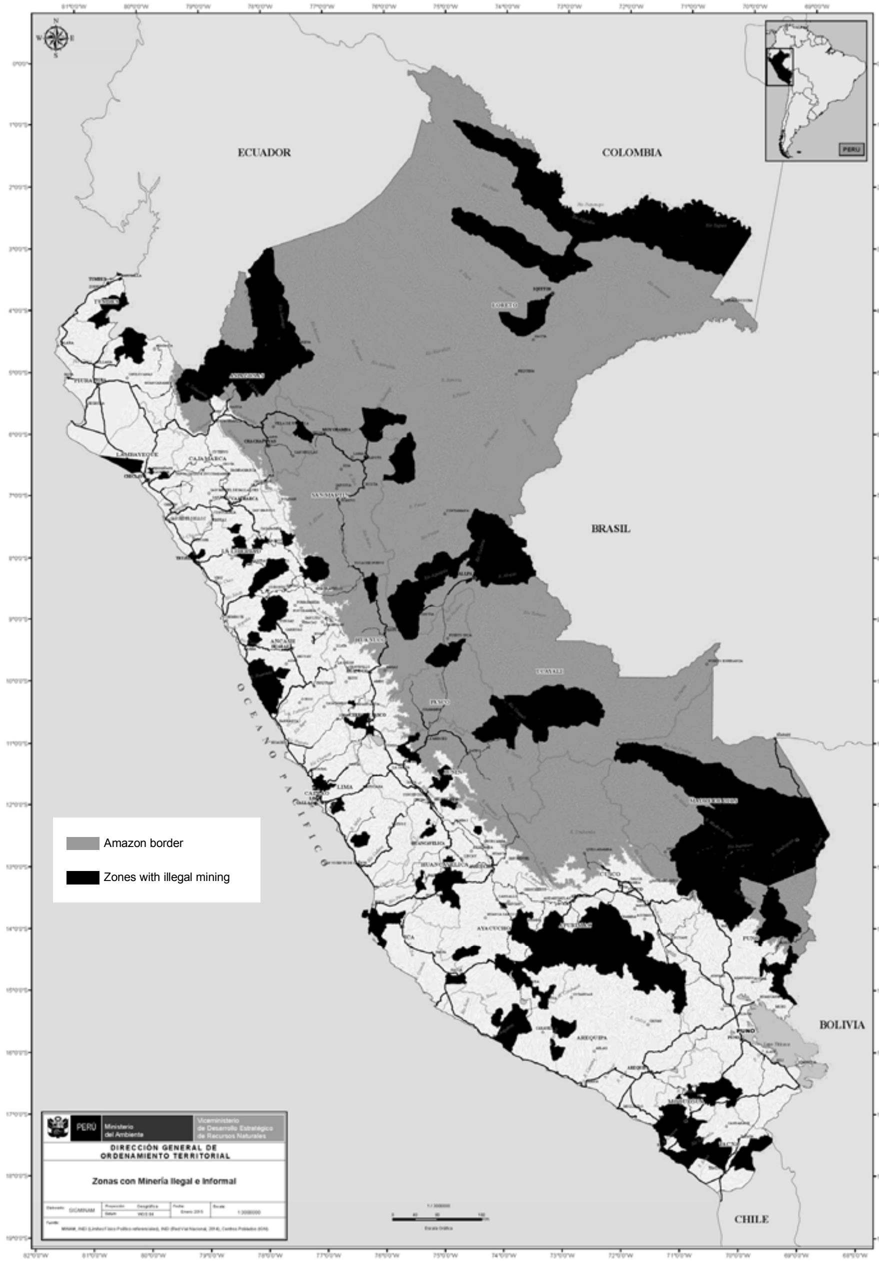
2.3. Mining environmental liabilities

Law No 28271 regulating environmental liabilities from mining defines these liabilities as facilities, effluents, emissions, waste or tailings resulting from mining operations at sites that are currently abandoned or inactive and that pose an ongoing threat or potential risk to people’s health, the surrounding ecosystem and property.

Mining environmental liabilities are a serious hazard to life, health and the environment because of the possible presence of toxic substances and heavy metals in tailings and waste rock. The risks are surface run-off, seepage and acid mine drainage, which can contaminate surface and groundwater and a variety of ecosystems. In addition, wind can carry off any particulate matter present, which could affect people through inhalation or the ingestion of contaminated water and food, while extreme weather events could weaken the physical stability of dumps, possibly causing tailings to break loose.

The Ministry of Energy and Mining has kept an inventory of mining environmental liabilities since 2006, with 8 616 such sites registered by 2015. According to the related assessment of risk to humans and the environment, 50% of mining environmental liabilities pose a high or very high risk. Although mining environmental liabilities exist in all regions of Peru, most are found in the regions of Áncash, Cajamarca and Puno, each of which has more than 1 000 such liabilities (Oblasser, 2016).

Figure 12.3. Areas where illegal and informal mining are concentrated



Note: the boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations and the OECD.
Source: Ministry of the Environment.

