GLOBAL LAND OUTLOOK

Latin America and the Caribbean Thematic Report

Sustainable Land Management and Climate Change Adaptation

United Nations
Convention to Combat Desertification

This thematic report on Latin America and the Caribbean was commissioned by the Sustainable Development and Human Settlements Division of the Economic and Social Commission for Latin America and the Caribbean (ECLAC), within the framework of the Agreement between ECLAC and the United Nations Convention to Combat Desertification and Mitigate the Effects of Drought (UNCCD). The report was prepared with the generous support of the Changwon Initiative of the Republic of Korea.

GLO Latin America and the Caribbean Team

Coordinator and editor: Cesar Morales, E.

Contributors: Francisco Brzovic, David Candia and Maria Elena Cruz

Reviewers: Jose Miguel Torrico, Sasha Alexander

Layout and design: Miller Design

Manuscript editor: Marina Drummond

Recommended citation: United Nations Convention to Combat Desertification. 2019. The Global Land Outlook, Latin America and the Caribbean Thematic Report, Bonn, Germany.

For more information and GLO materials, please visit www.unccd.int/glo.

ISBN: 978-92-95110-85-4
eISBN: 978-92-95110-86-1

Printed on Rendezvous Super White paper FSC® 100% recycled.

Cover Photo: © Shutterstock - fleewinter.com

GLOBAL LAND OUTLOOK

Latin America and the Caribbean Thematic Report

Sustainable Land Management and Climate Change Adaptation

EXECUTIVE SUMMARY

The extensive arable land and great biodiversity present in Latin America and the Caribbean (LAC) have the potential to ensure sustenance and a good quality of life for its more than 600 million inhabitants. Nevertheless, the loss and degradation of lands and habitats is one of the region's main challenges.

Desertification, the degradation of lands and habitats, the disappearance of numerous animal and plant species, have become recurrent and even habitual phenomena in the region (GEO-6/LAC report, UNEP, 2016). This is the case of deforestation in Amazonia and other forest ecosystems, and the loss of grasslands in fragile mountain biomes. This is mostly the result of unsustainable land management. Regional and international demand for products such as crops, livestock, timber, oil and minerals put pressure on decision makers to prioritise short-term goals that may lead to degradation of the lands where such goods and services are produced.

Illegal, poorly controlled activities (such as mining and logging) that cause serious environmental impacts prevail in the region. Simultaneously, increased competition for resources, primarily land, and the growing number of players involved in its management and planning (all with disparate visions, interests and decision-making power), have led to a governance structure where conflicts are likely to increase.

Timely action to prevent, reduce and reverse land degradation can improve food and water security, contribute to climate change adaptation and mitigation, and avoid conflicts and migration. In this regard, the initiative for land degradation neutrality promoted by the United Nations Convention to Combat Desertification (UNCCD) should be highlighted. It is also worth noting the efforts of regional players committed to this struggle – ministries and/or sectoral services and some non-governmental organisation networks to institutionalise the fight against land degradation, recover pre-Hispanic technologies and promote sustainable management.

The large systems that dominate the arid, semi-arid and dry sub-humid lands of the region cover the territories of two or more countries, including: the dry and desert areas of Mexico; the Central American dry corridor; the arid and semi-arid zones of La Guajira in the Colombian Caribbean that penetrates into Venezuela; the plains of Colombia and Venezuela; the Brazilian Northeast region; the Gran Chaco region shared by Argentina, Bolivia and Paraguay; the highland ecosystems of Argentina, Bolivia, Chile and Peru; the coastal arid and hyper-arid zones that extend from the south of Ecuador through Peru to Chile; and the Patagonian steppe in Chile and Argentina that stretches down to Tierra del Fuego. In addition, there are the systems of the insular territories. These are the semi-arid and sub-humid lands in the Caribbean: namely the arid and semi-arid zones in some islands of the Netherlands Antilles and Aruba, in Hispaniola, in Cuba and in some smaller islands.

Other systems under intense pressure in the region occur in different climate contexts. These should be considered due to the expansion and intensification of agricultural activities, such as in the Amazon basin, the Brazilian Cerrado and grasslands (fields), the Uruguayan savanna and the humid pampas in Argentina.

LAC has experienced important changes in land use. When the Europeans arrived in the 15th century, the forest cover of LAC accounted for approximately 75 per cent of the territory. At present, forests cover less than 50 per cent of the territory, 90 per cent of which is due to the expansion of agriculture and livestock, especially during the 20th century and the beginning of the 21st century.

The continental territory of LAC covers around 22.5 million square kilometres; 20 per cent corresponds to Mexico and Central America, 1 per cent to the Caribbean and 79 per cent to South America. Between 1990 and 2016, the land for cultivation shifted from 7.8 per cent to 10 per cent, grasslands from 28.1 per cent to 29 per cent, forests from 49.8 per cent to 45.3 per cent and other land uses from 14.3 per cent to 15.7 per cent.

In LAC, the primary factors that have contributed to land degradation are population growth, deforestation and the management of grassland ecosystems (savannas, steppes, pampas, fields, etc.), as well as natural phenomena exacerbated or not by human action. As land degradation progresses, soil, hydrology, biomass, biodiversity and climate are all adversely affected.

In spite of the current trends, it is important to consider the notable advances in sustainable land management practices carried out since the pre-Hispanic era of LAC, such as those that incorporate efficient farming systems and agricultural practices that allowed the population to feed itself and incorporate new crop areas, while slowing down land degradation.

Regarding the factors that affect degradation, an analysis was carried out in eight LAC countries, considering six factors, as well as their concurrence and convergence in a certain geographical space, and their evolution in a certain period of time. The analysis revealed the occurrence of processes of land degradation. The factors considered were the following: Low content of organic carbon in the soil, aridity, water stress, change in soil cover and deforestation, plus all possible combinations among said factors. The countries studied were Mexico, Guatemala, the Dominican Republic, Ecuador, Peru, Paraguay, Brazil and Argentina. The database used and the method of analysis applied – Analysis of Convergence of Relevant Variables – correspond to those used in the World Atlas of Desertification, a project of the Joint Research Centre of the European Commission.

Without prejudice to the differences between and within countries, there are shared situations and similarities in their processes of land degradation. In all countries, the degraded area is a significant proportion of the national territory and the main variables that affect this process are repeated with great frequency. This is the case of deforestation, both as a variable considered individually, and combined with others. The same occurs, albeit on a smaller scale, with the incidence of soils with a low organic carbon content and the decline in productivity.

Finally, national, binational and sub-regional projects of technical and financial cooperation aimed at sustainable land management and climate change adaptation were identified, which, in some cases, incorporated biodiversity conservation and water resource management. In this review, projects of the Global Environment Facility (GEF) and projects of some agencies and international non-governmental organisations were analysed, among them: the Euroclima programme of the European Union; EU-funded initiatives grouped under the Integrated Zone of the Southern Cone (ZICOSUR); and the Ecosystem-based Adaptation (EbA) programme – in particular those initiatives implemented by the International Union for the Conservation of Nature (IUCN), and Initiative 20x20, under the aegis of the World Resources Institute (WRI) and the Bonn Challenge.

© Neil Palmer (CIAT)

Global Land Outlook
LATIN AMERICA AND THE CARIBBEAN THEMATIC REPORT

Contents

© Miguel Pinheiro/CIFOR

1. INTRODUCTION

Recent reports from national and international specialised agencies warn of the growing urgency of implementing all the necessary measures to preserve and develop the natural capital of the planet, a necessary condition for the survival of the human species.

Among the main messages of the Regional Evaluation for Latin America and the Caribbean of the GEO-6[1], the region hosts a significant portion of the planet's natural wealth and, at the same time, that the future of regional economies, as well as the capacity of the countries of Latin America and the Caribbean (LAC) to combat poverty and reverse inequality, depends greatly on natural capital and the ability of governments to manage it effectively.

The GEO-6/LAC report highlights that desertification, degradation of land and habitats, and the disappearance of numerous animal and plant species have become recurrent and even habitual phenomena in the region. This is the case of deforestation in Amazonia and other forest ecosystems, as well as the loss of grasslands in fragile mountain biomes, with the consequent reduction in ecosystem services and functions and the development and well-being of human beings.

It is relevant here to reproduce two paragraphs of the key message with which the aforementioned GEO-6 LAC report introduces the issue of land degradation in the region, highlighting its seriousness and calling for efforts to be focussed on land governance.

Global Environment Outlook 6 – Report on Latin America: Two key messages

The widespread degradation of terrestrial ecosystems in LAC is mostly the result of unsustainable land management. Regional and international demand for products such as food crops, livestock, wood, oil, and mining from LAC, coupled with adverse socioeconomic conditions and the need for foreign investment, exerts pressure on decision makers to prioritise short-term goals that may result in degradation of lands where these goods and services are produced.

Illegal activities, such as mining and logging, cause a very severe impact in the region. Government enforcement is essential for controlling these extremely damaging activities where some private individuals become rich while environmental impacts affect ecosystems and human settlements. The reduction of illegal logging and deforestation in the Brazilian Amazon are examples of how adequate government policies can reduce environmental impact. The increasing competition for resources (e.g. land) and the growing number of stakeholders (with disparate views, interests and decision-making power) in land management and planning has led to a complex land governance structure, where conflicts among actors for finite resources are occurring and are likely to increase.

Source: El estado de la biodiversidad en América Latina. UNEP 2016.

The report highlights that there are driving forces that will determine the future of the region, among which climate change stands out. This is a situation of great concern for LAC countries due to the expected impacts on water availability, food production, human health, land use, and physical and natural capital. Unsustainable production and consumption patterns are also a driving force that exerts increasing pressure on soil, water and biodiversity. The demographic changes that drive urbanisation and other forms of human settlements are forces that generate increasing demands on basic services for the population, such as the provision of water, energy, housing, health care, and the handling of chemicals and waste. The lack of attention to these driving forces will have far-reaching environmental and socioeconomic consequences.

This regional thematic report sets out to illustrate current trends in land degradation and desertification, as well as to show the changes in land use, and the losses of land resources. Driving forces and impacts of these trends and phenomena are identified. The regional perspectives of these processes, and the related challenges and opportunities of the future are also examined.

The first section presents a general review of this problem and the main trends recorded in recent decades. The second section contains an analysis of drylands, and the third section, of the conversion of forests to crops and their historical evolution.

The fourth section examines the main factors that affect land degradation and desertification in nine representative countries of each of the subregions of the continent: Mexico, Guatemala, Jamaica, the Dominican Republic, Ecuador, Peru, Paraguay, Argentina and Brazil. The fifth section presents a summary of the cost estimates of land degradation in LAC. The sixth section contains a systematisation of the main efforts deployed in the region to address the problems identified, both through investment projects aimed at sustainable land management and adaptation to climate change. The report closes with concluding points, perspectives and a review of major challenges for the region.

1.1 TERRITORIAL WEALTH OF LAC AND BIODIVERSITY

From the perspective of land in its broadest sense, LAC region has five million km^2 of arable land, 23 per cent of the world's forested areas, and between 60 and 70 per cent of all life forms on the planet. It receives 29 per cent of the rainfall and has approximately 30 per cent of the world's renewable water resources. The territory of LAC includes 12 of the 14 biomes of the world, and 867 unique ecoregions (Olson et al. 2001).

The extensive arable territory and the great biodiversity present in LAC have the potential to ensure both sustenance and a good quality of life for its population, which exceeds 600 million people. However, the loss and degradation of habitats continues to occur and is one of the region's main challenges.

Figure 1: Terrestrial biomes in Latin America and the Caribbean.

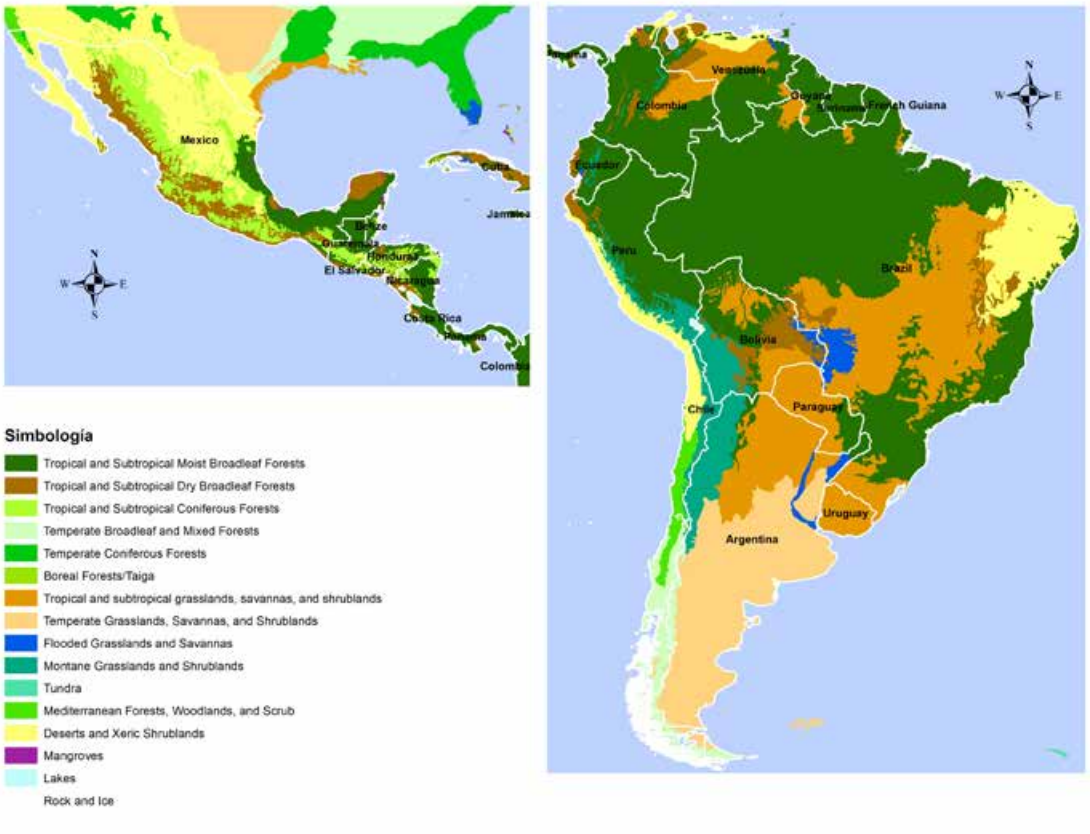
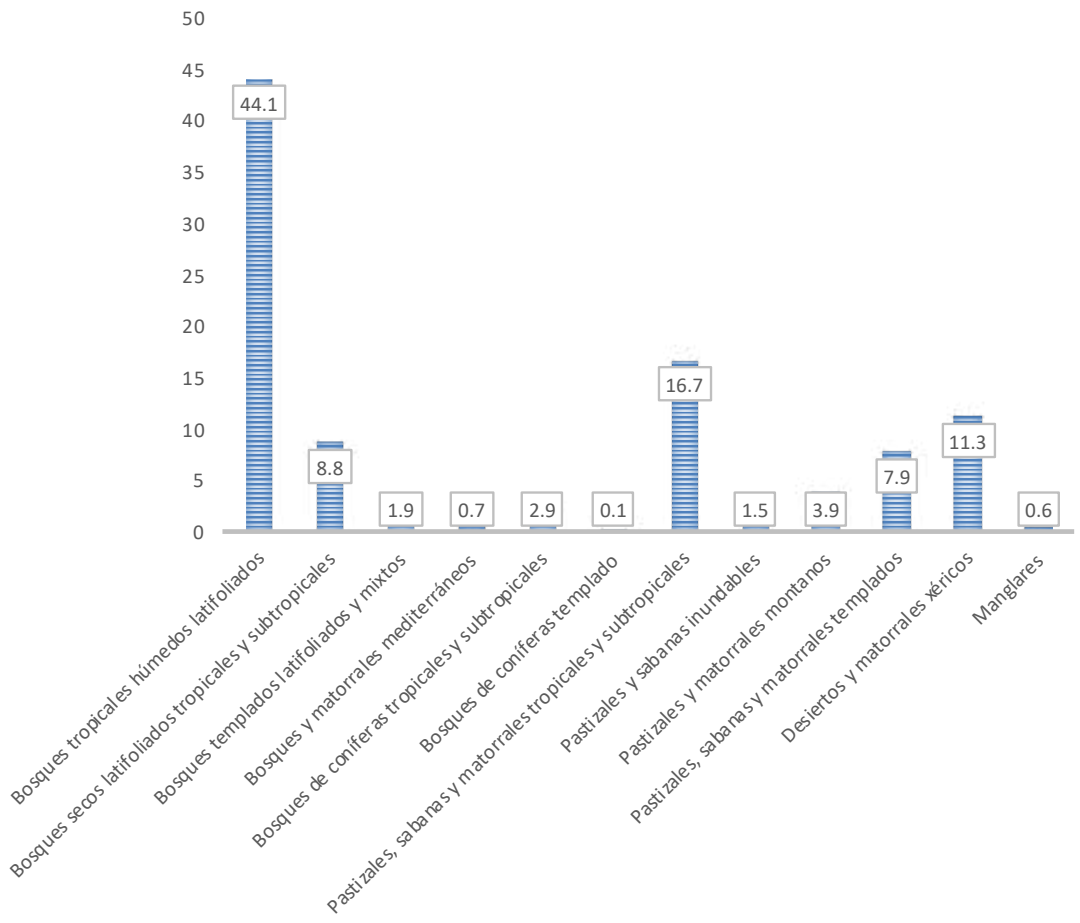


Figure 2: Relative area of the biomes of Latin America and the Caribbean, In thousands of km² (CEPAL, 2002).



For its part, the UNCCD, in a document based on estimates from the Food and Agriculture Organisation (FAO) and other specialised agencies, highlights that demographic pressures, accelerated urbanisation, and changes in demand for food create enormous pressures on land and ecosystems.[2] It is estimated that by the year 2050, the world population will reach 9 billion people, which implies that agricultural production should increase by 70 per cent globally, and by 100 per cent in developing countries.[3] To achieve this, and to maintain current average productivity, by 2050 it will be necessary to add 6 million hectares per year to agricultural production and use twice as much water.

Estimates of the Millennium Ecosystem Assessment in 2005 indicated that 60 per cent of ecosystems are already degraded[4] as a result of unsustainable land management. The regional and international demand[5] for food, wood and petroleum products, together with restrictive socioeconomic conditions and the need to attract foreign investment, are elements that exert pressure on governments and decision-makers. Faced with this situation, they tend to prioritise short-term goals, thereby promoting the degradation of land resources where these goods and services are produced.

Recently, in March 2018, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) stressed that timely action to prevent, reduce and reverse land degradation can improve food and water security, contribute to climate change adaptation and mitigation, and avoid conflicts and migration. It is estimated that by 2050 about 4 billion people will be living in drylands, which further highlights the crucial importance of taking action.

The IPBES report predicts that by the year 2050, land degradation and climate change combined will reduce crop yields by an average of 10 per cent worldwide. and up to 50 per cent in some regions. Among other factors, the decrease in land productivity makes societies, particularly in the drylands, vulnerable to socioeconomic instability. In these dry areas, years with extremely low rainfall are associated with increases in violent conflicts by up to 45 per cent. For every 5 per cent of loss of gross domestic product (GDP) partly caused by degradation, there is a 12 per cent increase in the probability of violent conflicts. By 2050, land degradation and climate change may force a population of between 50 and 700 million people to migrate.

Avoiding, reducing and reversing land degradation is essential for meeting the Sustainable Development Goals contained in Agenda 2030.[6] The area of non-degraded land is progressively shrinking on a global scale, while the demands for a range of competing uses increase.[7]

On a national level, implementation of effective public regulations that impede the development of high-impact, degrading and polluting activities, such as illegal mining, especially gold mining, and the indiscriminate felling of trees, is crucial. Gold mining in Amazonia is an illustration of an activity which degrades and pollutes lands and waters in a highly fragile ecosystem. The same applies to the expansion of agriculture and livestock by means of the destruction of native forest, which is frequently considered as having no value. In this sense, the reduction of deforestation in the Brazilian Amazon is an example of how adequate public policies can reduce environmental impacts. Since 2004, the Government of Brazil has been implementing the Action Plan for the Prevention and Control of Deforestation in the Amazon based on three cornerstones: a) territorial and land-use planning; b) environmental monitoring and control; and c) promotion of sustainable production.

Soil governance, management and planning are core elements of soil care; it is crucial to undertake them given soil remains an irreplaceable natural resource. The increase in competition with regard to soil usage, and the growing number of stakeholders involved, with disparate visions, interests and decision-making power, have led to a complex decision-making structure. Current conflicts between soil stakeholders are likely to increase in future in the face of an even more limited allocation of soil resources. As such, a wide range of flexible instruments for soil management need to be developed in order to avoid and/or reduce degradation of this resource.

1.2 LAND DEGRADATION NEUTRALITY

The purpose of the Land Degradation Neutrality (LDN) initiative, driven by UNCCD, is to stop the current loss of fertile land due to its degradation. Unlike past approaches, the LDN sets a goal for degradation management that consists of a response hierarchy, with measures to prevent or reduce land degradation, combined with others to reverse past degradation. In other words, losses are

balanced with gains so as to reach a state where there is no net loss of fertile and productive land.

LAC have a rich experience of sustainable land management (SLM), based on the ancestral knowledge of native peoples and peasants who still use some of these techniques today. This wealth of knowledge was progressively put aside in favour of modern technologies applied to high productivity monocultures and large-scale livestock farming, even though these technologies may threaten the sustainability of ecosystems. The recovery and updating of this valuable knowledge-base can be very useful for avoiding future land degradation, reversing existing trends in land degradation, and recovering degraded ecosystems.

Within the framework of future scenarios, the GEO-6 report warns that the prospects for the region will not be desirable if economic considerations continue to be prioritised over environmental protection. In this context, the need arises to decouple economic growth from the consumption of resources in order to protect and sustain natural capital. It will be necessary to strengthen the resilience of ecosystems and of ecosystem services in order to adapt to future environmental changes. An important role in reducing vulnerability to future environmental and socioeconomic crises will be played by investment into ecological infrastructure.[8]

It has been found that climate change is already a crucial challenge for the LAC region and will be even more so in the future. Its damaging effects are diverse: melting of glaciers, change in general climate scenarios, modification of seasons, frequent flooding and the occurrence of new disasters.

Ecosystems that took millions of years to evolve are in danger, and many populations of species are being dramatically reduced. Natural processes, such as pollination, and animals, such as corals, are currently threatened, yet they are crucial for the survival of ecosystems.

The forests of the region contribute to the regulation of temperature and precipitation, produce oxygen, and act as natural carbon dioxide sinks. They are, however, today being threatened by the development of urban infrastructure and the model necessary to sustain a growing population.

Box 1: Ecosystem services

Ecosystem services are the direct or indirect contribution of ecosystems to human well-being (TEEB. 2014). Ecosystem services which make a direct contribution are called final services, while those making an indirect contribution are classified as intermediate services. Four types of ecosystem services have been defined:

Provisioning services: These are the material benefits that people obtain from ecosystems, for example, the supply of food, water, fibres, wood and fuels.
Regulating services: These are the benefits obtained from the regulation of ecosystem processes, for example, regulation of air quality and soil fertility, control of floods and diseases and pollination of crops, capture and storage of greenhouse effect gases (such as carbon), wastewater treatment and prevention of soil erosion.
Supporting services: These are necessary for the production of all other ecosystem services, for example, by providing spaces in which plants and animals live, allowing species diversity and maintaining genetic diversity.
Cultural services: These are the immaterial benefits that people obtain from ecosystems, for example, the source of inspiration for aesthetic manifestations and engineering works, cultural identity and spiritual well-being.

REFERENCES

1 ONU Medio Ambiente 2016. GEO-6 ALC. "Evaluación regional para América Latina y el Caribe". Programa de Naciones Unidas para el Medio Ambiente (PNUMA), Panama City, Panama.

2 UNCCD, 2014, Land in Numbers.

3 FAO. "Scarcity and abundance of land resources: competing uses and shrinking land resource base", SOLAW TR02, p. 7.

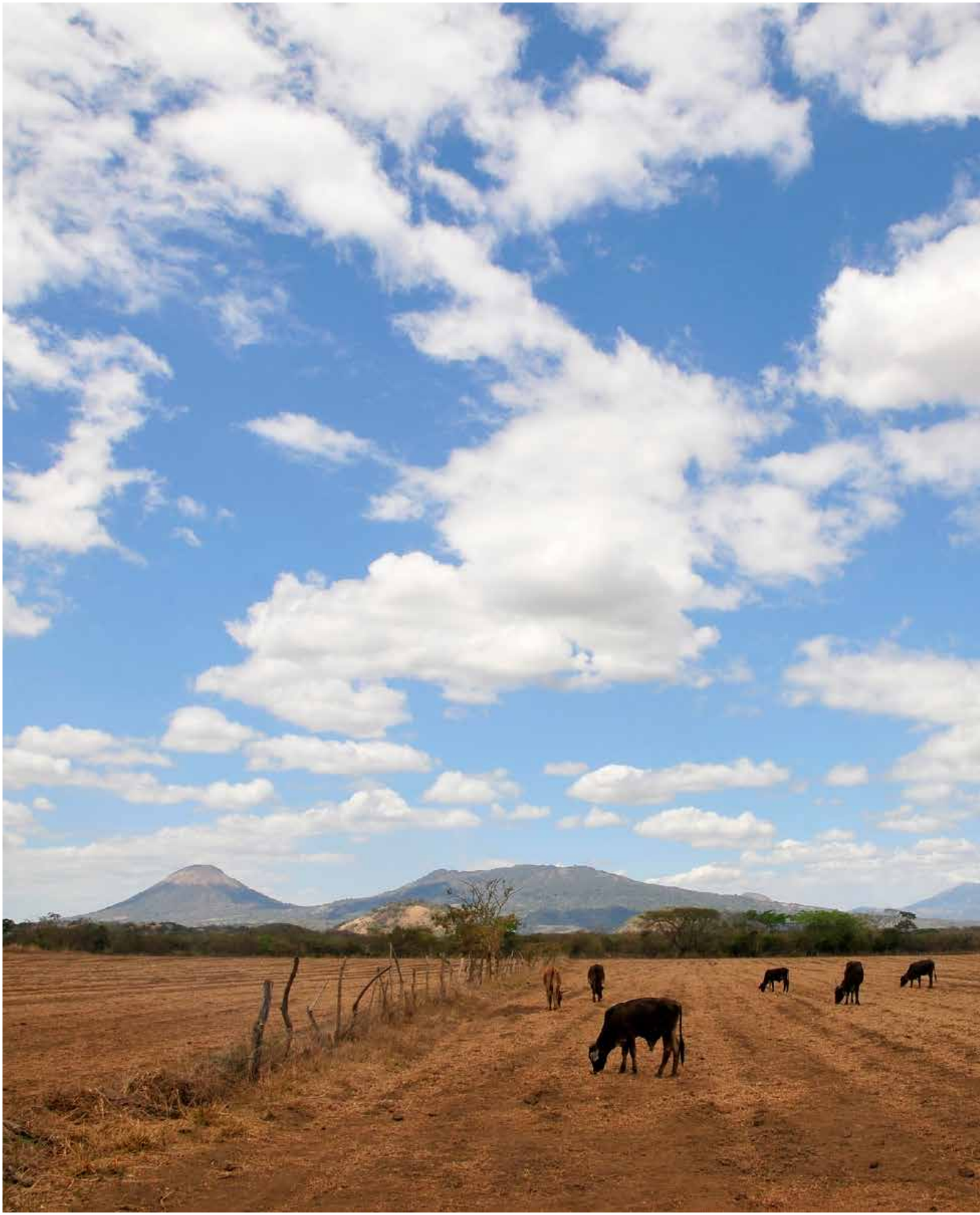
4 Millennium Ecosystem Assessment, Ecosystems and Human Well-being: Synthesis, 2005, p. 39.

5 In relation to international demand for ecosystem products, the notion of "teleconnection" has been applied to illustrate the relationship (triggered by large food companies) between consumers and ecosystems that are very distant from each other and apparently unrelated (UNEP 2016).

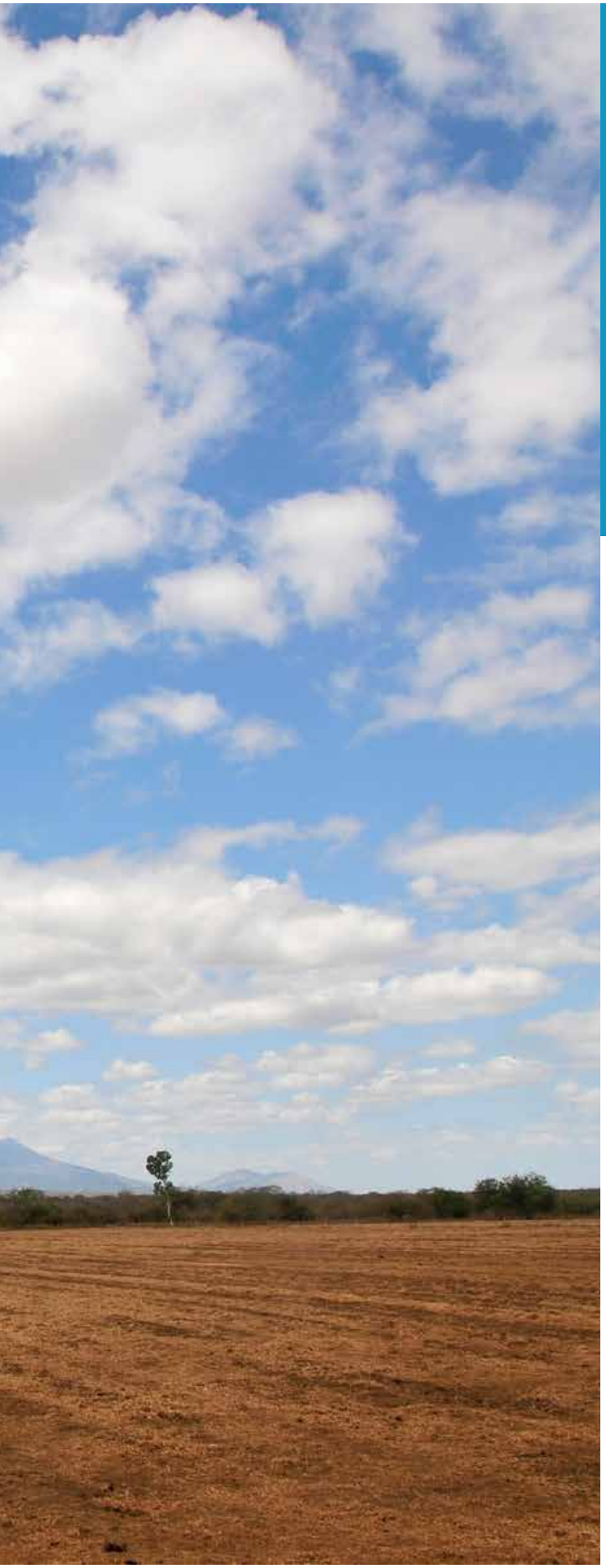
6 In September 2015, more than 150 heads of state met at the historic Sustainable Development Summit at which they adopted the 2030 Agenda. This Agenda includes seventeen universally applicable goals which, from 1 January 2016, have governed the efforts of countries to achieve a sustainable world by 2030.

7 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES/6/L.9/Rev.1, March 2018.

8 This refers to any infrastructure that mitigates the extreme effects of climate, such as droughts and floods, both for farmers and for rural and urban communities, as well as any infrastructure that mitigates water pollution and increases water supply, while also protecting biological diversity.



© Neil Palmer (CIAT)



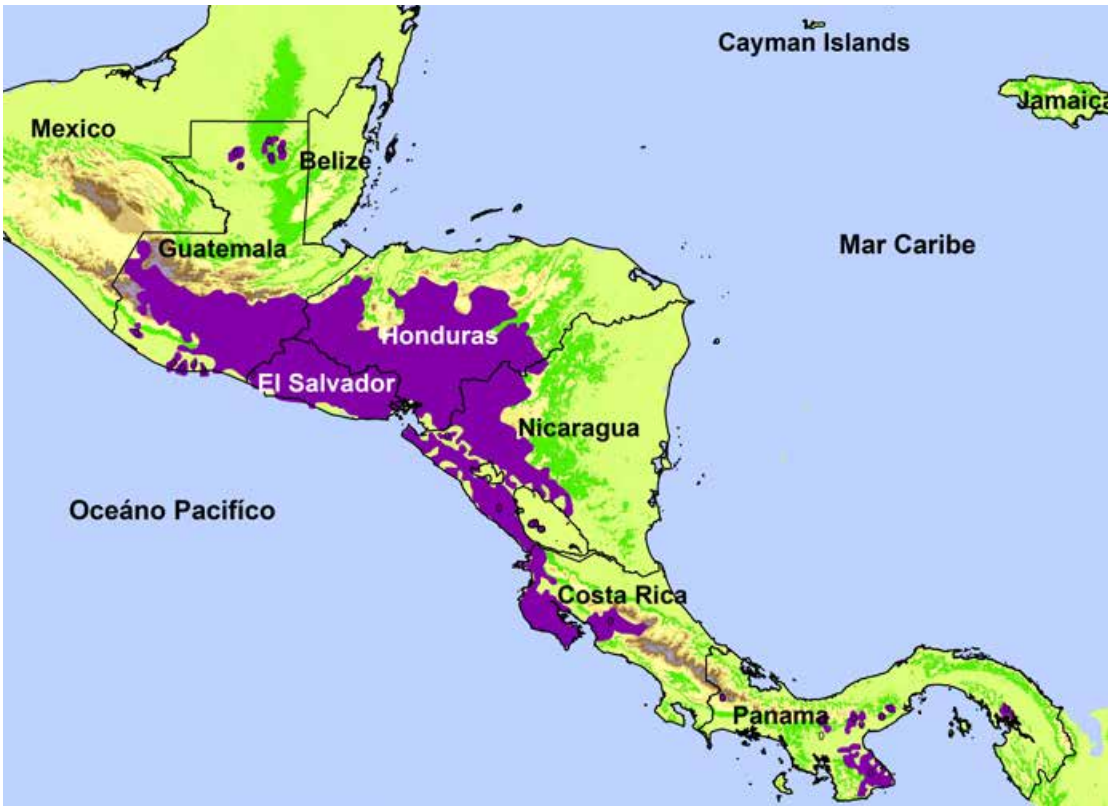
2. DRYLANDS

The great longitudinal extension of the LAC region gives rise to extreme situations: from centres of tropical aridity near the Equator, to arid and semi-arid cold zones in southern Patagonia and Tierra del Fuego. The great heights of the Andes chain that divides the subcontinent determines simultaneous gradients of aridity and temperature; in less than 200 kilometres, conditions can arise that range from coastal desert on the Pacific Ocean to arid plateau at an altitude of more than 4,000 metres.

This environmental heterogeneity is reflected in the geographical discontinuity of arid, semi-arid and dry sub-humid zones in the region. The varied nature of this situation makes it all the more important to be aware of the local expressions of the desertification phenomenon, and of the processes that determine it.

The large systems that dominate the arid, these drylands involve the territories of two or more countries, and encompass the dry and desert areas of Mexico; the Central American dry corridor or arch; the arid and semi-arid zones of La Guajira in the Colombian Caribbean that penetrate into Venezuela; the plains of Colombia and Venezuela; the Brazilian Northeast region; the Gran Chaco region shared by Argentina, Bolivia and Paraguay; the highland ecosystems in Argentina, Bolivia, Chile and Peru; the coastal arid and hyper-arid zones that extend from the south of Ecuador through Peru to Chile; and the Patagonian steppe in Chile and Argentina that stretches down to Tierra del Fuego.

Box 2: The Central American Dry Corridor



The Central American Dry Corridor is one of the most susceptible ecoregions to climate variability and change. It is a strip of land 1,600 kilometres long and 100 to 400 kilometres wide. It covers the lowlands of the Pacific coastal area; most of the region of the central foothills of Chiapas (Mexico); Guatemala; El Salvador; Honduras; Nicaragua; the province of Guanacaste in Costa Rica; and Panama's Dry Arc region.

It is an ecoregion of tropical dry forest that covers almost one-third of the territory of Central America and is characterised by periods of heat or intense rainfall, exacerbated under the influence of the El Niño-Southern Oscillation (ENSO) phenomenon.

More than 45 million inhabitants live in this vast territory, 40 per cent of whom live in rural areas. Poverty affects more than half of the inhabitants of the region and approximately 20 per cent live in extreme poverty. It is estimated that around 10 per cent of the population in the region suffers from undernourishment, especially in periods of emergency and rehabilitation in the face of recurrent droughts and floods, with their respective consequences on livelihoods and the development of countries.[2]

Guatemala, small-scale farmer of the Dry Corridor. This is a strip of land 1,600 kilometres long and 100 to 400 kilometres wide in which 90 per cent of the population of Central America are concentrated.

© Reuters/Jorge Silva

Comuna de Petorca, Valparaíso Region, Chile, located 220 km north of Santiago. This commune has been affected by a severe and prolonged drought, which has affected agriculture and especially a large part of the avocado plantations, located on hillsides to avoid frost.

© Nicolo Gligo

In this context, it is also worth noting the semi-arid and sub-humid lands of the minor systems of the Caribbean which, although not significant from the perspective of the subcontinent, are significant in insular territories. These include the arid and semi-arid zones in some islands of the Netherlands Antilles, Aruba, Hispaniola, Cuba and in some smaller islands.

Additionally, although occurring under different climate conditions, several other systems must also be considered due to the fact that they are being subjected to intense pressure from the expansion and intensification of agricultural activities. This includes the Amazon basin, the Cerrado and grasslands (fields) in Brazil, the Uruguayan savanna and the humid pampas of Argentina.

REFERENCES

1 Fernando Santibáñez, 1994, "La desertificación en América Latina y el Caribe", Annals of the Latin American Desertification Workshop, edited by Fundación Grupo Esquel Brasil, 1994.

2 Technical Meeting. Central American Dry Corridor and arid zones of the Dominican Republic, Guatemala 12-13 June 2019. United Nations Environment Programme, UNEP, Central American Bank for Economic Integration (BCIE) and FAO.

3. PAST AND CURRENT LAND USE

3.1 HISTORICAL EVOLUTION OF THE CONVERSION OF NATIVE FORESTS[1]

Until the end of the 19th century, the highest rates of deforestation worldwide were recorded in the temperate regions of the world. In the Americas, there is evidence that native cultures regularly used fire to convert forest areas into cropland, or as an instrument for managing wild fauna and flora. On the American continent, the conversion of forests on a large scale began in the late 15th century, with the arrival of European conquerors.

The geographical distribution of deforestation changed across the world in the 20th century, but its main cause continued to be the expansion of agricultural land[2], and triggered by an increase in mechanisation, urban expansion, the development of diverse infrastructure and mining. Throughout the 20th century, deforestation generally increased in the southern part of the world, particularly in tropical regions. In areas of temperate and boreal climate, deforestation slowed down, or was reversed, at the end of the 19th century and in the 20th century. By the end of that century, the forest area in most of Europe was stable or increasing, and forests covered about one-third of the total surface area.[3] The situation of the forest surface area in North America has been stable since the beginning of the 20th century, after two centuries of deforestation.