Peru has a number of laws regulating mining environmental liabilities and mine closures, many of which set an example to the rest of the region. The biggest problems posed by such liabilities are the existence of abandoned mines whose owners have not been identified and the need for greater funding to remediate them. Remediation mechanisms are available for only 10% of mining environmental liabilities and only 12% of those responsible for mining environmental liabilities have been identified. As of 2015, those responsible for 7 531 liabilities for which there was no mitigation plan had still not been identified (Office of the Ombudsman, 2015). The Ministry of the Environment (MINAM, 2014) highlighted some serious problems arising from abandoned tailings and closed mines that had not been subject to any sort of remediation.

2.4. Socioenvironmental conflicts

Socioenvironmental conflicts relate mainly to the availability of natural resources, competition for their use and conditions that potentially endanger the health of local residents. They also relate to overlaps in various types of concession, including for mineral exploration and mining, and the territory of some communities (MINAM, 2014). The Office of the Ombudsman (2007) identified the following causes of socioenvironmental conflicts in Peru: (i) people's fear of pollution from extraction activities; (ii) their negative perception of others' enrichment from land they inhabit; (iii) their lack of confidence in the State's ability to prevent pollution and degradation of their living environment; (iv) the perceived incompatibility between extractive operations and farming and other economic activities; (v) the impact on communities.

Over the 2003-2013 period, conflicts intensified, especially between mine operators and communities. The Office of the Ombudsman (2013) reported that, in December 2013 alone, there were 139 socioenvironmental conflicts, representing 64.4% of all conflicts recorded. Most related to mining (74.8%) and hydrocarbon extraction (12.2%). The departments with the highest concentration of such conflicts were Áncash, Apurímac, Cajamarca, Ayacucho, Puno and Cusco.

3. Sectoral policies, regulatory framework and oversight

3.1. Institutional framework

During the period covered by the review, both the institutional framework and laws governing the mining sector underwent a number of changes, giving rise to new methods of co-ordination, project approval and environmental impact assessment.

Until the recent establishment of the Ministry of the Environment, the Ministry of Energy and Mining was responsible for overseeing most of the environmental aspects of mining. The responsibilities of the Ministry of Energy and Mining included both promoting mining investment and approving environmental impact assessments. This dual role was a source of conflict because, in many instances, the aims were incompatible: promoting investment or protecting the environment.

Under the national environmental impact assessment system (SEIA), whose rules of procedure were approved in 2009 (Supreme Decree No. 019-2009-MINAM), assessments of investment projects in the mining sector were standardised and environmental certification was made a mandatory prerequisite for new mining operations with a potentially significant environmental impact (MINAM, 2015). Before 2012, the approval rate of environmental impact studies of mining activities was 17% (MINAM, 2014).

The Department of Mining Environmental Affairs of the Ministry of Energy and Mining used to be responsible for conducting environmental impact assessments of mining projects. This changed in December 2012, with the enactment of Law No. 29968 and the creation of the National Environmental Certification Service for Sustainable Investment (SENACE), although the process of transferring the assessment role only began in 2015 (Supreme Decree No. 006-2015-MINAM). The environmental impact assessment system is mainly responsible for conducting semi-detailed environmental impact assessments and environmental impact statements for mining projects, while SENACE concentrates on detailed environmental impact studies for investment projects with a potentially significant environmental impact. One of the main SENACE mechanisms in the future will be a one-stop shop for environmental certification, which will check and approve detailed studies electronically**.**

3.2. Oversight and co-ordination

In 2007, the supervision and inspection functions originally performed by the Ministry of Energy and Mining were transferred to Peru's energy and mining investment regulator (OSINERGMIN) and, in mid-2010, to OEFA.[4] OEFA is responsible for large-scale activities, while regional governments and the Department of Mining of the Ministry of Energy and Mining oversee smaller-scale activities. OEFA also supervises national, regional and local environmental enforcement entities.

Between 2010 and 2015, OEFA processed around 1 000 files transferred from OSINERGMIN, satisfactorily in nearly 100% of cases (MINAM, 2016b). In 2010-2013, it also carried out 757 inspections of mining operations (68% scheduled and the remaining 32% in response to complaints or environmental emergencies) and issued 186 penalties for infringement of water, air or soil quality regulations (MINAM, 2015).

Following OEFA inspections of environmental enforcement entities, especially those of regional governments, in 2012-2014 the performance of these entities was found to be poor (MINAM, 2016b). OEFA and the Ministry of the Environment should therefore increase their provision of technical assistance, training and co-ordination.

Since 2013, environmental inspections have been carried out on the basis of watersheds, which allows for a comprehensive assessment of the performance of mining units operating in the same area and for an overall analysis of their impact on the environment.

As monitoring and oversight of mining operations are fragmented, it is essential to improve co-ordination between State institutions such as the Ministry of the Environment, OEFA, the national water authority, the Ministry of Health, the National Meteorology and Hydrology Service of Peru (SENAMHI), provincial municipalities and regional governments. In line with their respective roles in relation to the mining sector, they need to improve and expand training for their officials on granting concessions and conducting environmental inspections. They also need to ensure the effective implementation and funding of these tasks.