Deforested areas in Paraguay. Agriculture and livestock farming for export have grown strongly in recent decades, occupying new areas and displacing the native forest.

In the Department of Piura, in the north of Peru, there is an important area where dry forest predominates, home to the Ignacio Távara Peasant Community, among others.

© Cesar Morales

Figure 3 (Map right): Net change in agricultural and forest surface area by country/territory, 2000-2010 (FAO State of the World's Forests 2016).

In Central and South America, forest cover accounted for 75 per cent of the surface area of the territory when the Europeans arrived in the 15th century; deforestation in the 18th and 19th centuries reduced it to approximately 70 per cent at the beginning of the 20th century. By the end of the 20th century, however, the forest area had declined to less than 50 per cent of the LAC territory. In the 20th century and at the beginning of the 21st century, the reduction of forested area was mainly caused by agricultural expansion. This is expressed by the strong correlation between agricultural expansion and deforestation, a trend that is also observed in other regions of the world (Sub-Saharan Africa and South and Southeast Asia). While almost 70 per cent of deforestation in Latin America has been attributed to commercial agriculture, some researchers[4], concluded that more than 90 per cent of deforestation in Latin America is due to agricultural expansion. In Africa, this ratio is only one-third, since small-scale agriculture is the most significant factor of deforestation there.

3.2 RECENT EVOLUTION OF LAND-USE IN LATIN AMERICA AND THE CARIBBEAN[5]

The figures presented include aggregate data for the region as a whole, and for each of three large subregions: South America, Mesoamerica[6] and the Caribbean. The continental territory of LAC covers around 22.5 million square kilometres; 20 per cent corresponds to Mexico and Central America; 1 per cent, to the Caribbean; and 79 per cent to South America. Considering these figures, in 2016 croplands accounted for 10 per cent, grasslands for 29 per cent, forests 44 per cent, other uses 15 per cent, and continental surface waters 2 per cent. Between 1990 and 2016, excluding inland waters (1.8 per cent of the territory), land destined for crops went from 7.8 per cent to 10 per cent, pastures from 28.1 per cent to 29 per cent, forests from 49.8 per cent to 45.3 per cent, and other land uses from 14.3 per cent to 15.7 per cent.

One interesting element is that since 2000 there has been an increase in the net conversion of forests to croplands, grasslands and other uses.[7] Between that year and 2016, there was an increase of 70 per cent in croplands, 33 per cent in grasslands, and 50 per cent in other land uses, while the area under forests was reduced by 55 per cent.

In Mesoamerica, during the period under study, croplands expanded by 6.1 per cent, grasslands remained at 39 per cent, while other uses rose from 10.2 per cent to 12.9 per cent; and forests were reduced from 37.4 per cent, to 34 per cent, especially from 2000 onwards.

In the Caribbean, the picture is the opposite to the rest of the region. Between 1990 and 2016, croplands were reduced by 5.4 per cent, grasslands by 8.1 per cent, and other land uses by 32.5 per cent. Meanwhile, forest lands increased by 45.2 per cent. The crucial element about this change was that about 85 per cent of the increase in forests corresponded to naturally regenerated forests, probably being a matter of deforested areas that were later abandoned, while the remaining 15 per cent corresponded to replantations.

Table 1: Net changes in farming/livestock and forestry areas in countries and territories of Latin America and the Caribbean. 2000-2010.

+ agricultural area - forest area	- agricultural area + forest area	+ agricultural area + forest area	- agricultural area - forest area	0 agricultural area 0 forest area
▪ Argentina ▪ Brazil ▪ El Salvador ▪ Haiti ▪ Honduras ▪ Panama ▪ Paraguay ▪ Peru	▪ Costa Rica ▪ Cuba ▪ Puerto Rico ▪ Dominican Rep. ▪ Uruguay	▪ Chile	▪ Colombia ▪ Ecuador ▪ Guadalupe ▪ Guatemala ▪ Virgin Islands (USA) ▪ Jamaica ▪ Nicaragua ▪ St. Lucia ▪ Trinidad and Tobago	▪ Bolivia ▪ French Guiana ▪ Guyana ▪ Mexico ▪ Suriname ▪ Venezuela

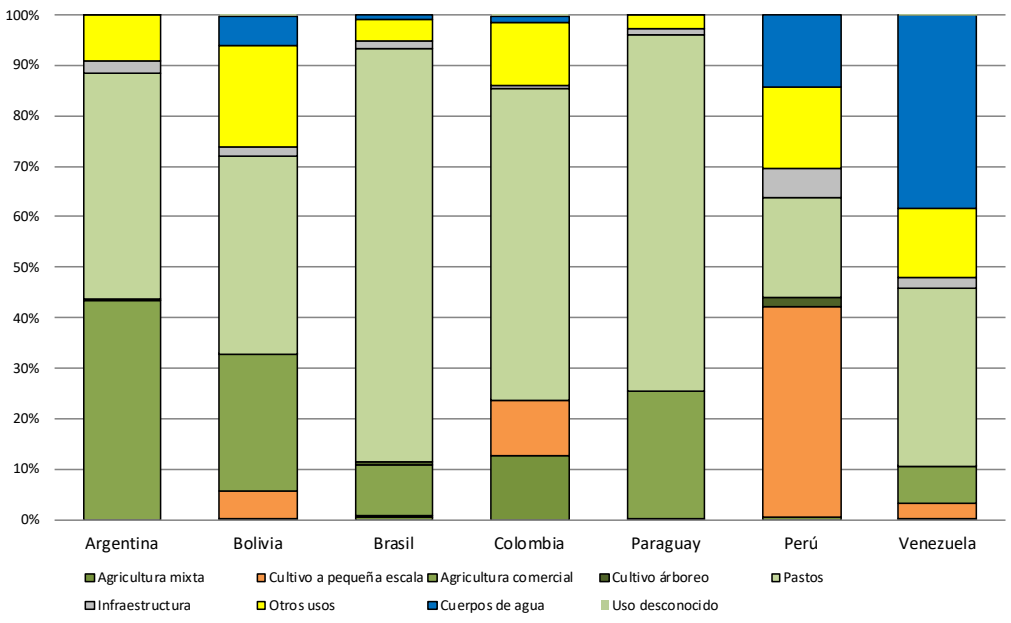
+ Area increase; - Area reduction; 0 No significant variation.
Source: FAO State of the World's Forests 2016.

The evolution of farming/livestock and forestry areas does not follow the same pattern of increases and reductions observed at the subregional level. In the period 2000-2010, some of the countries with major relative weight in the region experienced net increases in croplands and net reductions in forest areas.

In others, there were net reductions in both farming/livestock and forest areas, or net increases in both categories of use. Finally, in another group of countries, there were net increases in forest areas and net reductions in crop areas (Table 1).

In seven countries of South America (De Sy et al., 2015), the relationship between deforestation and the expansion of pastures destined for extensive grazing (Figure 4)was analysed, for the period 1990-2005.[8] This concluded that 71 per cent of deforestation was due to an increase in grasslands, 14 per cent to the increase in commercial croplands, and less than 2 per cent to infrastructure and urban development. The expansion of pasturelands caused the loss of at least one-third of the forests in all countries, except in Peru, where the expansion of small-scale farmland (41 per cent) was the dominant factor. In Argentina, the expansion of pasturelands caused the loss of approximately 45 per cent of forests, and the expansion of croplands, more than 43 per cent. In Brazil, more than 80 per cent of deforestation was associated with conversion to pasturelands.

Figure 4: Deforestation attributed to various factors in seven countries of South America, 1990-2005.[8]



Large areas of Amazonia in Brazil have been deforested to make way for livestock. The image shows an area that still conserves the native forest, separated by a dirt road from another area deforested for livestock.

Gold mining (photo right) has experienced the most growth in Amazonia of all the countries that share this biome. The image shows an illegal mining facility in the Madre de Dios Department in Peru, where the destruction it causes can be seen.

© Andre Penner

3.3 LAND DEGRADATION IN LATIN AMERICA AND THE CARIBBEAN

In LAC, the primary factors that have contributed to land degradation are population growth, the intervention of grassland ecosystems in the broadest sense of the term (savannas, steppes, pampas, fields, etc.)[9] and deforestation, as well as natural phenomena exacerbated or not by human action. An indirect factor is international demand, which has contributed to the intervention of grassland ecosystems and deforestation, as well as to an unsustainable intensification of exportable agricultural production.

As land degradation progresses, soil as well as hydrology, biomass, biodiversity and climate are adversely affected.[10] The Amazon rainforest, for example, plays a crucial role as a climate-regulating system worldwide. Temperature increases, and the interruption of energy and water cycles could gradually transform the Amazon rainforest into savanna.[11]

"Forests in LAC covered almost one billion hectares by 2016 according to FAO (trees at least 5 m tall within areas above half a hectare)[12]. However, studies aimed at estimating the extent of land degradation in LAC have adopted broader definitions of forests including fragmented forests and even savannas. The World Resources Institute (WRI 2016) establishes, for an area of 1,660 million hectares of forests and associated ecosystems, that there are 450 million hectares of intact forests in LAC, and that the other 1,210 million hectares would correspond to fragmented forests, deforested areas and degraded areas[13]. Degradation and deforestation is primarily attributed to large- and small-scale agriculture, infrastructure and mining."

Humid biomes account for 51 per cent of degraded lands in the region, and include humid, tropical broadleaf and subtropical forests, while dry biomes are estimated at 48 per cent, and include dry and subtropical forests, dry broadleaf, tropical and subtropical grasslands, savannas and shrubland. Temperate biomes, with only 1 per cent of the land, correspond to temperate broadleaf and mixed forests.[14]

A central factor has been the conversion of natural areas, derived from the growth of agricultural, forestry and derived agroindustry production, which has meant that between 2001 and 2012, around 37 million hectares of natural forests and grasslands were transformed into agricultural land. In the case of Paraguay, for example, there is an evident correlation between expansion of the area of soybean and grasslands and a decrease in the area of natural forests.[15] Another case is the increase of 43 per cent in croplands observed in Argentina, Bolivia, Chile, Paraguay and Uruguay between the crop cycles of 2000/01 and 2010/11, which occurred mainly at the expense of savanna and forest landscapes. In Brazil, an area of 5.4 million hectares has been converted from cerrado or rainforest to soybean cropland in the agricultural states of Goiás, Mato Grosso and Mato Grosso do Sul.[16]

Although regional rates of deforestation have fallen since the mid-1990s by 67 per cent[17] in the Brazilian Amazon, and by one-third in Central America, native forests continue to be destroyed, increasing the amount of relatively unproductive landscapes, with the consequent loss of substantial economic benefits. Under current conditions, projections indicate that between 2000 and 2050, LAC will lose an additional 7 per cent of its total forest cover.

Another estimate of degradation can be inferred from the World Bank's 1990-2015 time series on forest cover in LAC.[18] This calculation includes native vegetation and forest plantations but excludes fruit trees, forest species that are part of agroforestry systems, and urban parks. It also assumes that the deforestation occurring over a period is equivalent to the negative change

Box 3: Gold processing cycle in Amazonia

In Amazonia, it is not possible to extract alluvial gold without destroying the forest and the soil, since this mineral is found as particles in alluvial soils and mud from riverbanks. Therefore, the forest, riverbed and riverbanks must be destroyed.

Four extraction methods are practised: a) Artisanal: with very simple carts and tools; b) with motor pumps and chupaderas on the ground and inside the forest; c) with various types of dredges in riverbeds; d) with heavy machinery (front loaders and dumper trucks).

Sand and gravel are removed from the site and transported to the washing facilities, where the material at the end passes over a jute canvas, under which there is plastic material, where the fine sand with the gold particles is deposited.

The gold sand is collected in containers and mercury is applied for amalgamation. 2.8 kg of mercury is used to obtain 1 kg of gold. This process takes place on the banks of the river or in the camp.

The amalgam obtained is 60 per cent mercury and 40 per cent gold, and is given the name amalgam button or pearl.

This pearl or button is subjected to heat with a blowtorch. The mercury volatilises and melts the gold, obtaining mercury-free gold. 76 per cent of the miners carry out this task in the camps, and 24 per cent in the open air.

Between 50 and 60 per cent of the vaporised mercury remains in a gaseous state and disperses, and the rest immediately returns to a liquid state and falls around the area where the process takes place.

The use of hoods to recover the mercury is practically non-existent. In the dredgers which operate on the rivers, mercury is usually volatilised in the same dredger, and eventually ends up in the river water.

The bacteria in the sludge act on the mercury that falls to the ground or water, transforming it into methylmercury, a highly toxic compound, which is consumed by organisms in the food chain and accumulates in fish, carnivores especially, and reaches humans through the consumption of fish. In the process of mercury volatilisation, the vapours are breathed in by the miners and also cause pollution.

© AndrePenner

Brazil, the practice of slash and burn. This practice is frequently used to clear the native forest and open up space for agriculture and livestock, deforesting the most valuable species then burning the rest.

in forest cover in the same period and adds the further assumption that the harvest of trees from commercial plantations has been offset by new plantations with an equivalent surface area.[19] When looking at this result, it must be borne in mind that there are no positive changes in the regional aggregate, since there are no increases in the forest area, although there is increased afforestation in some countries.[20]

In this study, it is considered that land that is deforested, whether by fire, clearing or harvest, is destined for agricultural crops, commercial plantations, livestock grazing (pasturelands, shrubs, shoots), or is abandoned, giving rise to new subsequent vegetation, and eventually to the restoration of the original forest. The basic hypothesis is that

The Paraguayan Chaco. The image shows deforestation of the native forest, using heavy machinery to clear land and make it suitable to cultivate species for export.

© cbf.org.bo

The image shows a panoramic view of the central region of Costa Rica, showing the scale of deforestation processes.

degradation processes occur on all deforested land, notwithstanding that this process also occurs in non-deforested areas, undergoing unsustainable management systems (selective extraction of timber species, extraction of firewood, cattle grazing, thinning forests without allowing recovery, etc.). If the basic hypothesis is accepted, the deforested lands recorded in the period 1990-2015 across the entire region would reach almost 100 million hectares (986,000 square kilometres).[21]

3.4 A NOTE ON PRE-HISPANIC CONSERVATION TECHNOLOGIES

In a historical view of changing land-use in LAC, it is important to highlight the most significant agricultural production methods, developed by the major civilisations that flourished in the Mesoamerican and Andean areas. These forms of production, which incorporated efficient farming systems and ingenious agricultural practices, solved the problem of providing food for the population at the time. These systems that made it possible to incorporate crop areas and slow down land degradation were successful and sustainable, judging by their persistence. Some outstanding examples of these practices are farming on terraces or platforms, which took place on thousands of hectares along the Andes Mountains and the Aztec chinampas (raised fields) in Mexico.

The advantages of terraces go beyond their capacity to transform a slope into arable land, as they are an effective means to control erosion, improve water management, maintain moisture in the soil profile, minimise the risks of frost, and enable better use at different altitudes. The terraces contribute to changing the potential land-use, from limited forestry or protection, to more intensive use, suitable for crops under irrigation.

The conquest and consequent imposition of new forms of land management and production led Andean communities to adopt other systems of agricultural and livestock production, a transformation that led to erosion, loss and neglect of ancient technological knowledge developed over several centuries. The platform structures and those of the channel and reservoir systems stopped

Deforestation and destruction of the Brazilian Amazon.

© Bernardita Stuven Marambio

Colca Canyon, Arequipa; Cultivated platforms or terraces in Peru. This valley, located 220 km from Arequipa, has a system of terraces or platforms with an irrigation system, both highly efficient, which made it possible to feed the local indigenous population and those of many other places in the so-called Inca Empire.

being maintained, which caused their deterioration and a loss of efficiency in the sustainability of water management and production processes. Verification of the efficiency of these management systems has led to projects being implemented, for some decades now, focussed on agricultural production, aimed at restoring, adapting and validating these ancient technologies.

3.5 GOOD PRACTICES BASED ON TRADITIONAL KNOWLEDGE

There are important but still insufficient initiatives, in different countries in the region, to take this ancestral knowledge and update it with current scientific advances, and also generate new technologies with the key goal of preventing land degradation. In this regard, we can mention institutions such as the EMBRAPA (Brazilian Agricultural Research Company), which has a specialised office for the drylands of Northeast Brazil, and the Semi-Arid Institute in the same country, along with the Brazilian Ministry of Science and Technology's Centre for Management and Strategic Studies.

In Argentina, the National Institute of Agricultural Technology (INTA) also has some programmes with this same focus. In addition to INTA, there are other institutions such as the Argentinean Institute of Arid Zones (IADIZA) located in the Province of Mendoza. In Peru, with a rich tradition of ancestral technologies respectful of the land and natural resources, the Ministry of Agriculture and Irrigation has implemented a National Strategy of Rural Talent with a national school, in which they collect, systematise and provide training to spread knowledge of these types of practices. (See Boxes 4 and 5 on ancestral practices in Peru.)

Box 4: The "kamayocs" in Peru

One of the first experiences of knowledge management at the agrarian extension level was through peasant-led innovations, called "kamayocs". In the southern highlands of Peru in the 1960s, the Asillo Irrigation Project in Azángaro, Puno, employed Arequipa peasants, called "kamayocs", who were experts in managing terraced irrigation. This consists of using techniques based on ancestral knowledge to irrigate cultivated terraces by means of gravity, improving efficiency and helping protect the soil from erosion.

These "kamayocs" transferred their knowledge to small-scale farmers who only used more modern irrigation techniques, which not solve the problems of erosion. Now the trained farmers are experts in gravity-based irrigation for cultivated terraces. Another project in Cusco, the Irrigation Improvement Plan in the Sierra and Jungle, located expert farmers in the Arequipa countryside, called "Unu Kamayoq", who were using refined technology to irrigate their plots. They were brought to the Rural Development in Microregions Project in Cusco.

By adopting and adapting this training methodology, called Pachamama Raymi, it was possible to reverse the initial situation, demonstrating that the ancestral knowledge, which had been preserved by these "kamayoqs", could be replicated in other regions. It was found that, thanks to the skills and abilities of the Cusco-based farmers, "farmer-to-farmer" training was a successful means of spreading knowledge.

Source: Saberes y haceres andinos deben ser revalorados frente al cambio climático. http://www.biodiversidadla.org/Documentos/Saberes_y_haceres_andinos_deben_ser_revalorados_frente_al_cambio_climatico

Box 5: Good practices and ancestral knowledge to tackle climate change in Peru

Various public and private institutions (NGOs, IFAD projects carried out in the Sierra, universities, regional governments, etc.), engage in a continuous dialogue between ancestral knowledge and practices and academic knowledge, seeking to harmonise and disseminate a suitable combination of Andean technology and modern technology, which will be accepted, resumed, recreated, or renewed by farming communities. These include:

Experiential Training: from farmer to farmer through the "kamayoc" and "yachachiq" (technological farming leaders), who provide technical assistance and/or agricultural training to the communities through participatory "learning by doing"; adapting, implementing or innovating techniques for agriculture and/or for suitable renewable energies. These techniques include irrigation by gravity, drip and sprinkling, water pumps, improved cookers, solar dryers, vegetable growing, improvements for cattle, etc. These activities are replicated in other regions of the country (Cusco, Puno, Huancavelica, Ayacucho, Cajamarca, Ancash). The "kamayocs" can be paid for their services in money, products (bartering) or ayni (reciprocal aid). In some central highland communities the "arariwa" also operates, an Andean crop supervisor who warns of possible pests and risks to their plots.

Sowing and water harvesting: in the face of losing water sources (ponds) and natural lagoons, the communities work on planting and collecting rainwater, creating small reservoirs or feeding and widening the beds for the driest season. Likewise, infiltration ditches are built to catch rainwater and improve the flow of the springs. Water harvesting is also carried out by protecting bofedales, puquiales and manantes, and preserving and conserving watersheds and micro-watersheds.

Living Fences: afforestation and reforestation with resistant native species such as "queñoa", "colle", "mutuy" etc., bordering plots, orchards or forests to protect the soil, thereby avoiding pests and protecting against wind and frost. This idea is all about forming a microclimate that mitigates possible atmospheric damages.

Agricultural Strategies: preserving and improving soils through organic fertilisation (fermented manure, compost, green manure, etc.); constructing platforms to recover arable land and plant species; diversified sowing of different varieties in a single plot (e.g. dozens of potato varieties); recovering the potato seed through the buds for sowing; sowing at three different times; plots in different ecological floors and microclimates, since each land has different aptitudes and is exposed to different risks; sowing new crops (onions, carrots, peas, fruit trees, etc.).

The Andean communities hand ancestral knowledge and awareness down from generation to generation, on subjects such as the land, water, seasons, flora and fauna of their territories. This knowledge, reevaluated and potentiated together with contemporary knowledge, forms the basis of a systematic, planned, adaptive and intercultural strategy at a governmental level to deal with climate change.

Source: http://www.biodiversidadla.org/Documentos/Saberes_y_haceres_andinos_deben_ser_revalorados_frente_al_cambio_climatico

© Scott Wallace / World Bank

REFERENCES

1 This section is based, unless otherwise indicated, in the FAO document (2016) "The State of the World's Forests 2016. Forests and agriculture: land-use challenges and opportunities". Rome.

2 If there is no indication otherwise, 'agricultural' will be considered synonymous with 'agro-livestock' (croplands and grasslands).

3 In general, increases in forests occurred both through regeneration and forest plantations.

4 Hosonuma, N.; Herold, M.; De Sy, V.; De Fries, R. S.; Brockhaus, M.; Verchot, L.; Angelsen, A.; and Romijn E.2012. "An assessment of deforestation and forest degradation drivers in developing countries". Environmental Research Letters, 7(4): 0044009, 12. Quoted in FAO (2016).

5 The figures on land use presented in this section are those reported, unless otherwise indicated, in FAO, Land Use - FAOSTAT (online, 02/26/2018)

6 Mesoamerica includes Central America and Mexico.

7 Net conversion in the sense that, in the same area, there has been more than one change, for example, from forest to grasslands, and then to crops and other uses. They also include conversions of areas between forest categories, from grasslands to crops, and from these three categories of use to other land uses, as might be inferred from the data.

8 De Sy, V.; Herold, M.; Achard, F.; Beuchle, R.; Clevers, J. G. P. W.; Lindquist, E and Verchot, L. V. 2015. "Land use patterns and related carbon losses following deforestation in South America". Environmental Research Letters, 10(12): 124004. Quoted in FAO (2016).

9 There are many definitions for the concept of grasslands, but a simple general definition is "ecosystems in which the dominant vegetative component is comprised of herbaceous species", as mentioned by Alba Mejía, J. E. in "Grasslands of South America" (attributed to Coupland R. T.).

10 Much of the text that follows, unless otherwise indicated, is based in the document "The Economic Case for Landscape Restoration in Latin America" prepared by Vergara, W. et al. for the Word Resources Institute (WRI, 2016). This document reproduces the bibliographic quotes of this study that were considered relevant for this report.

11 FAO, Land use - FAOSTAT (online, 02/26/2018).

12 Marengo et al., 2011 quoted in WRI, 2016.

13 Many of the figures do not always coincide with the various sources used, either because they are derived or inferred from different estimates or because the categories of information were defined differently, including or excluding certain items. In any case, the important aspects are the trends, the turning points and the scenarios to which they can give rise.

14 World Resources Institute. 2014. Atlas of Forest and Landscape Restoration Opportunities. 2014. Washington, DC: World Resources Institute; Potapov, P.; Laestadius, L and Minnemeyer, S. 2011. "Global Map of Forest Condition". Washington, DC: World Resources Institute. Available at <www.wri.org/forest-restoration-atlas>. Quoted in WRI, 2016.

15 Morales, C. 2017.Manuscript on agro-industrial development in LAC.

16 FAOSTAT 2014; FONTAGRO-BID 2014; Chomitz et al., 2007; MercoPress 2013 quoted in WRI, 2016.

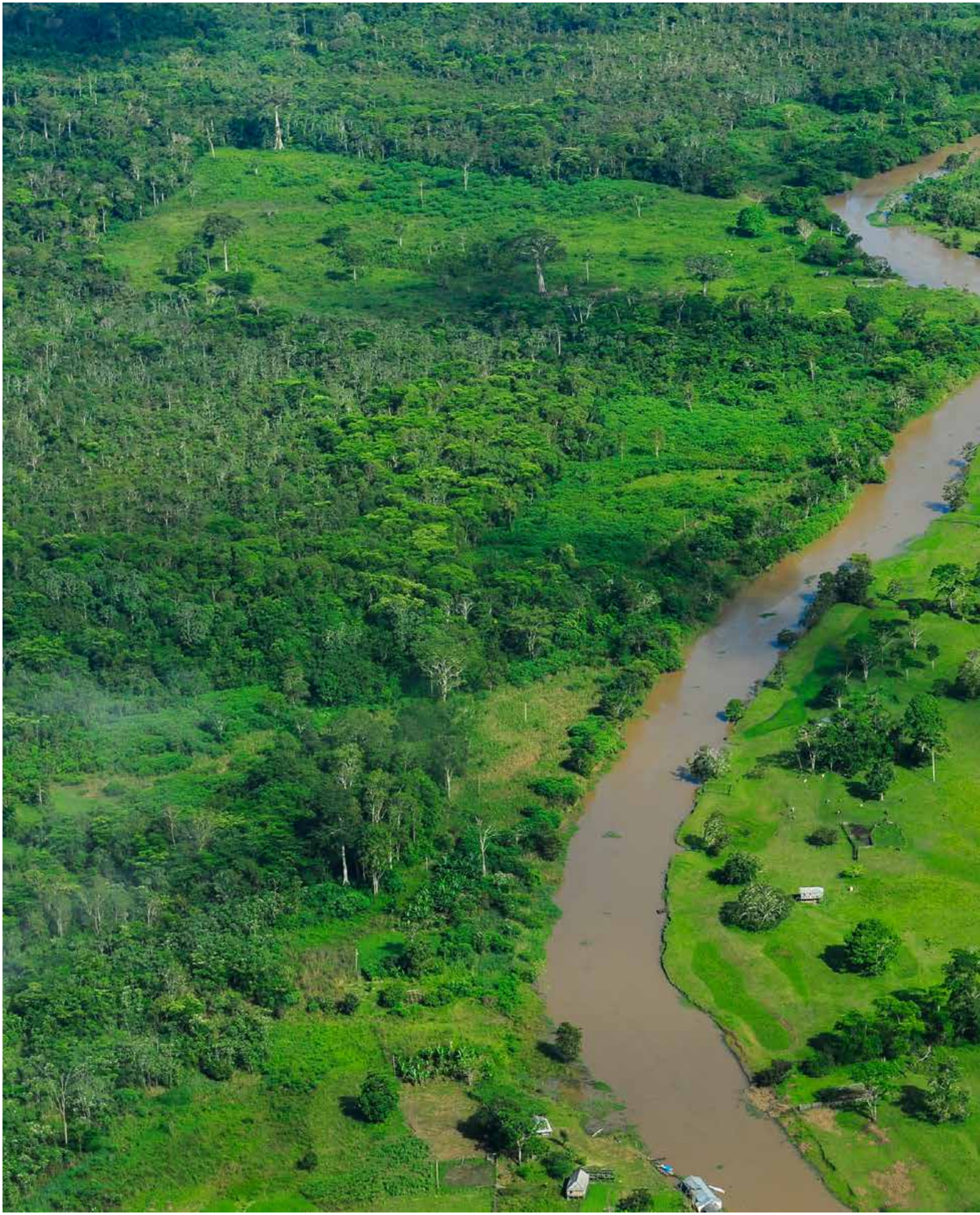
17 FAO (Food and Agriculture Organisation of the United Nations), 2015. "Global Forest Resource Assessment 2015". Rome: FAO; Hansen et al., 2015; Chiabai et al., 2011; INPE 2010, Kaimowitz 2008; Hecht 2012. Quoted in WRI, 2016.

18 World Development Indicators, World Bank, 2017 (online): https://data.worldbank.org/data-catalog/world-development-indicators.

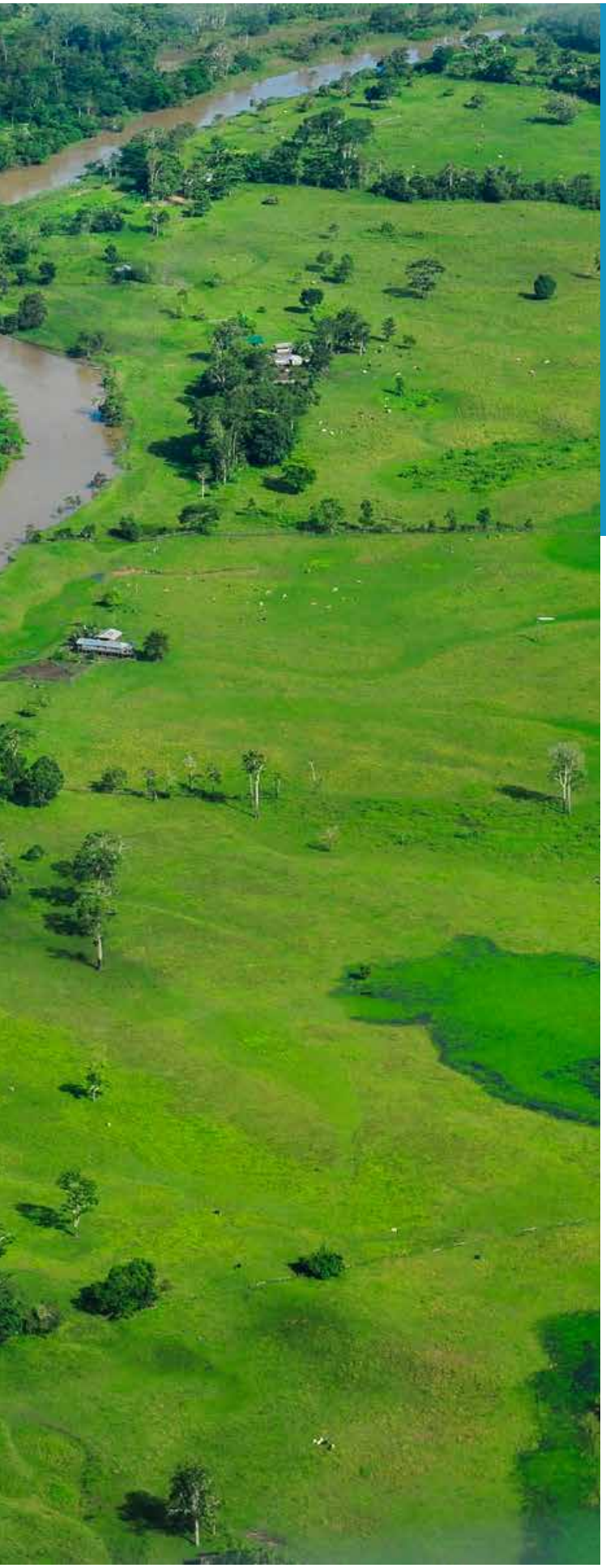
19 Morales, C. 2017.

20 This expanded definition of the LAC region includes the various overseas island territories of the United Kingdom (excludes South Atlantic islands), the overseas departments and communities of France, the US Virgin Islands, Puerto Rico and the island countries and special municipalities of the Dutch Caribbean (Netherlands Antilles and Aruba).

21 It should be noted that this estimate corresponds to the net loss of forests (according to the FAO definition) that occurred between 1990 and 2015, while the WRI study (2016) cited elsewhere represents the accumulated deforestation since the European intervention in the fifteenth century.



©Neil Palmer/CIAT



4. MAIN FACTORS AFFECTING LAND DEGRADATION

This section identifies and analyses the main variables that can affect land degradation in eight LAC countries:

Mesoamerica: Mexico and Guatemala

Caribbean: Dominican Republic

South America: Ecuador, Peru, Paraguay, Brazil and Argentina.

These countries are considered representative of the diverse situations that exist in an area as large as LAC.

In order to conduct the analysis, the databases used to build the World Atlas on Desertification were processed, following the methodology developed and known as Relevant Variables Convergence Analysis. The methodology is briefly explained below.

The following variables were considered for the analysis; Organic Carbon in the Soil, Aridity, Water Stress, Change in Soil Cover and Deforestation, plus all possible combinations of them, 64 in total. This is because the data comes with a resolution of 1 km^2, that is to say on that surface of the territory (each pixel), information can come from a single variable or be combined with one or more others on that surface.

Box 6: The methodology

Following the UNCCD's definitions for degradation and for the factors affecting it, the surface of the degraded areas in each of the selected countries was measured, following the methodology applied to produce the World Atlas on Desertification, drawn up by the European Union's Joint Research Centre. This methodology is known as Relevant Variables Convergence Analysis, and in this case it was conducted by following the steps indicated below.

The following variables involved in the processes of land degradation and desertification were considered:

a. Aridity
   - Water stress
   - Decline in primary productivity
   - Changes in vegetation cover or changes in land-use
   - Deforestation

b. All the variables indicated above are in historical series of at least ten years and with a pixel resolution of 1 km^2.

c. Official socioeconomic information was obtained from each country on poverty, inequality, population, administrative unit areas and population density.

d. The variables mentioned above were ordered with the median as a reference, considering the higher or lower values, according to each case, as indicative of their incidence on land degradation.

e. Databases were created at a municipal level (or the corresponding administrative unit in each country). For Brazil, for example, this involved working with over 5,500 municipalities; for Peru more than 1,800 districts; for Ecuador just over 1,500 parishes; and for Mexico 2,450 municipalities.

f. The information obtained for each smaller territorial administrative unit was added to higher levels, for example, from parishes or districts in some countries, to provinces, departments, regions and states, depending on the case.

g. For each territorial unit of each country, the variables most affecting land degradation were identified.

h. The results obtained were ordered according to the incidence of the variables considered, and the socioeconomic variables were subsequently added.

i. Because the comparison is made regarding the median for the same period, the results obtained reflects the recent incidence of degradation factors on a selected territory.

4.1 Mexico

Of all the factors affecting land degradation, water stress combined with other variables is the most prevalent in Mexico. Water stress in conjunction with low organic carbon content in the first thirty centimetres of soil, plus aridity, is the most significant combination of factors in terms of area affected, accounting for 19 per cent of the total. Aridity and deforestation, each individually and separately, affect 7 per cent of the territory. "Other" includes all the other combinations of variables (50 in total), which individually appear in no more than 2 per cent of the territory.

The states most affected by the set of variables of aridity alone, aridity, lowest soil organic carbon (SOC); water stress and SOC; water stress plus aridity and water stress plus SOC and aridity together, are Baja California Sur, Chihuahua, Sonora, Guanajuato and Zacatecas. Of these states, only Zacatecas is among those with the highest poverty rates, however when measuring according to the decline in productivity (lower productivity) and deforestation, Chiapas appears first as the poorest state with the highest extreme poverty.

© Francisco Rodríguez

A third of the area planted with corn in the State of Guerrero, Mexico, has low yields due to being on degraded land, and also because it is very vulnerable to drought. The image shows a farmer ploughing his land to sow corn.

Table 4.1 Mexico: Poverty and extreme poverty by State

States	% Poverty	% Extreme Poverty
Chiapas	78.5	48.8
Guerrero	67.6	46.7
Oaxaca	67.4	44.2
Puebla	61.2	27.3
Tlaxcala	60.5	16.5
Zacatecas	60.2	17.9
Veracruz	58.4	33.0
Tabasco	57.3	23.7
Hidalgo	54.9	24.6
Michoacán	54.8	24.6
San Luis Potosí	52.5	29.4
Durango	51.3	20.1
Campeche	50.3	27.1
Guanajuato	48.6	17.4
Yucatán	48.5	24.2
Morelos	43.6	16.1
México	42.9	20.0
Querétaro	41.5	17.9
Nayarit	41.3	19.8
Tamaulipas	39.4	14.3
Chihuahua	39.2	16.9
Aguascalientes	38.2	9.7
Jalisco	37.0	14.1
Sinaloa	36.5	14.9
Colima	34.7	7.1
Quintana Roo	34.6	18.2
Sonora	33.8	15.7
Baja California Sur	31.9	11.6
Mexico City	28.7	7.7
Coahuila	27.9	10.6
Nuevo León	21.1	9.0

Figure 4.1.1 Mexico: Incidence of the main factors of land degradation. (As a percentage of total land in the country).

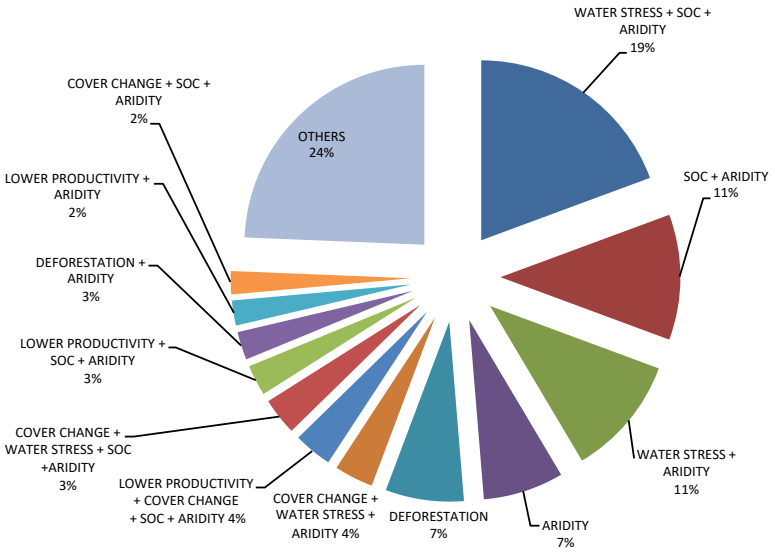
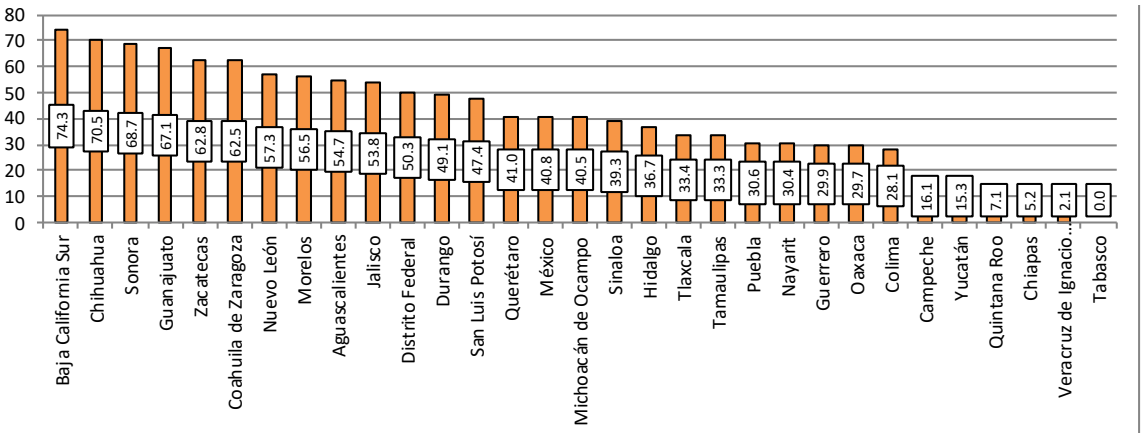


Figure 4.1.2 Mexico: states most affected by set of variables related to water stress and aridity.