Table 12.5. Ex ante and ex post evaluations of mining projects

Ex ante	Ex post
Environmental impact assessment system	National environmental assessment and oversight system (SINEFA)
Environmental certification(Regional governments, Ministry of Energy and Mining and SENACE)	Environmental audits and enforcement(OEFA and regional governments)

Source: ECLAC elaborations on the basis of MINAM (2015) "Estudio de desempeño ambiental 2003-2013".

3.3. Legal framework for mining

The General Mining Act (Supreme Decree No. 014-92-EM), enacted in 1992, is the main regulatory framework for mining in Peru, with the Ministry of Energy and Mines charged with enforcing the Act's environmental aspects. The last 7 of the Act's 226 articles contain environmental provisions.

Environmental regulation of mineral exploration and mining activities has been introduced fairly recently. In 2008, environmental regulations were issued for mineral exploration activities (Supreme Decree No. 020-2008-EM) and in 2014, nearly 21 years after the first sector regulation was adopted, environmental protection and management regulations for mining activities, including operations, profits, general work, transportation and storage, were introduced (Supreme Decree No. 040-2014-EM). With regard to the main environmental pressures exerted by this sector, regulatory changes have been adequate overall, although many should be strengthened.

Provisions on water, air and soil pollution

The State has enacted laws and decrees to control and correct the environmental pressures exerted by mining. Even though mining regulations were amended during the 2003-2013 period, in line with World Health Organization guidelines on emissions, there is still a long way to go before they are fully implemented.

The Ministry of the Environment has announced mandatory environmental quality standards for mining. Water protection standards were enacted in 2008 (Supreme Decree No. 002-2008-MINAM) and, in 2013, similar provisions for the air and soil were adopted (Supreme Decree No. 006-2013-MINAM and supreme decree 002-2013-MINAM). Limits were also imposed on the discharge of effluents.

Mining companies are required to submit and adhere to comprehensive plans to bring their operations into line with the maximum permissible limits on the discharge of liquid effluents from mining and metallurgical operations (Ministerial Resolution No. 154-2012-MEM/DM). According to Miyashiro, Méndez and Orihuela de Campos (2014), between 2012 and 2015 successive deadlines were set for the submission of these plans, in an effort to apply the maximum permissible limits and environmental quality standards systematically.

Even though progress has been made at the watershed level in controlling the discharge of liquid effluents from metallurgical plants and mining complexes into water, a comprehensive national environmental monitoring network should be developed.

Provisions on mercury pollution

Environmental quality standards were recently adopted on permissible mercury concentrations in water (Supreme Decree No. 002-2008-MINAM) and in soil (Supreme Decree No. 002-2013-MINAM). In addition, the Solid Waste Act (Law No. 27314) includes rules on handling mercury. However, during the period covered by the review, mercury controls had not been effective enough.

The Government of Peru's efforts to control the use of mercury culminated in 2015 with the ratification of the Minamata Convention on Mercury (Supreme Decree No. 061-2015-RE), which establishes strict measures for the production, import, export, use and disposal of mercury. Ratification is expected to significantly reduce mercury use, environmental pollution and the risk to human health, as well as to strengthen controls on mercury.

Provisions on informal and illegal mining

Informal and illegal mining activities began several decades ago and have proliferated in response to soaring metal prices. The first attempt to regulate these activities was in 2002 with the enactment of a law to formalise and promote artisanal and small-scale mining (Law No. 27651), which includes a classification of activities in the subsector.

The State is actively promoting the formalisation of informal mining and the prohibition of illegal mining. This has included a national plan for the formalisation of artisanal mining (Supreme Decree No. 045-2010-PCM) and Emergency Decree No. 012-2010, which emphasises the need to regulate gold-mining in the department of Madre de Dios. Law No. 30011 empowers OEFA to conduct environmental inspections of companies working without any operating or environmental permit. The corrective environmental management instrument (IGAC), adopted in 2012 (Supreme Decree No. 004-2012-MINAM), applies to existing artisanal and small-scale mining operations that are in the process of being formalised, to bring them into compliance with current environmental legislation. This instrument seeks to prevent, mitigate and compensate any environmental damage caused by mining operations.

The strategy for rationalising artisanal and small-scale mining (Supreme Decree No. 029-2014-PCM) was adopted to promote environmentally sustainable processes that reduce the use of mercury and cyanide in mining operations, especially small-scale gold mining and processing. Measures implemented in this area have been adequate, but further efforts are required to ensure that internationally accepted techniques and standards are used in artisanal mining, particularly gold mining, to prevent environmental degradation and adverse effects on the health and quality of life of people living in affected areas.

Provisions on mining environmental liabilities

Law No. 28271, regulating environmental liabilities from mining, was enacted in 2004, mainly to prevent the risks they pose to the country. The Law identifies liabilities, establishes accountability and provides for funding remediation measures. The Law regulating mine closures (Law No. 28090 of 2003) and its implementing regulations of 2005 and 2006 defines mine closure plans, rehabilitation measures and required financial guarantees (Oblasser, 2016).