4.2 Guatemala

Six degradation factors affect 96.2 per cent of Guatemalan territory, and of these deforestation is by far the most significant, as can be seen in figure 4.2.1. Indeed, this variable considered alone, i.e. not combined with any others, is found in 63.8 per cent of Guatemalan territory. The remaining 3.8 per cent is explained by a set of 20 combinations of different degradation variables, each with an incidence of 1.2 per cent or less.

The second most significant factor is the decline in productivity, with a 4 per cent presence in the territory when considered alone. When this variable is combined with deforestation, the incidence is 7 per cent.

The Department of Alta Verapaz, in second place in terms of the incidence of deforestation in the country, displays the highest total and extreme poverty in the country. The Departments of Chiquimula and Zacapa have the highest levels of deforestation combined with the highest extreme poverty.

Table 4.2 Guatemala: Total poverty, extreme poverty and inequality.

Departments	% Extreme poverty	% Total poverty	GINI
Alta Verapaz	46.65	89.58	31.39
Chiquimula	37.00	78.98	31,10
Zacapa	36.72	71.64	38.82
Suchitepéquez	29.53	80.48	32.54
Izabal	28.90	69.10	32.99
Baja Verapaz	27.30	72.54	30.73
Totonicapán	24.50	80.57	28.90
Jalapa	22.75	77.34	25.13
Quiché	20.15	76.90	26.32
Petén	19.79	75.14	30.83
San Marcos	18.73	76.43	24.00
Quetzaltenango	17.31	67.33	27.52
Chimaltenango	16.37	78.68	23.60
Jutiapa	16.27	60.17	33.80
Retalhuleu	15.04	68.62	28.17
Sololá	14.57	84.48	19.72
Santa Rosa	14.27	62.61	28.40
Sacatepéquez	11.40	62.14	27.48
Huehuetenango	11.27	67.59	22.63
El Progreso	6.11	44.28	31.47
Escuintla	3.04	47.37	28.49

Figure 4.2.1 Guatemala: Incidence of the main factors of land degradation (As a percentage of total land in the country).

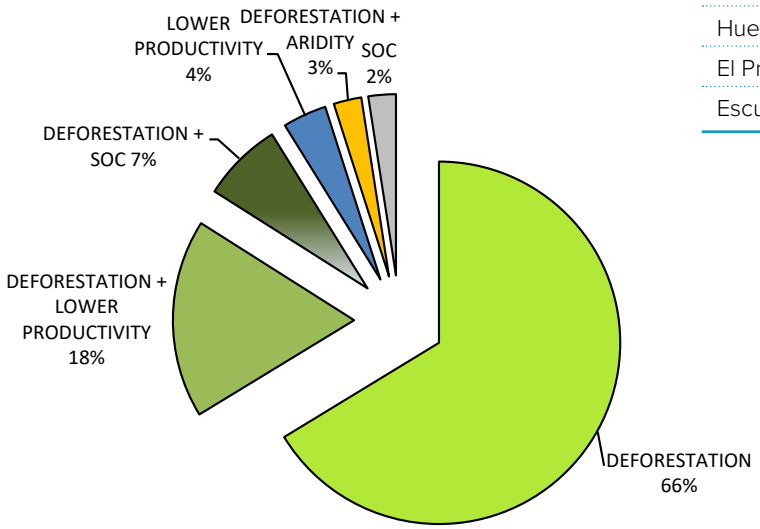
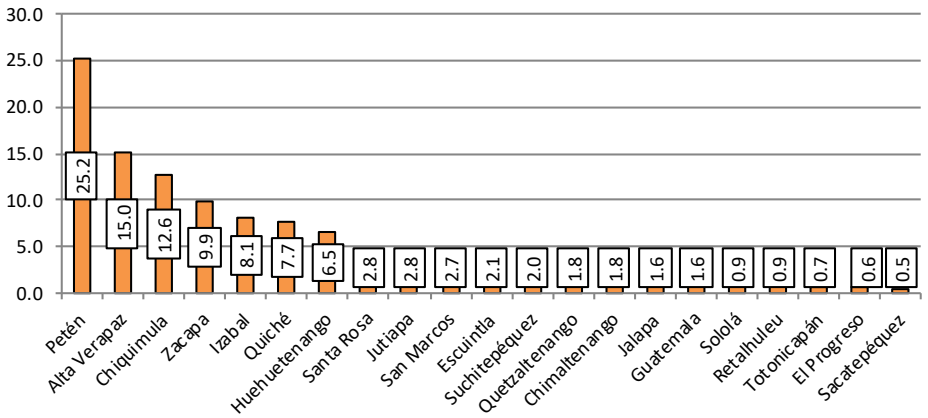


Figure 4.2.2 Guatemala: Incidence of deforestation by Department.



Guatemala, Dry Corridor; Guatemalan peasant looking for water.

4.3 Dominican Republic

As in many of the other countries analysed, deforestation and water stress, alone and/or combined with the other degradation variables, affect most of the territory. Twelve combinations or variables alone account for three quarters of the total.

At a provincial level, a high proportion of incidence of the degradation variables identified can be observed. 90 per cent of the presence of variables and their combinations is found in four provinces; Monseñor Nouel, Santiago, La Vega and Samaná.

When analysing poverty and degradation variables at a provincial level, no relation between them is seen, except in the case of Monte Plata.

Table 4.3
Dominican Republic: Poverty and degradation by province.

	% Poverty	% Degradation
La Altagracia	52.1	72.1
La Romana	45.9	32.5
Elías Piña	41.5	77.2
Monte Plata	41.5	82.3
Puerto Plata	41.5	74.7
San Cristóbal	41.1	71.5
El Seibo	41	58.7
San Juan	41	67.9
Samaná	39.9	91.9
Azua	39.7	63.7
Peravia	38.8	45.8
Hato Mayor	38.7	85.6
San José de Ocoa	38.6	87.3
Barahona	38.3	73.1
Dajabón	37.6	82.8
Espaillat	37.6	85.1
Hermanas Mirabal	36.7	65.5
Duarte	36.2	83.7
Baoruco	35.5	71.8
Pedernales	35.3	63.1
Sánchez Ramírez	35	91.8
Valverde	34.8	87.4
María Trinidad Sánchez	34.7	71.1
Monte Cristi	34.4	48.0
San Pedro de Macorís	34	61.4
Independencia	33.6	73.9
La Vega	32.2	94.2
Santo Domingo	31.8	75.4
Monseñor Nouel	31.5	98.1
Santiago	30.2	95.1

Figure 4.3.1
Dominican Republic: Incidence of the most important degradation factors at a provincial level.

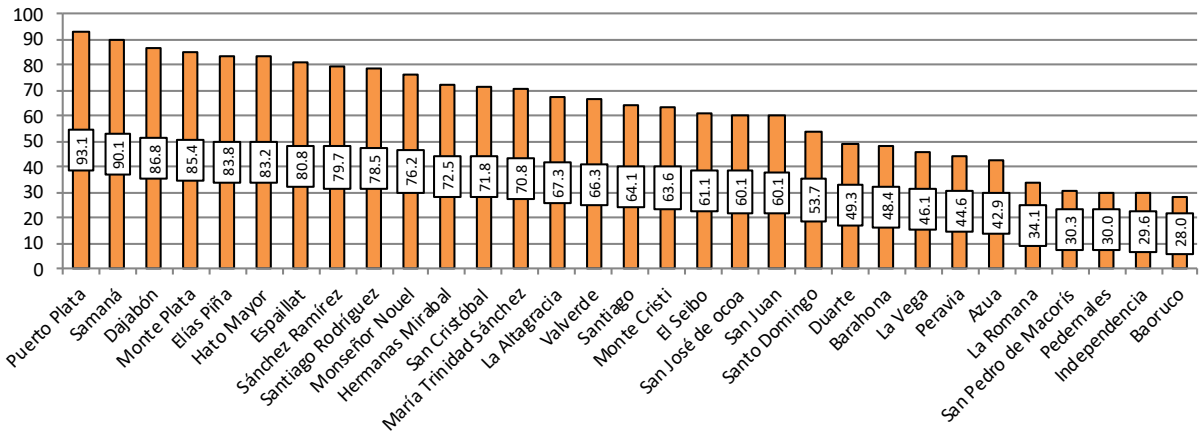
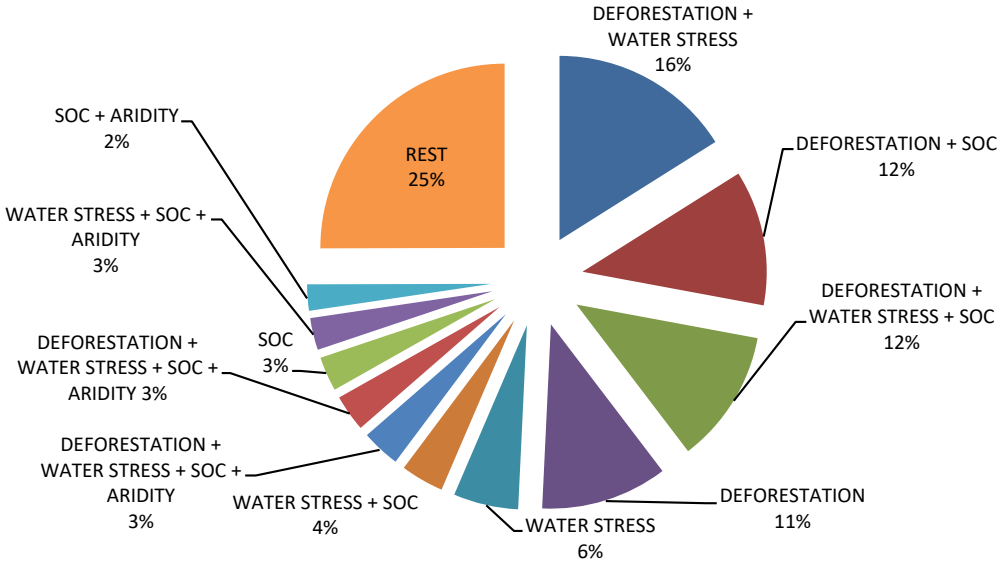


Figure 4.3.2
Dominican Republic: Incidence of the main factors of land degradation.
(As a percentage of total land in the country).



The Dominican Republic has been experiencing a severe ongoing drought for the past 25 years. The image shows the Maguaca dam in La Mata Municipality in Santa Cruz, with a low level of water storage.

Ecuadorean Sierra. Herd of goats grazing in community areas.

4.4 Ecuador

11 combinations of variables, out of a total of 63 impacting on land degradation in Ecuador, affect 75.9 per cent of Ecuadorean territory. The remaining 21 per cent corresponds to the 52 remaining combinations of variables, each with an individual incidence of less than 1.6 per cent.

The main degradation factor is deforestation, both individually (30 per cent of the total) and combined with other variables. Deforestation and all its combinations account for 50 per cent of the total factors affecting land degradation. The "rest", accounting for 21 per cent of the total, corresponds to 52 other possible combinations of variables, each with an incidence equal to or less than 1.6 per cent.

The provinces with the highest incidence of deforestation in their territory are, as expected, those of the Oriente, Morona Santiago, Sucumbíos, Orellana, Zamora Chinchipe and Napo regions.

These six provinces of the Oriente region also have the highest rates of poverty, extreme poverty and inequality.

Table 4.4 Ecuador: Total poverty, extreme poverty and inequality.

Provinces	% Poverty	% Extreme Poverty	GINI Index Inequality
Morona Santiago	58.7	31.5	0.453
Napo	54.2	32.8	0.481
Chimborazo	53.5	18.7	0.403
Cotopaxi	45.1	13.3	0.396
Pastaza	44.7	21.5	0.450
Bolívar	43.3	15.8	0.388
Esmeraldas	43.2	13.6	0.370
Orellana	42.7	19.6	0.433
Sucumbios	42.6	15.5	0.378
Zamora Chinchipe	42.0	9.0	0.361
Los Ríos	33.3	6.2	0.352
Carchi	32.6	8.5	0.364
Imbabura	32.4	8.4	0.407
Loja	31.3	7.0	0.401
Manabí	31.3	6.3	0.372
Santa Elena	30.6	*	0.340
Cañar	29.4	5.0	0.377
Tungurahua	26.8	5.2	0.393
Santo Domingo de los Tsachilas	25.3	*	0.370
Azuay	20.9	3.0	0.392
El Oro	20.2	*	0.340
Guayas	18.1	2.2	0.388
Pichincha	12.1	1.7	0.406
Galápagos	n/i	n/i	0.295
MEDIAN	32.6	8.8	0.388

Note: * = no statistical representation
= n/i = no information
Source: INEC, National Institute of Statistics and Census

© elproductor.com

Dry forest, Manabí, Ecuador. Cattle sheltering in the shade. These forest formations are very fragile and exposed to strong anthropic pressures from expansion of cultivated areas and the livestock overload, especially goats.

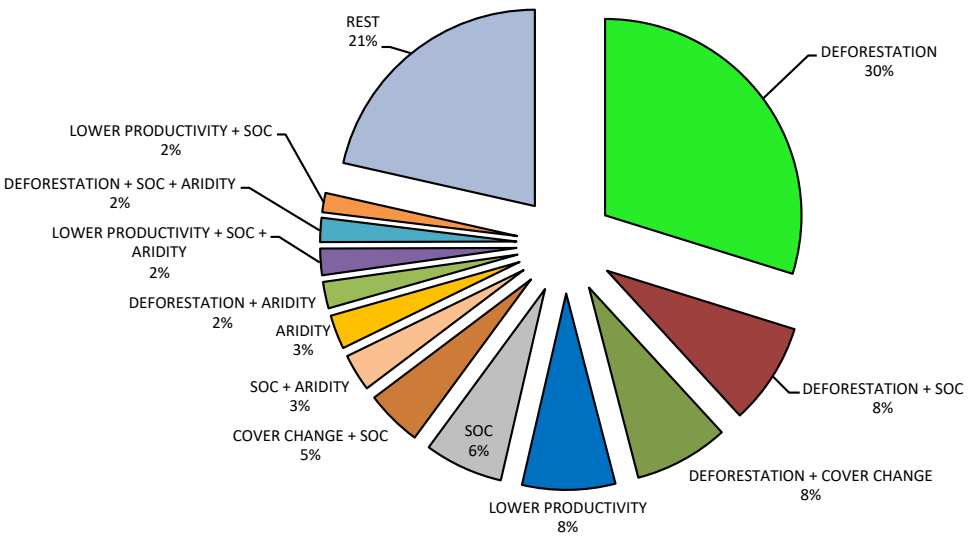
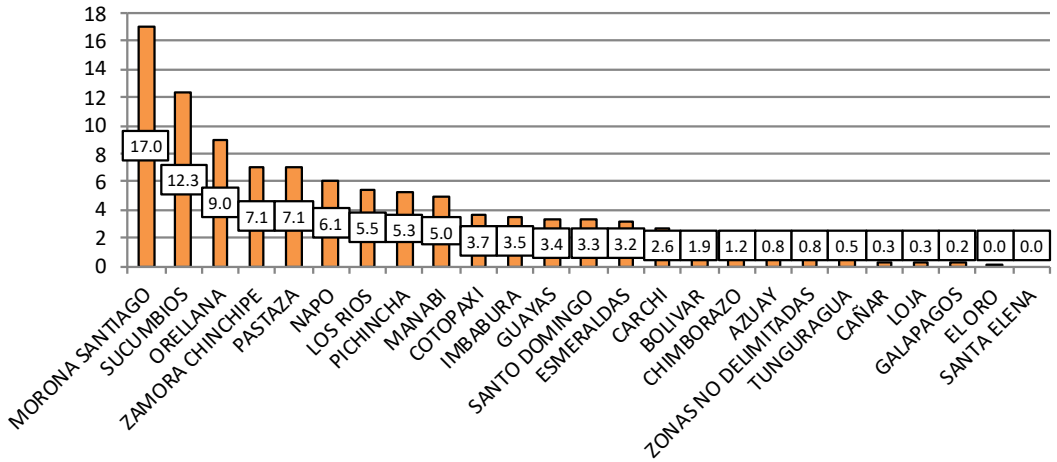


Figure 4.4.1 Ecuador: Incidence of land degradation factors. (As a percentage of total land in the country).

Figure 4.4.2 Ecuador: Incidence of deforestation at a provincial level.



4.5 Peru

Deforestation, low SOC, and aridity are the main factors contributing to land degradation in Peru, as can be seen in Figure 4.5.1. These factors account for 76.8 per cent of all the variables, alone and combined, that affect this process. The rest corresponds to a total of 54 combinations of variables, each affecting less than 3 per cent of the total area.

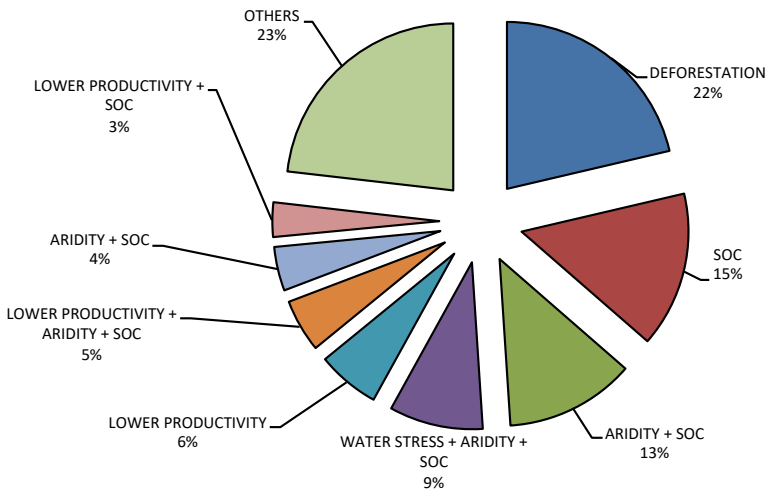
The two departments most affected by the degradation factors identified are Loreto and Ucayali, both in the Peruvian Amazon region. They are followed by Callao and the Madre de Dios department, also in the Amazon region, and a matter of concern due to the significant presence of illegal mining operations, mainly for gold, which are highly degrading to land and water.

Finally, the Departments of Ucayali, Pasco and Callao, along with the incidence of the degradation factors mentioned above, have high poverty rates of above 45 per cent of the population.

Table 4.5 Peru: Incidence of degradation and poverty factors.