With regard to mine closures, mining companies in Peru have an obligation to take the necessary measures to avoid harming people and the environment. All mine closure plans must be approved by the Ministry of Energy and Mining and endorsed by OEFA. Between 2003 and 2013, the number of mine closure plans submitted rose from 11 to 78 (MINAM, 2015) and 36 closure plans for medium- and large-scale mines were approved in 2015. In 2010-2013, the number of OEFA environmental audits of mine closure plans increased from 8 to 16.

While Peru's laws on mine closures and mining environmental liabilities, and their respective registers, are considered to be extremely comprehensive and even to set an example for Latin America, real progress has been slow and mine closure and remediation plans have been drawn up for only a small percentage of mining environmental liabilities. One of the biggest problems has been determining the ownership of abandoned mine sites, in which case the high cost of their remediation falls on the State (central government and regional governments). It is therefore recommended to further strengthen funding policies, disseminate more information on risks, identify owners and managers, and develop and implement more monitoring mechanisms.

In 2006, a company called Activos Mineros S.A.C. was formed to handle the remediation of mining environmental liabilities left by former State-owned mining companies (CENTROMIN). In exceptional cases, CENTROMIN also handles the remediation of high-risk liabilities that have been abandoned or whose owners have not been identified.

Law No. 26793 established the National Environment Fund (FONAM) to analyse and promote investment in remediation. In addition, a number of legislative bills have been tabled which, if approved, would promote the remediation of mining environmental liabilities using funding from the State, the private sector and international institutions. In order to increase investment in and funding for remediation activities, consideration should be given to secondary mining to capitalise on the economic potential of mining environmental liabilities. It is also necessary to ensure that remediation plans are approved by SENACE and audited by OEFA.

Provisions on socioenvironmental conflict resolution

Concerns over socioenvironmental conflicts led the Government of Peru to launch, in 2004, a Strategic Analysis and Social Conflict Prevention Unit (UAEPCS) designed to raise funds to tackle social conflict preventively (ANGR, 2014). The project continued to evolve until 2012, when the National Office for Dialogue and Sustainability (ONDS) was established to resolve the large number of mining-related disputes. By June 2015, ONDS had co-ordinated 157 forums for dialogue across the country, 68 in response to mining-related disputes (MINAM, 2015).

Supreme Decree No. 052-2010-EM was issued in 2010, updating the regulations of 2003 on the prior commitment requirement for the development of mining activities. The new provisions, based on a sustainable development approach, attach special importance to such issues as compliance with social agreements, building responsible relationships, local employment, economic development and ongoing dialogue. Another tool available to the State for resolving social conflict is Ministerial Resolution No. 161-2011-PCM, which contains guidelines and strategies for social conflict resolution.

It is essential to disseminate information on mining projects to prevent potential environmental impacts and social conflicts. Of particular note are Peru's prior consultation instruments, specifically Law No. 29785 and its implementing regulations, Supreme Decree No. 001-2012-MC and the principles of International Labour Organization (ILO) Convention No. 169. Participatory workshops and public hearings have been held in this connection. Project approval is facilitated by involving residents of mining areas in negotiations and by adjusting projects. Effective public access to information and participation in the permit granting process should be expanded further to support this. It is also necessary to monitor compliance with agreements, as part of the effort to promote greater transparency on the possible impact of mining on the environment and human health.

Although the community relations plans stipulate a mining company's social obligations, identification and verification of such commitments should be improved, as should monitoring of compliance with commitments. Over the period covered by the review, three successive institutions have been responsible for oversight: the Department of Mining (until 2007), OSINERGMIN (until 2010) and now OEFA. In 2014, OEFA adopted an environmental best practices register, to create a culture of corporate social responsibility, and established a national environmental complaints information service (SINADA).

In a bid to make mining taxation more transparent, Peru was the first country in Latin America to adopt the related standards of the Extractive Industries Transparency Initiative (EITI), setting an example to other major mining countries in the region. However, EITI environmental provisions should be incorporated more fully.

Notes

[1] Amounting to 50% of government revenues from the mining sector.

[2] Percentage of the value of minerals extracted, increasing in line with sales volume. This revenue is allocated to local governments (80%), regional governments (15%) and universities (5%) to finance investment.

[3] Allowing private mining companies to invest the equivalent of up to 50% of their annual corporation tax in building infrastructure in mining areas.

[4] The Agency for Environmental Assessment and Enforcement (OEFA) is part of the Ministry of the Environment and was established by Supreme Decree No. 001-2010-MINAM.

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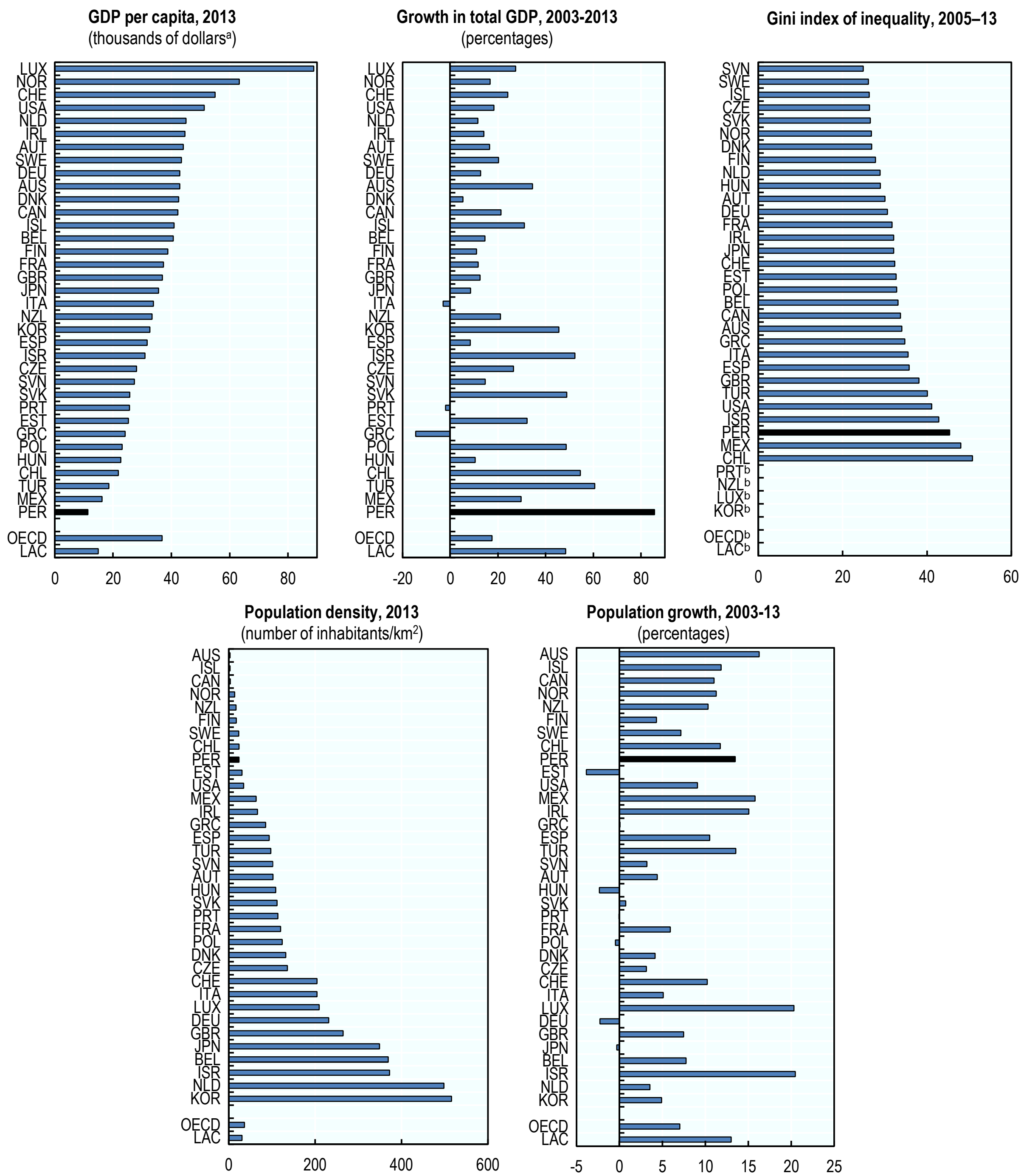
Annex I: Selected Data