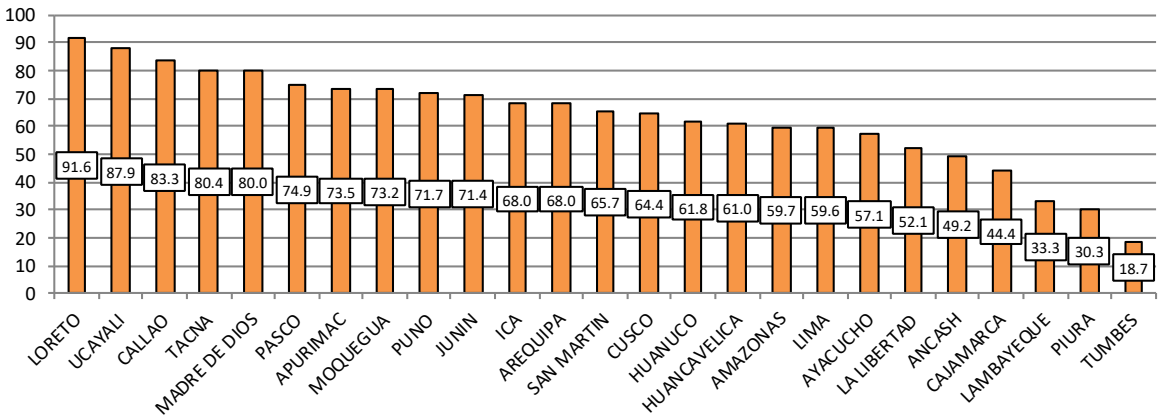
	Incidence of Degradation Factors	% Poverty
Loreto	91.6	48.2
Ucayali	87.9	48.2
Callao	83.3	47.0
Tacna	80.4	46.4
Madre De Dios	80.0	45.7
Pasco	74.9	45.3
Apurimac	73.5	44.9
Moquegua	73.2	44.5
Puno	71.7	44.2
Junin	71.4	44.1
Ica	68.0	43.2
Arequipa	68.0	43.1
San Martin	65.7	43.0
Cusco	64.4	42.7
Huanuco	61.8	42.1
Huancavelica	61.0	42.1
Amazonas	59.7	42.0
Lima	59.6	41.72
Ayacucho	57.1	41.2
La Libertad	52.1	40.3
Ancash	49.2	39.8
Cajamarca	44.4	39.6
Lambayeque	33.3	37.6
Piura	30.3	37.0
Tumbes	18.7	34.9

Figure 4.5.1 Peru: Incidence of land degradation factors. (As a percentage of total land in the country).



Peru, Andean Sierra. Rural village with deforested and degraded lands. As can be seen in the image, crops are grown in furrows in the direction of the slope.

Figure 4.5.2 Peru: Incidence of the main degradation factors at a department level.



4.6 Paraguay

Paraguayan Chaco
Bulldozer deforesting land to make way for livestock and agriculture.

80 per cent of Paraguay's territory is affected by deforestation and combinations of this variable with practically all the others, i.e. aridity, SOC, lower productivity, water stress and land cover change. The factors of degradation, land cover change and aridity, considered individually, are also important.

At a department level, analysing the information available reveals a large impact on the territory from the variables identified as most important and their combinations.

Finally, we can see a certain relationship between the incidence of degradation variables and poverty. This occurs in the Departments of San Pedro, La Guaira and Caaguazú, where a high presence of degradation variables coincides with poverty.

Table 4.6 Paraguay: Degradation and poverty by Department.

	% Degradation factors	% Poverty
San Pedro	87.1	36.1
Ñembecu	86.7	21.7
Guaira	85.2	31.5
Caaguazu	82.8	42.2
Alto Parana	80.5	16.4
Boqueron	80.4	15.3
Caazapa	75.2	36.2
Central	74.9	15.8
Paraguari	72.7	29.0
Cordillera	71.2	27.2
Itapua	67.5	27.9
Misiones	66.9	21.1
Amambay	62.8	19.1
Canindeyu	62.3	20.9
Presidente Hayes	55.5	20.6
Concepcion	54.3	30.2
Asuncion	48.3	

Figure 4.6.1 Paraguay: Incidence of the main degradation factors at a department level.

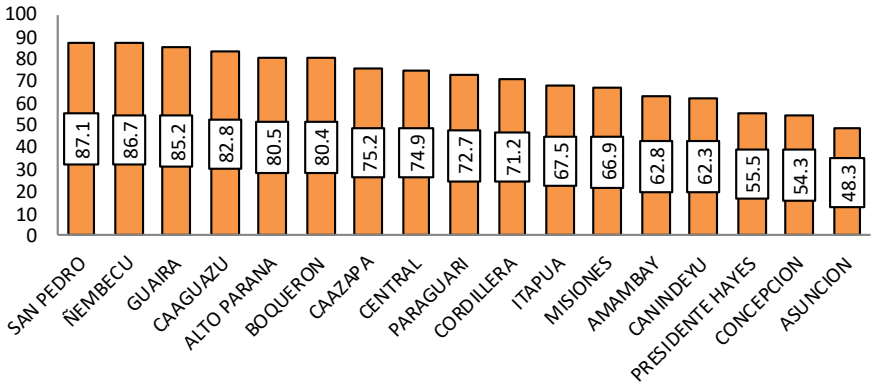
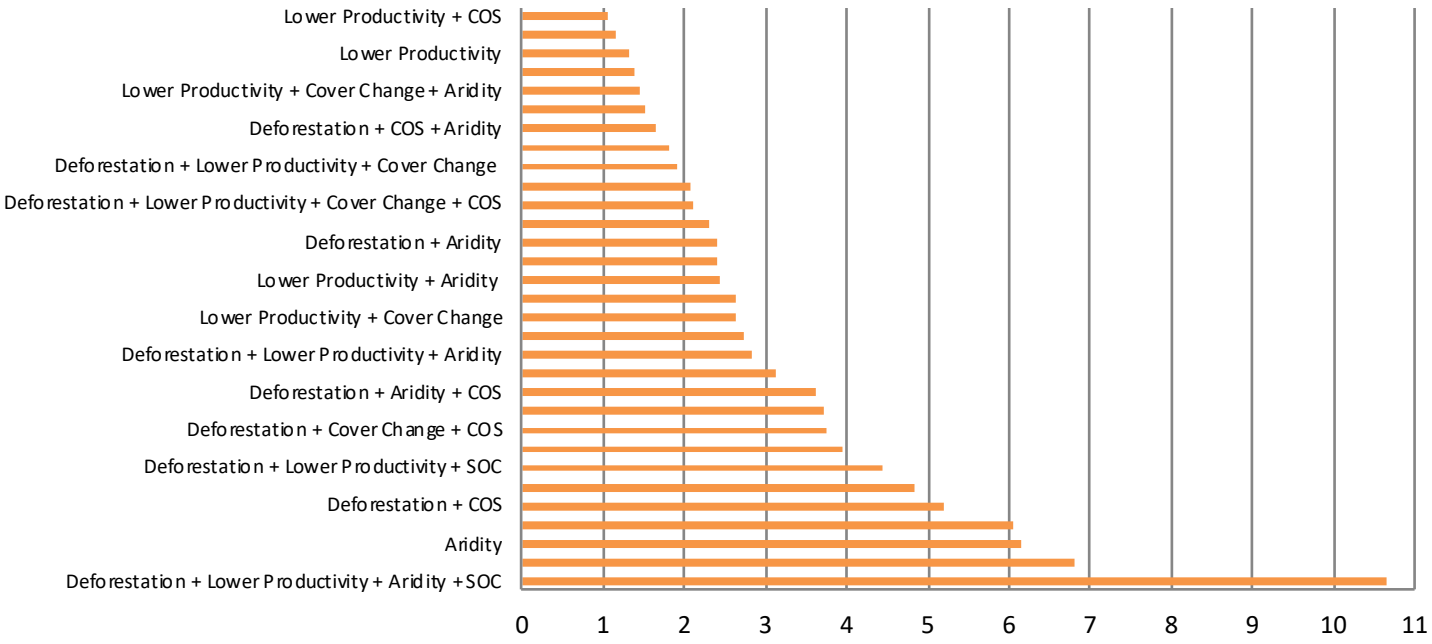


Figure 4.6.2 Paraguay: Incidence of the main degradation factors.



4.7 Brazil

Northeastern Brazil is the region historically associated with the processes of desertification and droughts and the semi-arid climate. The image shows a farmer preparing his arid lands.

On a national level, the main degradation factors affecting the territory are the deforestation variable, alone and in combination with other variables, such as lower productivity, lower productivity and SOC, lower productivity plus SOC and aridity. The ten variables affect 75 per cent of the territory. However, it is important to note that given the huge number of situations in the country, not all States are represented in the graph in question. Deforestation certainly affects places where there is a significant presence of native forests and land has been opened up to commercial agriculture. On the other hand, in some States in the northeast of the country, where the area that can be deforested is small, the variable of land cover change is relevant, either alone or in combination with other variables.

© Alejandro Arigoni MG

That said, the analysis at the state level shows the high incidence of deforestation in Amapá, Acre, Mato Grosso, Amazonas and Rondonia, while all the northeast states show a much lower incidence of the degradation factors that are important at the national level.

Box 7: The three main biomes of Brazil

The Amazon: The Amazon occupies about 49 per cent of the territory of Brazil and covers the states of Acre, Amapá, Amazonas, Pará, Rondônia, Roraima and part of the states of Maranhão, Tocantins and Mato Grosso. The Amazon has the largest area of tropical forests in the world and is equivalent to two thirds of the total tropical humid reserves, hosting most species of flora and fauna. The Amazon is home to 1.5 million catalogued plant species, three thousand species of fish, 950 types of birds and a large number of mammals, reptiles and insects.

It also contains 20 per cent of the world's freshwater stock, as well as important mineral reserves. The Amazon rainforest is self-sustaining, i.e. it is a system that maintains its own nutrients in a permanent cycle. There is a delicate balance between the ecosystem and biological populations, which is sensitive to human interference.
Source: IBGE (Brazilian Institute of Geography and Statistics)

The Cerrado: The Cerrado is the second largest biome in Brazil. It occupies nearly two million km2, covering the states of Goiás, Tocantins, Mato Grosso, Mato Grosso do Sul, the Federal District and parts of São Paulo, Minas Gerais, Maranhão, Piauí and Bahia, which represents about 25 per cent of the national territory.

It is the Brazilian savanna. It has soil poor in nutrients and normally low vegetation, with scattered plants of dry appearance. Two well-marked seasons characterise the Cerrado: dry winter and rainy summer. Many species of fauna, including insects threatened with extinction, live in this environment. And the biome still holds other surprises: watersheds and large plateaus, characteristic relief of the central region of Brazil.
Source: Oswaldo Cruz Foundation, FioCruz

The Caatinga. (from tupí: "white forest" or "white vegetation", kaa = forest, vegetation, tínga = white)

The Caatinga is a biome concentrated in the northeast region of Brazil, occupying about 12 per cent of the national territory, covering vast areas of Ceará, Piauí, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia and also a part of the north of Minas Gerais.

In the Caatinga regions, the climate is hot with prolonged dry seasons and the rainy season influences the life of animals and plants. The diversity of species is lower, compared to other Brazilian biomes such as the Atlantic Forest and the Amazon. However, recent studies reveal a high number of endemic species, i.e. species that only occur in that region. The vegetation is characterised by tortuous shrubs, with a dry and whitish appearance almost all year round.

The climate of the Caatinga is called semi-arid. Characteristics of this type of climate are low humidity and low rainfall and long periods of absence of rain, which can reach eight or nine months of drought per year.

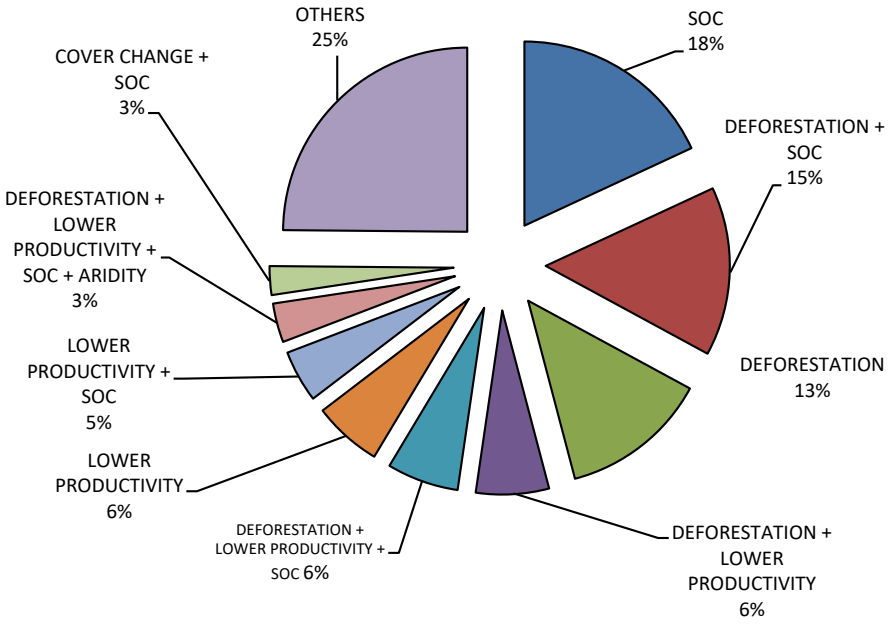


Figure 4.7.1 Brazil: Incidence of land degradation factors
(As a percentage of total land in the country).

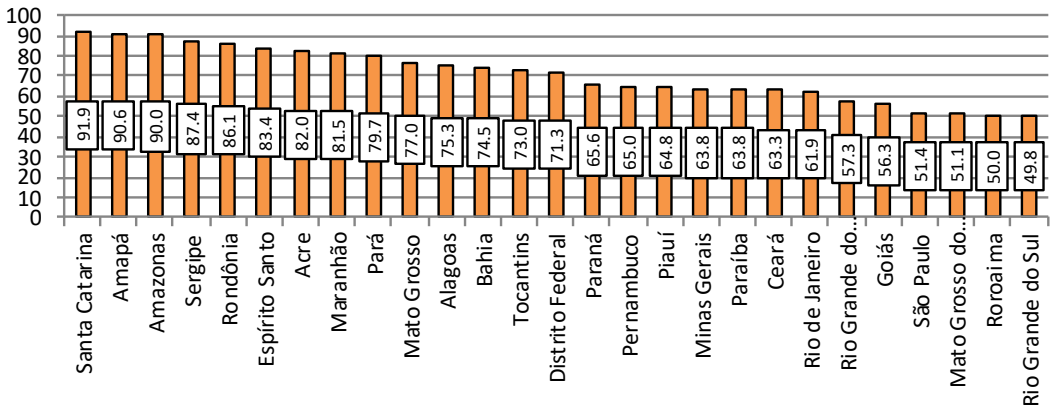


Figure 4.7.2 Brazil: incidence of land degradation factors on a state level.

4.8 Argentina

Decline in productivity, aridity considered both alone and in combination with decline in productivity, vegetation cover change and SOC affect more than half of the Argentinian territory. Another group of 51 variables, with low incidence individually, together affect about 25 per cent of the territory.

The provinces of Santa Cruz, San Luis and Santa Fe have the most territory affected by the identified variables or combinations thereof.

Finally, it should be noted that, at a provincial level, there is no clear relationship between the incidence of the degradation factors analysed and poverty measured by unsatisfied basic needs (UBN). It is worth noting that the situation may be different at higher levels of disaggregation within each province.

Table: 4.8 Argentina: Degradation and poverty by province.

Provinces	% Incidence Degradation Factors	% Poverty By Ubn
Santa Cruz	79.9	8.5
San Luis	78.6	13.9
Santa Fe	76.9	8.1
Buenos Aires	69.2	5.7
Catamarca	61.0	14.0
La Pampa	59.8	5.6
Formosa	59.4	29.0
Corrientes	59.1	18.9
Salta	57.4	23.8
Mendoza	56.7	11.5
Tierra del Fuego	55.5	23.6
Córdoba	54.1	9.5
Jujuy	48.2	20.5
Entre Ríos	47.3	10.0
La Rioja	46.6	15.3
Chaco	44.7	21.8
San Juan	42.8	13.6
Neuquén	41.4	14.3
Chubut	39.9	9.5
Santiago del Estero	33.3	23.4
Río Negro	29.6	11.4
Tucumán	9.0	17.6
Misiones	4.7	18.3

In recent decades, Argentina – like other Latin America and Caribbean countries – has experienced strong growth in terms of agriculture and livestock. In Argentina's case, this process took place in the humid pampa region and later expanded to the north of the country. The image shows the deforestation of native forest to clear land for soybean cultivation.

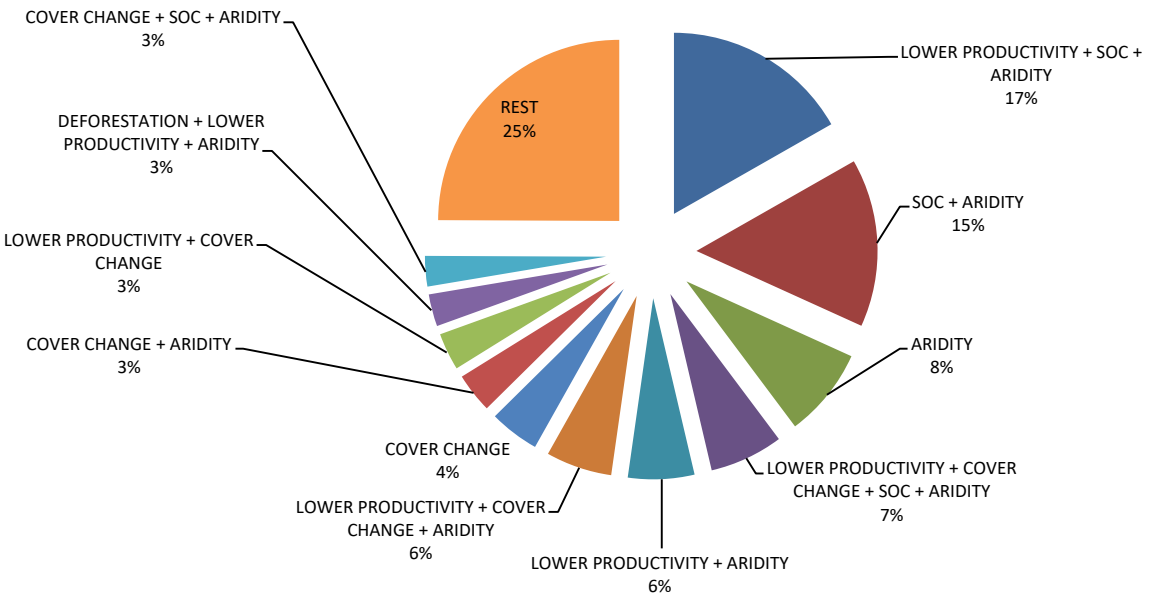
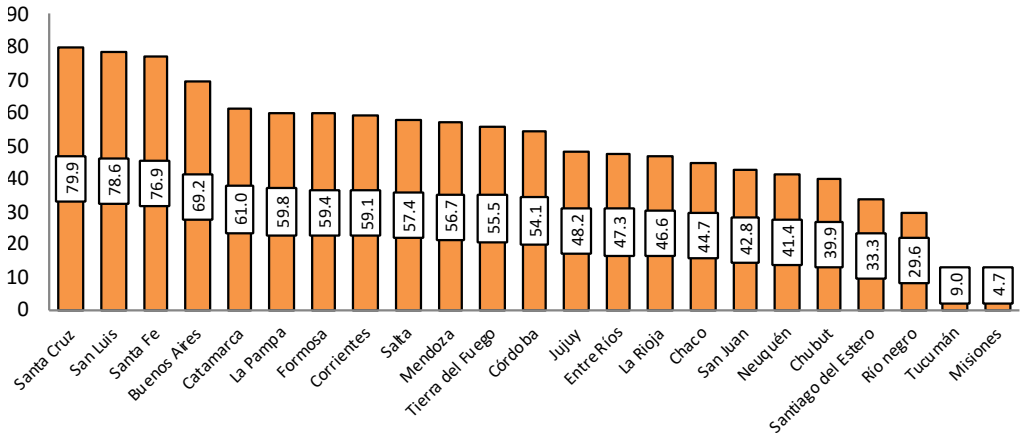


Figure 4.8.1 Argentina: Incidence of land degradation factors. (As a percentage of total land in the country).