I. A. Selected socioeconomic data



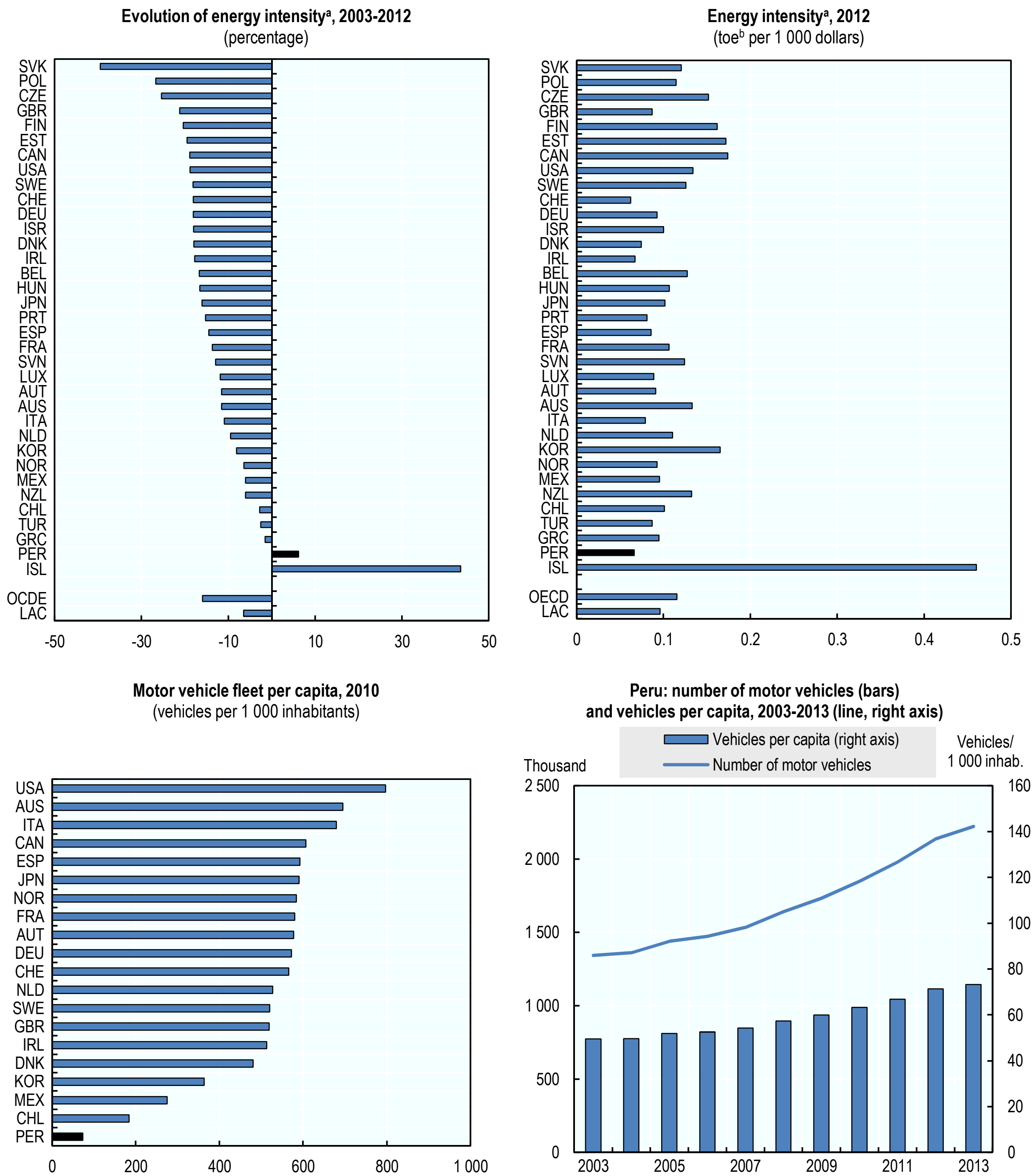
Note: Data are from the year indicated or the most recent year with information available; they may include estimated and provisional figures and calculations. Variations in definitions may limit the comparability of data between countries.

a. Gross domestic product at constant 2011 prices and purchasing power parity.

b. Not available.

Source: ECLAC calculations on the basis of CEPALSTAT database; national accounts information provided by OECD; and World Bank, *World Development Indicators*; information provided by the International Comparison Programme and national accounts information.

Total primary energy supply



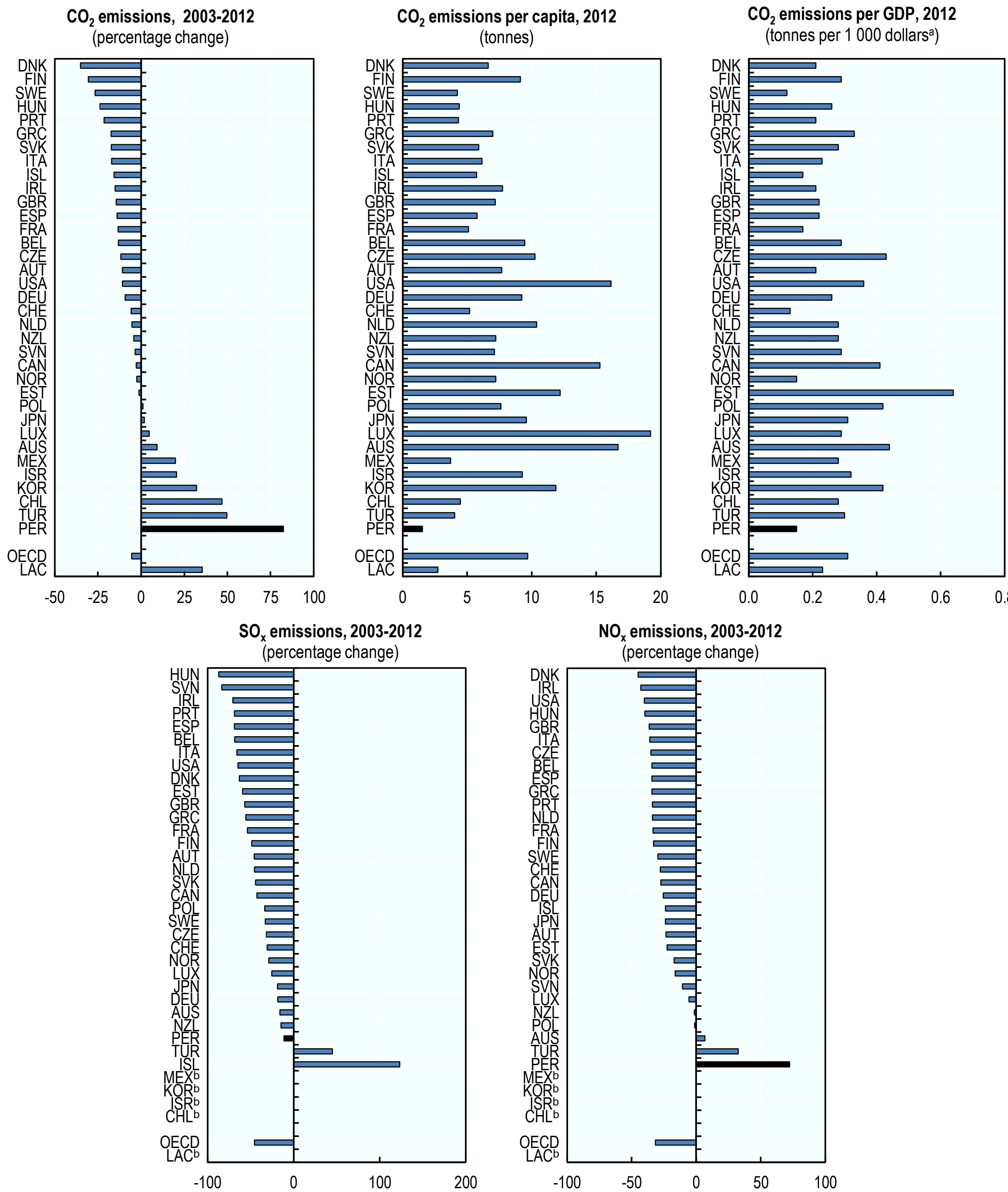
Note: Data are from the year indicated or the most recent year with information available; they may include estimated and provisional figures and calculations. Variations in definitions may limit the comparability of data between countries.