Figure 4.8.2 Argentina: Incidence of deforestation at a provincial level.



CONCLUSIONS

Despite the differences between countries and within them, LAC has many shared characteristics and similarities in its processes of land degradation. In all the countries, the degraded area constitutes a significant proportion of national territory, and in all cases the main variables affecting this process are repeated with great frequency. Deforestation exists in all the countries, as both a variable considered individually and in combination with others. The same is observed with respect to soils with low carbon content, degradation and the decline in productivity, although on a smaller scale. In most of the countries, variable aridity appears, acquiring greater importance in the cases of Mexico and Peru than elsewhere.

Table 4.9 presents a summary of the most relevant characteristics of the countries analysed, indicating for each one the degradation variables that most frequently affect the territory, as well as the departments or provinces most affected.

Country	Total area (km^2)	Population (Millions)	Poverty		Degradation estimates (% of land)			Main degradation factors	Territories most recently affected
			Total	Extreme	PRAIS	Based on WAD data	Other sources		
Mesoamerica and the Caribbean									
Mexico	1,964,380	123.6	44	9.4	47.09	32.9	47.8 (*)	Water Stress Aridity Deforestation Low SOC	Baja California Sur, Chihuahua, Sonora, Guanajuato and Zacatecas
Guatemala	108,890	16.9	43.1	11.8	24.1	55.6		Deforestation Decline in Productivity	Petén, Alta Verapaz, Chiquimula
Dominican Republic	48,670	10.7	30.5	6.3	48.53	59.9		Deforestation, Water Stress, Low Carbon Content in the Soil	Provinces of Monseñor Nouel, Santiago, La Vega and Samaná
South America									
Brazil	8,515,770	206.1	19.9	5.5	26.4	36.0	61.4 (****)	Deforestation, Decline in Productivity, Low Carbon Content in the Soil	States of the northern region linked to the Amazon and the Cerrado
Argentina	2,780,400	43.4	32.0	6.7	38.5	40.0	87 (**) 30 (***)	Decline in Productivity, Aridity, Low Carbon Content in the Soil and Land Cover Change	Provinces of Santa Cruz, San Luis and Santa Fe
Paraguay	406,752	6.6	26.6	6.0	51.6	62.3		Deforestation, Lower Productivity, Change in Vegetation Cover, Aridity and Loss of Productivity	Departments of San Pedro, Ñeembecú, Guairá, Caaguazú and Alto Paraná
Peru	1,285,220	31.4	21.8	5.0		58.1	54 (****)	Deforestation, Aridity, Water Stress and Low Carbon Content in the Soil	Departments of Ucayali, Pasco and Callao, Madre de Dios, Apurimac and Moquegua
Ecuador	256,370	16.1	18.2	4.7	28.6	49.9		Deforestation, Low Carbon Content in the Soil and Change in Vegetation Cover	Provinces of the Oriente region (Morona Santiago, Sucumbíos, Orellana, Zamora Chinchipe and Napo)

Table 4.9: Summary of relevant information about the countries analysed.

(*)CONAFOR-UACH. 2013. National line of land degradation and desertification. Final report. National Forestry Commission and Autonomous University of Chapingo. Zapopán, Jalisco.

(**) Zuleta, Gustavo & Malizia, Lucio & Fontana, José & Zurita, Alex & Teixeira, Daniela & Guida-Johnson, Bárbara & Cony, Mariano & Maranta, Aristóbulo & Espinoza-Mendoza, Victoria E. (2017). Priority Areas for Ecological Restoration (APREs) in Argentina.

(***) Report on the State of the Environment 2016. On www.argentina.gob.ar/sites/default/files/mayds_informe_estado_ambiente_2016_baja_1_0.pdf

(****) MANAGEMENT AND STRATEGIC STUDIES CENTRE – CGEE. Desertificação, degradação da terra e secas no Brasil. Brasília, DF: 2016. 252p

(****)Reduction of the Degradation of Agricultural Soils. Peruvian Ministry of Agriculture. On https://www.mef.gob.pe/contenidos/presu_publ/ppr/talleres/ppat2013/04julio2012/5AGRICULTURA/degradacion_suelos_agrarios.pdf

Figure 5: Costs of desertification and land degradation.

Source: ECLAC/GM, ECLAC/UNDP, ECLAC/GIZ, ECLAC/FAO: Studies on the Costs of Inaction regarding Desertification and Land Degradation in Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Belize, Ecuador, Peru, Chile, Bolivia. Authors: Morales C., Araníbar Z., Dascal, G.,

Argentina: Bouza, Mariana E.; Aranda-Rickert, Adriana; Brizuela, Maria Magdalena; Wilson, Marcelo G.; Sasal, Maria Carolina; Sione, Silvana M. J.; Beghetto, Stella; Gabious, Emmanuel A.; Oszust, Jose D.; Bran, Donaldo E.; Velazco, Virginia; Gaitan, Juan J.; Silenzi, Juan C.; Echeverria, Nora, E.; De Lucia, Martin P.; Iurman, Daniel E.; Vanzolini, Juan I.; Castoldi, Federico J.; Hormaeche, Joaquin Etorena; Johnson, Timothy; Meyer, Stefan; and Nkonya, Ephraim M. 2016. Economics of land degradation in Argentina. In Economics of land degradation and improvement - A global assessment

5. COSTS OF LAND DEGRADATION AND DESERTIFICATION

Estimating the costs of desertification and land degradation has gained particular importance over the last decade, in tandem with national efforts to combat these processes, and to efficiently and effectively allocate the resources required in order to do so.

The UNCCD's Second Scientific Conference "Economic assessment of desertification, sustainable land management and resilience of arid, semi-arid and dry sub-humid areas", held in Bonn, Germany from 9 to 12 April 2013, compiled and systematised the main work and applied methodologies to measure the costs of desertification and land degradation.

Academic centres such as the Centre for Development Research (Zentrum für Entwicklungsforschung) at the University of Bonn, and initiatives such as Economics of Land Degradation (ELD) have worked intensely on this subject, helping to estimate the costs of degradation and desertification in different parts of the world.

In LAC, the Economic Commission of the United Nations (ECLAC) has developed several projects in this area together with other agencies, such as the Global Mechanism of the UNCCD, the United Nations Development Programme (UNDP), the FAO, the Joint Research Centre (JRC), the European Union and the German Agency for Cooperation (GIZ).

In Colombia, in March 2018, policymakers were presented with a summary of evidence-based measurements on the costs of land degradation and restoration. On this occasion it was reported that, according to the study, the costs of degradation reached 10 per cent of Gross World Product in 2010, due to the loss of biodiversity and ecosystem services[1].

The figure presents the estimates on the costs of inaction regarding desertification and land degradation in LAC countries.

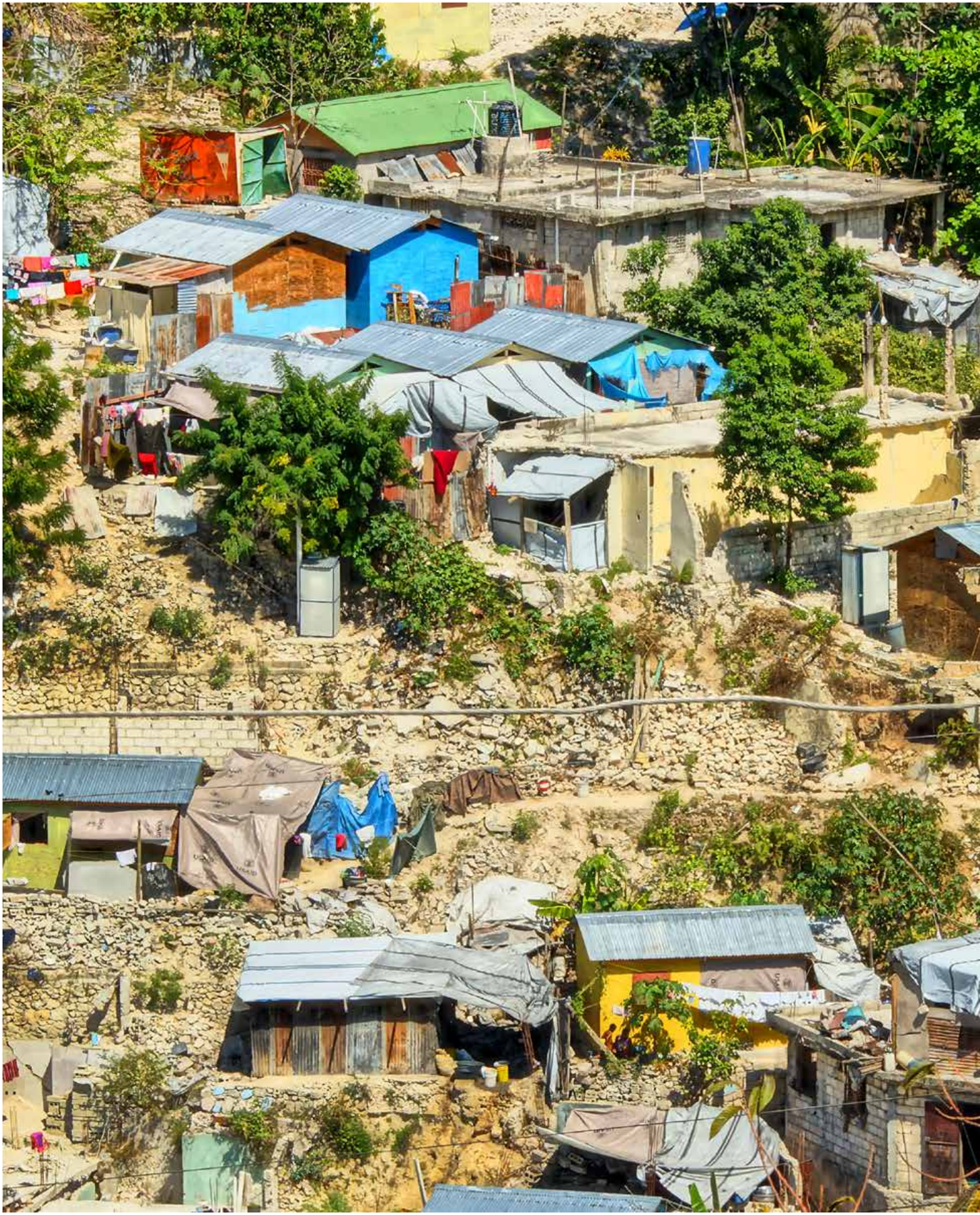
As a percentage of total agricultural GDP

Panama (2011) 6.6%
Costa Rica (2011) 4.5%
Nicaragua (2011) <1%
Guatemala (2011) 5.8%
Honduras (2011) 10.5%
Belize (2011) 3.6%
Ecuador (2013) 10.1%
Department of Piura, Peru (2013) 13.3%
Bolivia (2014) 15.5%
Chile (2015) Regions IV=23.4%, V=9%, VI=9%, VII=11.7%, Metropolitan Region=5.5%

As a percentage of total GDP

Brazil (2008) 1.33%
Paraguay (2009) 6.6%
Argentina (2017) 26%
-16% of GDP for ecosystem services

1 IPBS, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Summary for policymakers of the thematic assessment of land degradation and restoration.



6. SUSTAINABLE LAND MANAGEMENT AND CLIMATE CHANGE ADAPTATION

A sweep was carried out of technical and financial cooperation projects aimed at sustainable management, climate change adaptation and, in some cases, biodiversity conservation. It was judged preferable to include projects focussed on drylands[1] or with these as a significant component (arid, semi-arid and dry sub-humid lands).

This investigation reviewed Global Environment Facility (GEF) projects and those of some agencies and international non-governmental organisations, among them the European Union's Euroclima programme; other initiatives also financed by the EU, grouped under the Integrated Zone of the Southern Cone (ZICOSUR); the Ecosystem-based Adaptation programme (EbA), in particular those initiatives implemented by the International Union for the Conservation of Nature (IUCN), and Initiative 20x20 that developed under the aegis of the World Resources Institute (WRI) and the Bonn Challenge.

Haiti has one of the most complex situations of deforestation and land degradation in the region. One of the most significant anthropic pressures is urban expansion in larger cities. The image shows inhabitants living on eroded hillsides with steep slopes.

6.1 GEF PROJECTS

As is widely known, the GEF is an association for international cooperation in which 183 countries work together with international institutions, civil society organisations and the private sector to address global environmental problems. There are 32 donor countries and 151 recipients of project funds. The GEF is currently the world's main source of resources for environmental projects, hence its relevance in the framework of projects of interest for this document.

Although it is housed within the World Bank (WB) and receives administrative services from the Bank, the GEF is an independent organisation. The WB acts as the Fund's trustee and also operates as an implementing agency for GEF projects, together with UNEP and the UNDP, to which various other international cooperation organisations have been added. The GEF, on the other hand, is the financial mechanism of the main multilateral environmental conventions.

GEF projects are framed in focal areas that target relevant issues linked to land degradation. From this document's perspective, the focal area "land degradation" is core. However, projects which integrated the focal areas "international waters" (relevant in the case of shared river basins and lakes), "climate change" and "biological diversity" with land degradation were also researched. This is a concise list of GEF projects benefitting the sample of selected countries, alone or in binational or sub-regional associations (in alphabetical order)[2], and their objectives. The list is ordered by country.

Argentina

Sustainable management of arid and semi-arid ecosystems to combat desertification in Patagonia
Focal area: land degradation. With final evaluation in 2016. Investment: USD 5.2 million of GEF contributions and USD 26.6 million of co-financing. Implementing agency: UNDP; executing agency: Secretaries of Environment and Sustainable Development and of Agriculture, Argentina.

Much of the Argentinian Patagonia is experiencing advanced processes of land degradation and desertification as a result of overgrazing, drought and anthropogenic pressures. The image shows a Patagonian landscape.

The objective of the proposed project was to control desertification in Patagonia by implementing sustainable land management practices, seeking to restore ecosystems in their integrity, stability and functions, in the context of sustainable development of Patagonia. The project's immediate objective or purpose was to eliminate the barriers that currently prevent sustainable land management being adopted in the region. A further objective was to undertake actions in the field to complement the Sustainable Sheep Farming Development Programme for Patagonia, increasing its contribution to the fight against land degradation and conserving the integrity of the region's ecosystem.

Sustainable management of the drylands in the northwest
Focal area: land degradation. Implementation approved in 2014. Investment: USD 3.5 million of GEF contributions and USD 20.8 million of co-financing. Implementing agency: UNDP; executing agency: Secretariat of Environment and Sustainable Development, Argentina.

The objective of the project was to develop a framework for sustainable land management to alleviate degradation, maintain ecosystem services and improve rural livelihoods in the drylands of northwestern Argentina.

Argentina, Bolivia, and Paraguay

Sustainable forest management in the Gran Chaco Americano cross-border ecosystem
Focal areas: land degradation, biodiversity and climate change. Project completed in 2017, final evaluation not available. Investment: USD 6.9 million of GEF contributions and USD 18.4 million of co-financing. Implementing agency: UNEP; executing agencies: Secretariat of Environment and Sustainable Development of Argentina, Ministry of Environment and Water of Bolivia and Secretariat of the Environment of Paraguay.

The project was aimed at reversing land degradation trends in the Gran Chaco by supporting sustainable land management in the productive landscape. The following goals were established:

- The practices of sustainable forest management adopted for the land would focus on 500,000 hectares on 9 demonstration sites and their

The Bolivian Chaco covers an area of approximately 200,000 km² and lies in the eastern and southeastern regions of the departments of Santa Cruz, Chuquisaca and Tarija. The image shows the dry forest in the town of Villamontes in the Bolivian Chaco.

manifest effects on 850,000 hectares, thus reducing land degradation, conserving biodiversity and increasing carbon sequestration.

- The areas of the biological corridors between protected areas located in the demonstration sites would increase by 280,000 hectares, managed in a conservationist scheme, thereby improving connectivity.
- The incomes of 4,586 producers and their families would increase, and there would be additional potential for 4,000 more producers through the effects of the demonstration.
- The carbon sequestered on the project's demonstration sites would increase by 0.5 tonnes per hectare/year as a result of adopting sustainable management practices.

Brazil

Conservation and sustainable management of the Caatinga

Focal areas: biological diversity and land degradation. Final evaluation in 2014. Investment: USD 10.0 million of GEF contributions and USD 13.1 million of co-financing. Implementing agency: World Bank; executing agencies: the Development and Regional Action Company (CAR) and the Environmental Resources Centre (CRA) of Bahia, Brazil, and the Secretariat of the Environment (SOMA) and the Luiz Eduardo Magalhães Foundation (FLEM) of Ceará, Brazil.

The proposed objectives of the project were: (i) to contribute towards protecting the Caatinga's biodiversity, reducing carbon emissions to the atmosphere, and promoting greater carbon storage in Caatinga's vegetation, through activities that promote and ensure the conservation and sustainable management of the Caatinga biome; and (ii) to improve the socioeconomic situation and quality of life for the population living in these areas, thus promoting integrated and sustainable development in the Caatinga areas.

© FUNCEME

Brazil, goats feeding in the Caatinga biome.

To achieve the objectives, the project incorporated (i) a state plan, the formulation of evaluation and monitoring strategies, including mapping the Caatinga and of the state of preservation and degradation in terms of biodiversity, as well as introducing education and capacity-building for the conservation of biodiversity, carbon sequestration activities, and the use of efficient fuel technologies; (ii) targeted interventions in selected pilot demonstration areas, eliminating fire as a method for land clearing and adopting fuel-efficient wood stoves to conserve and rehabilitate defined landscape units, which would include investments and activities oriented to local populations, and improvements in their livelihoods; and (iii) public awareness and dissemination.

Sustainable land management in the semi-arid zone

Focal area: land degradation. Final evaluation in 2014. Investment: USD 5.9 million of GEF contributions and USD 9.2 million of co-financing. Implementing agency: IFAD[1]; executing agency: Ministry of Agrarian Development, Brazil.

The GEF contribution is integrated into the IFAD loan "Sustainable Development Project for Agrarian Reform Settlements in the Semi-Arid Northeast (PDHC)" and complements existing programmes, in particular the PDHC. It was envisaged that by addressing land degradation in the Sertão smallholders sub-sector, through an appropriate approach to implementing sustainable land management, the subsidy would generate highly significant socioeconomic and environmental benefits at the local, national and global levels. The overall objective of the proposal was to minimise the causes of degradation and its impact on the integrity of the Caatinga biome ecosystem in northeastern Brazil, by implementing systems of sustainable land use.

Sustainable land management in the semi-arid Northeast – Sergipe

Focal area: land degradation. Implementation approved in 2014. Investment: USD 3.8 million of GEF contribution and USD 17.3 million of

Erosion is one of the causes of soil degradation and desertification. In several Brazilian states, special programmes have been implemented to recover degraded soils. The image shows one of these programmes intended to control gullies in Sergipe.

© infraestruturameioambiente.sp.gov.br/institutogeologico

co-financing. Implementing agency: UNDP; executing agency: Secretariat of Sustainable Rural Development and Extractivism, Ministry of Environment and State Government, Brazil.

Objective: Strengthening sustainable land management frameworks to combat degradation processes in the semi-arid region of the state of Sergipe in the northeast.

Reversing the desertification process in susceptible parts of Brazil: sustainable agroforestry practices and biodiversity conservation (REDESER)
Focal areas: Biological diversity and land degradation. Implementation approved in 2016. Investment: USD 3.9 million of GEF contributions and USD 15.8 million of co-financing. Implementing agency: FAO; executing agency: Secretariat of Sustainable Rural Development and Extractivism and Ministry of the Environment, Brazil.