a. Total primary energy supply per unit of GDP at constant 2011 prices and purchasing power parity.

b. Tonnes of oil equivalent.

Source: ECLAC calculations on the basis of CEPALSTAT; OECD; IEA, *World Energy Statistics and Balances*; and National Superintendency of Public Registries of Peru.

I. B. Selected environmental data

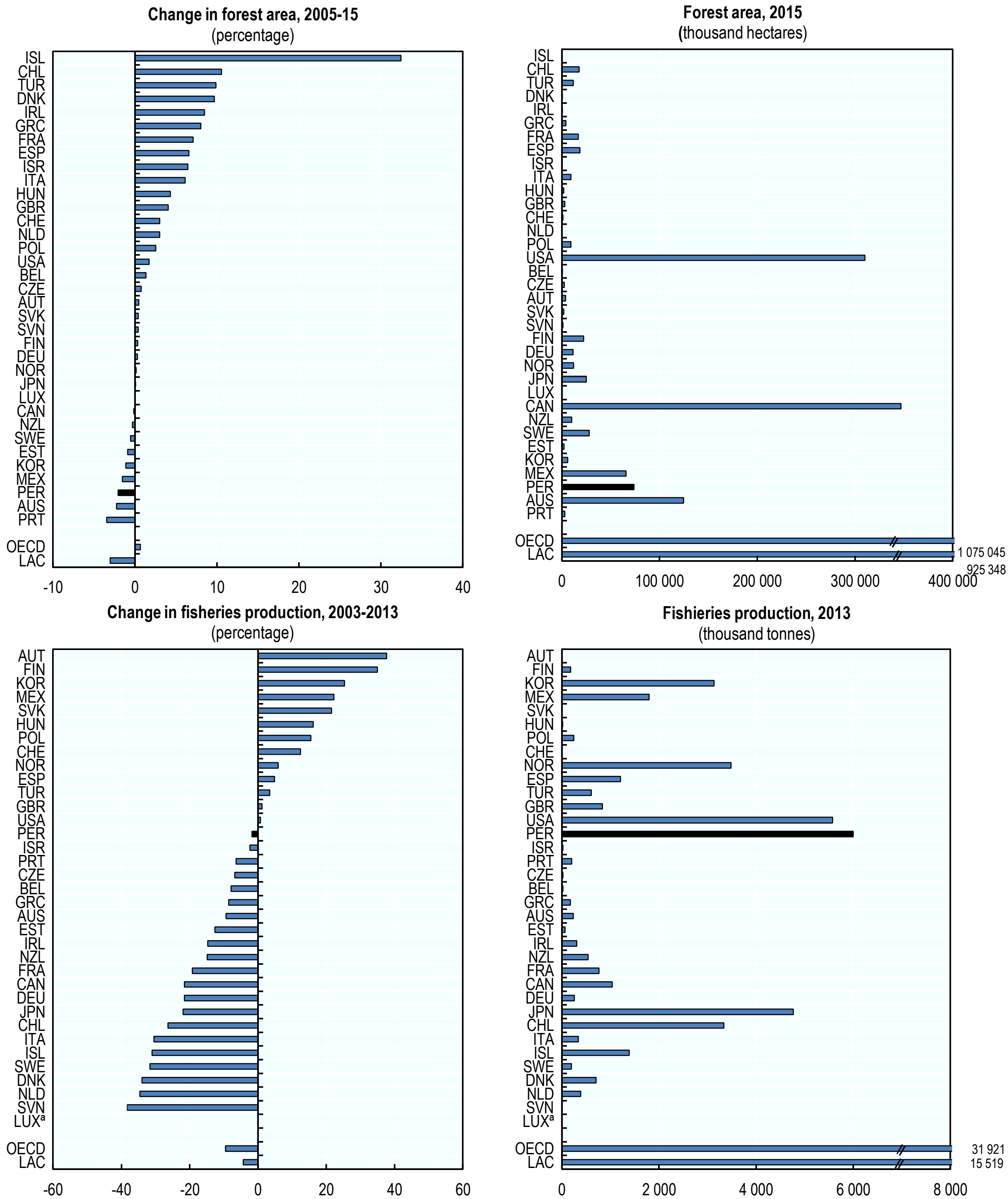


Note: Data are from the year indicated or the most recent year with information available; they may include estimated and provisional figures and calculations. Variations in definitions may limit the comparability of data between countries.

a. At constant 2005 prices and purchasing power parity.

b. Not available.

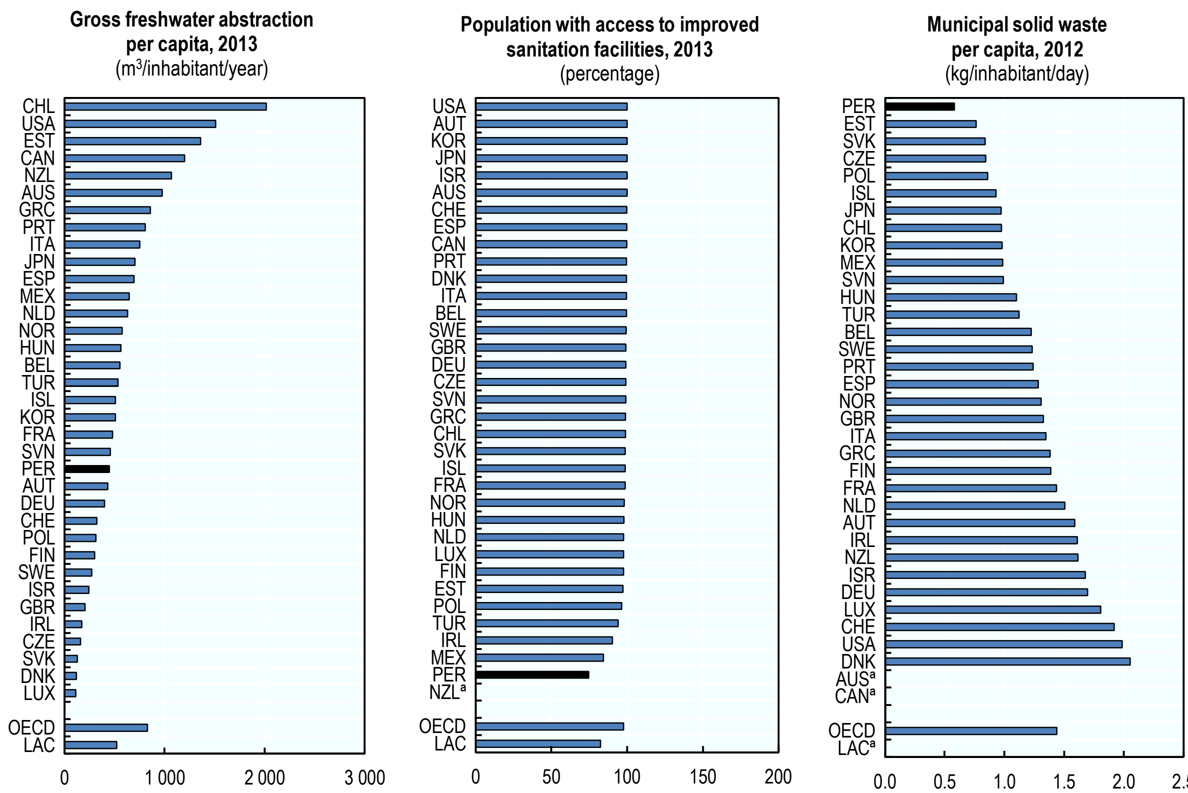
Source: ECLAC calculations, on the basis of OECD, IEA and Ministry of Energy and Mining of Peru.



Note: Data are from the year indicated or the most recent year with information available; they may include estimated and provisional figures and calculations. Variations in definitions may limit the comparability of data between countries.

a. Not available.

Source: Food and Agriculture Organisation of the United Nations (FAO), Statistics and Information Branch of the Fishery andAquaculture Department, 2016; *Global Forest Resources Assessment 2015*, Rome.



Note: Data are from the year indicated or the most recent year with information available; they may include estimated and provisional figures and calculations. Variations in definitions may limit the comparability of data between countries.

a. Not available.

Source: ECLAC calculations on the basis of World Bank, *World Development Indicators*; OECD and Ministry of the Environment of Peru.

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(97 2017 46 1 P) ISBN 978-92-64-28312-1 – 2017

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ISBN 978-92-64-28312-1
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