Objective: Stopping and reversing environmental degradation in areas susceptible to desertification, ensuring the flow of ecosystem services, promoting integrated management of natural resources, generating global environmental benefits and helping to reduce poverty. Development objective: To increase and improve the provision of goods and services for sustainable management and restoration of rain-fed forests and agroforestry production landscapes, helping to reduce poverty.

Ecuador

Promoting climate-smart livestock farming by integrating the reversal of land degradation and reducing the risks of desertification in vulnerable provinces
Focal areas: land degradation and climate change. Implementation approved in 2015. Investment: USD 3.9 million of GEF contributions and USD 22.2 million of co-financing. Implementing agency: FAO; executing agencies: Ministries of Environment and Agriculture, Livestock, Aquaculture and Fisheries, Ecuador.

Objective: Reducing soil degradation, increasing the capacity to adapt to climate change and mitigating greenhouse gas (GHG) emissions by implementing intersectoral policies and climate-smart livestock management, with an emphasis on vulnerable provinces.

© University of Guadalajara

San Luis de Potosí. Nopal plantation in arid lands in a farming community. This plant is an important resource because it also provides ecosystem services, such as water and soil retention, and a habitat for flora and fauna.

Ecuador and Peru

Multiplying the environmental and carbon benefits in high Andean ecosystems
Focal areas: biodiversity, land degradation and climate change. Implementation approved in 2014. Investment: USD 3.5 million of GEF contributions and USD 20.8 million of co-financing. Implementing agency: UNEP; executing agency: Consortium for eco-development of the Andean region (CONDESAN).

Objective: Protecting high-Andean critical ecosystems in selected intervention sites, by incorporating integrated and scientifically validated tools and practices of sustainable land management, which preserve and improve biodiversity and carbon stocks while helping to mitigate climate change.

Jamaica and other small Caribbean island nations[2]

Integrating water, land and ecosystem management in the small developing Caribbean island nations

Focal areas: biodiversity, international waters and land degradation. Project approved in 2012. Investment: USD 20.7 million of GEF contributions and USD 68.0 million of co-financing. Implementing agency: UNEP; executing agencies: Caribbean Environmental Health Institute (CEHI), Regional Coordinating Unit of the Caribbean Environment Programme (CAR/RCU) of the UNEP, Centre for Environmental Engineering and Management of Coasts and Bays of Cuba-Regional Activity Centre (LBS-RAC) and the Regional Activity Centre (RAC) for the Protocol Concerning Marine Pollution from Land-Based Sources and Activities in the Greater Caribbean.

Objective: Contributing to the preservation of Caribbean ecosystems of global importance and the sustainability of livelihoods by applying existing proven technologies and approaches, appropriate for small developing island nations, through improved management of coastal and inland water resources, sustainable land and forest management, which also seeks to improve the resilience of socio-ecological systems to the impact of climate change.

© Desmond Brown/IPS

Jamaica. The Yallahs River, one of the main water sources of the Mona deposit, has been dry for months (Note as of January 2019).

Mexico

Conserving coastal watersheds to achieve multiple overall environmental benefits in the context of changing environments
Focal areas: biodiversity, land degradation and climate change. Project approved in 2013. Investment: USD 39.5 million of GEF contributions and USD 228.3 million of co-financing. Implementing agency: World Bank; executing agencies: National Commission of Natural Protected Areas (CONANP), National Forestry Commission (CONAFOR), Mexican Fund for the Conservation of Nature (FMCN) and National Institute of Ecology (INE), Mexico.

Objective: Promoting integrated environmental management of selected coastal watersheds as a means of achieving biodiversity conservation benefits, increasing resilience to climate change and improving the sustainable use of land.

Sustainable land management
Focal area: land degradation. Approved for implementation in 2015. Investment: USD 1.7 million of GEF contributions and USD 8.7 million of co-financing. Implementing agency: FAO; executing agency: not mentioned.

Objective: Reducing land degradation by implementing a model of sustainable land management and strengthening local institutions to enable the concurrence of multisectoral policies and investment in public goods in three priority micro-regions.

© Michelle Carrere

Nicaragua, Bosawas Reserve. This reserve covers 15 per cent of Nicaraguan territory and is mainly inhabited by the indigenous Mayangna and Miskito ethnic groups, which have seen their livelihoods threatened as a result of the arrival of cattle ranching and deforestation, with consequent degradation.

Nicaragua

Sustainable land management in areas prone to drought
Focal area: land degradation. Final evaluation in 2012. Investment: USD 3.0 million of GEF contributions and USD 12.5 million of co-financing. Implementing agency: UNDP; executing agency: Ministry of the Environment and Natural Resources, Nicaragua.

The overall objective of the project is to help increase the integrity, stability, functions and services of the ecosystem, by promoting and incorporating sustainable land management policies and practices using an intersectoral approach, thereby also contributing to people's livelihoods and economic wellbeing. The project aims to create the governance agreements, financial conditions and knowledge base required so that sustainable land management practices take root and are widely adopted in the rural areas of Nicaragua's drylands.

Strengthening the resilience of multiple-use protected areas to deliver multiple global environmental benefits
Focal areas: biodiversity, land degradation and climate change. Implementation approved in 2015. Investment: USD 6.5 million of GEF contributions and USD 19.9 million of co-financing. Implementing agency: UNDP; executing agency: Ministry of the Environment and Natural Resources, Nicaragua.

Objective: Strengthened management effectiveness of multiple-use protected areas and the sustainable use of dry and humid forests in the wider landscape in western and north-central Nicaragua to ensure the flow of multiple ecosystem services, ensuring biodiversity conservation, sustainable land management, and climate change mitigation from land-use change.

Peru

Conservation, management and restoration of fragile lomas ecosystems
Focal areas: land degradation and biodiversity. The implementation of the project was approved in 2016. Investment: USD 2.0 million of GEF contributions and USD 13.5 million of co-financing. Implementing agency: UNDP; executing agencies: Ministry of the Environment; Municipality of Metropolitan Lima and district municipalities of Lima, Peru.

Objective: Conservation, management and restoration of fragile lomas ecosystems in Lima.

Promoting sustainable land management in Las Bambas
Focal area: land degradation. Project started in 2009 and ended in 2016 (there was no final evaluation available). Investment: USD 4.0 million of GEF contributions and USD 11.5 million of co-financing. Implementing agency: UNDP; Executing agencies: Provincial government of Cotabambas and Minera Xstrata, Peru.

Objective: The private sector, the government, NGOs and local communities constructively interact in support of sustainable land management, taking advantage of the corporate responsibility programmes set up by mining industries.

Dominican Republic

Demonstrating sustainable land management in the Upper Sabana Yegua watershed system
Focal area: land degradation. Final evaluation of the project in 2013. Investment: USD 4.4 million of GEF contributions and USD 25.5 million of co-financing. Implementing agency: UNDP; executing agency: Fundación Futuro.

Objective: To facilitate sustainable land management in the Upper Sabana Yegua through the creation of policies, practices, and incentives for financially and environmentally sound activities in harmony with the recommended land use and bio-climatic conditions of the ecosystem. To remove the present barriers and establish the framework and mechanisms for effective long-term management, financing, and technical development for Sabana Yegua.

Dominican Republic, Municipality of Monción, Province of Santiago. Livestock in drylands due to prolonged drought.

© Reuters/Richard Rojas

Dominican Republic and Haiti

Reducing Conflicting Water Uses in the Artibonite River Basin through Development and Adoption of a Multi-focal Area Strategic Action Programme.

Focal areas: land degradation and international waters. Execution completed in 2012; final evaluation of the project in 2016. Investment: USD 3.1 million of GEF contributions and USD 7.2 million of co-financing. Implementing agency: UNDP; executing agencies: Ministry of Environment and Natural Resources of the Dominican Republic, and Ministry of the Environment of Haiti.

Objective: To establish a bi-national framework between the Dominican Republic and Haiti for integrated management of the Artibonite river basin that will promote comprehensive, ecosystem-based reforms, demonstrations and investments, and lay the foundations for long-term environmental functionality and socioeconomic stability.

6.2 EUROCLIMA+[3]

Euroclima is a regional cooperation programme between the European Union (EU) and LAC, which focusses on climate change. Its main objective is to facilitate the integration of climate change mitigation and adaptation strategies and measures. Its actions are focussed on six areas, with the most relevant one dealing with "forests, biodiversity and ecosystems"[4], as the actions of this area help comply with Nationally Determined Contributions (NDCs) and/or national climate change action plans within the context of the Paris Agreement.

With this core purpose in mind, the cooperation programme seeks to reinforce the resilience of forests and ecosystems, and support local communities in the fight against climate change and environmental degradation. In the first call made by Euroclima in LAC, 163 concept notes were presented, of which 25 were pre-selected, leading to a shortlist for full proposals. At a second stage, seven concept notes were selected, covering fourteen countries in the region. These are now in the process of advanced implementation. According to the information available, the selection of two or three additional projects is expected.

All accepted concept notes consider actions in at least two countries. In four of them, with the participation of European entities, triangular cooperation is incorporated and coordination is included with local communities and organisations of indigenous peoples, as well as with local and national institutions in LAC. The projects currently being executed are relatively new and are for lower amounts than those which have been financed by the GEF.

The projects financed by EUROCLIMA+1 have several interesting characteristics: they follow a comprehensive and ecosystem-based approach, and engage a wide variety of players, bringing them closer to the communities, encouraging the participation of non-profit organisations, public institutions and private and community organisations.

The selected projects set out to strengthen models of integrated forest management, increase resilience in populations affected by climate change, and improve the management of land-use and protected areas. They also cover cross-cutting themes such as the management of water resources, the gender perspective, the inclusion of indigenous peoples, and the promotion of value chains. One cross-cutting issue that is mentioned, but not yet clearly defined, is the governance of these initiatives.

Honduras. Deforestation in the Patuca River Basin II.

PROJECTS FOR MAJOR ISSUES[5]

Forest value chains

EU contribution: USD 870,100[6].
Sub-regional project that incorporates Colombia, El Salvador, Guatemala and Honduras.
Project name: Promoting dialogue, exchange and forest value chains to adapt and mitigate climate change.
Objective: To strengthen integrated forest management models with a territorial management approach as a mechanism for climate change adaptation and mitigation.

Governance and land use management

EU contribution: USD 914,700.
Bi-national project: Honduras and Peru.
Project name: "Improving the governance and management of land-use to address the causes of forest loss and degradation and the improvement of carbon stocks".
Objective: To contribute to climate change resilient sustainable development through successful experiences in implementing REDD+ (conservation), forest landscape restoration (FLR) and Forest Law Enforcement, Governance and Trade (FLEGT) initiatives that generate benefits for the inhabitants of the territories of the Río Tinto and Río Blanco basins in Honduras, as well as in the Río Huayabamba sub-basin in the San Martín region of Peru.

Forest management and restoration in productive environments

EU contribution: USD 1,012,300.
Subregional project, incorporating Argentina, Bolivia, Brazil and Paraguay.
Project name: Forest management and restoration in productive environments.
Objective: To improve the socio-ecological resilience of local populations by strengthening forest management mechanisms and territorial governance of Gran Chaco.

Municipal actions

EU contribution: USD 1,070,700.
Bi-national project: Brazil and Mexico.
Project name: Articulating global agendas from the local. Adaptation based on ecosystems as a catalyst for municipal actions to achieve global goals.
Objectives: To increase local resilience by integrating the Ecosystem-based Adaptation approach (EbA) in priority municipalities of Mexico and Brazil, articulating global agendas on climate change, biodiversity conservation, sustainable development and disaster risk reduction.

Costa Rica, Province of Guanacaste.

Bolivia (photo right), desertification in the Department of Potosí.

© Alejandro Bolívar

© internacionales.blogspot.com

Services, goods and/or ecosystem functions

EU contribution: USD 881,400.
Bi-national project: Costa Rica and Peru.
Project name: Harvesting water, water services canon, and recognition of payment for environmental services under the South-South Cooperation framework.
Objective: The improvement of the water supply in semiarid tropical dry forest areas in Costa Rica and the protection, improvement and restoration of watersheds through a payment for ecosystem services system and a water canon in Peru.

Non-carbon benefits

EU contribution: USD 1,107,400.
Bi-national project: Bolivia and Panama.
Project name: Institutionalising the benefits not related to local carbon in national climate change adaptation and mitigation strategies in two pilot territories in Panama and Bolivia.
Objective: Non-carbon benefits (NCBs) are institutionalised in climate change mitigation and adaptation strategies in forests.

Biodiversity and community development

EU contribution: USD 996,600.
Bi-national project: Guatemala and Honduras.
Project name: Biodiversity and community development: strengthening the national management of protected areas.
Objective: Not stated.

6.3 ZICOSUR PROGRAMME[7]

The ZICOSUR Programme "Conservation, sustainable use and good governance of biodiversity in four vulnerable biomes in the centre of South America" was launched within the framework of the European Union "Biodiversity for life" strategy (B4Life)[8]. The scope of this instrument is global. Its aim is to contribute to the conservation of biodiversity and ecosystems and their services in development strategies and poverty eradication. The four biomes of Gran Chaco, Cerrado, Pantanal and Chiquitanos Dry Forests are relevant for Argentina, Bolivia, Brazil and Paraguay, and are located in the ZICOSUR area of influence, which covers a significant proportion of drylands.

The objective of the programme is to preserve the key environmental values of these ecosystems in order to contribute to the productive sectors, seeking the sustainability of the region's development. Three core strategic lines are proposed to achieve this objective: (1) the conservation of healthy and functional ecosystems; (2) the promotion of environmentally sustainable production systems; and (3) the strengthening of effective and inclusive environmental governance mechanisms.

©elpais.bo

Bolivia, Tarija. Severely eroded lands.

The Bolivian Pantanal on the border with Brazil.

The EU allocated EUR 10 million (USD 11.3 million) to this programme, which was awarded to five projects. Five consortia were formed to implement these projects. Three were based in Bolivia and led, respectively, by the Centre for Regional Studies for the Development of Tarija (CERDET, in Spanish); the Centre for Research and Promotion of Farmers (CIPCA, in Spanish); and the Foundation for the Conservation of the Chiquitano Forest (FCBC, in Spanish). One was in Argentina, the PROYUNGAS Foundation, and the final one was in Brazil, the World Wildlife Fund (WWF).

The projects that make up the programme are autonomous and administratively independent. The process for their integration and coordination in a single programme was led by the Delegation of the European Union based in Brasilia, which is responsible for administrative and technical monitoring. This was done in conjunction with the Delegations of La Paz and Buenos Aires in order to cover the projects with their main base in these countries. Meanwhile, the ZICOSUR Commission for the Environment, Sustainable Development and Climate Change helps coordinate the programme.

Below are the five projects in the programme, listed by the head consortium.

CERDET - Bolivia

Region of intervention: Gran Chaco (Argentina, Bolivia and Paraguay).
Other members of the consortium: COOPI, FUNDAPAZ, ICCO, TIERRA VIVA and LA CORDILLERA FOUNDATION.
Name: For our sustainable Gran Chaco: Active participation in territorial management models for environmental conservation integrated with sustainable production.
Objectives: To help conserve the environmental functions and ecosystem services of the Gran Chaco in Argentina, Bolivia and Paraguay, within the framework of sustainable productive development dynamics. Specifically, to develop territorial management and sustainable production models, integrated into the ZICOSUR, inclusive and adapted to climate change.

FCBC – Bolivia

Region of intervention: Chiquitano Dry Forests, Cerrado and Pantanal in Bolivia and Brazil.
Other members of the consortium: FAN, SAVIA, DEPARTMENTAL GOVERNMENT OF SANTA CRUZ, ECOA and BOSQUES DEL MUNDO.
Name: Connecting landscapes in the Chiquitano Dry Forest, the Cerrado and the Pantanal of Bolivia and Brazil for the sustainability of productive development, the conservation of their environmental values and adaptation to climate change.
Objectives: To build participative, inclusive and effective environmental and territorial governance in the Chiquitano Dry Forests, the Cerrado and the Pantanal of Bolivia (SC) and Brazil (MT-MS) that helps preserve connectivity and functionality of ecosystems, contributing to sustainable productive development and regional strategies of adaptation to climate change. Specifically, to strengthen the management of systems of protected areas integrated into productive landscapes in priority connectivity sites, based on participatory

Brazil. Chapada de Veadeiros, State of Goiás, Cerrado Alto.

governance that enhances the quality of the implementation of public policies geared towards the integrated management of the territory.

CIPCA – Bolivia

Region of intervention: Chaco (Bolivia and Paraguay), Dry forest (Bolivia) and Pantanal (Paraguay).
Other members of the consortium: ALTER VIDA, PCI, OXFAM and INTERMÓN.
Name: Environmental governance and consolidation of sustainable production systems in the Departments of Boquerón/Alto Paraguay (Paraguay) and Santa Cruz/Chuquisaca (Bolivia).
Objectives: To contribute to environmental sustainability and sustainable production in the degraded biomes of the Chaco, the Chiquitano Dry Forests and the Pantanal of South America as a base to allow the mainly indigenous people living in this territory to improve their livelihoods. Specifically, it sets out to strengthen the capacities of indigenous/peasant populations for environmental governance and for the consolidation of sustainable production systems in the Departments of Boquerón/Alto Paraguay and Santa Cruz/Chuquisaca.

Fundación Proyungas – Argentina

Region of intervention: Gran Chaco (Argentina, Bolivia and Paraguay).
Other members of the consortium: NATIVA and FUNDACIÓN MOISES BERTONI.
Name: Conservation, sustainable use and good governance of biodiversity in vulnerable biomes: Pilcomayo trinational shared management area.
Objectives: To implement a management scheme for a cross-border and integrated "Shared Management Area" for the conservation and sustainable development of the trinational Pilcomayo River basin, in the Gran Chaco ecoregion.

WWF – Brazil

Region of intervention: Cerrado - Pantanal: Brazil, Bolivia and Paraguay.
Other members of the consortium: WWF Bolivia and WWF Paraguay.
Name: A regional model of sustainable, participatory, inclusive and climate-smart development in interconnected areas of the Cerrado, the Pantanal and Chiquitano Dry Forests in Bolivia, Brazil and Paraguay.
Objectives: This project sets out to conserve the biodiversity and the ecosystem and cultural services and functions in the Cerrado, the Pantanal and Chiquitano Dry Forests to ensure sustainable productivity, contributing to the improvement of human well-being. More specifically, it will seek to strengthen conservation, productive systems and governance to foster a regional model of sustainable, participatory, inclusive and climate-smart development in interconnected areas of the Cerrado, the Pantanal and Chiquitano Dry Forests in Bolivia, Brazil and Paraguay.

6.4 ECOSYSTEM-BASED ADAPTATION

The United Nations Convention on Biological Diversity states that "the ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way"[9].

This definition gives rise to the premises and principles for Ecosystem-based Adaptation (EbA), which is defined as the use of biodiversity and ecosystem services as part of an overall adaptation strategy. The strategy needs to be cost-effective; generate social, economic and cultural co-benefits; contribute to the conservation of biodiversity; and integrate sustainable management, conservation and restoration of ecosystems to provide services that allow people to adapt to the adverse effects of climate change[10]. Its objective is to maintain and increase the resilience of ecosystems and people while reducing their vulnerability to the impacts of climate change.

The role of ecosystems and the traditional knowledge of local communities are crucial in the design of adaptation measures and disaster risk reduction. EbA actions that are planned and designed appropriately can improve livelihoods, ensure food security, reduce the impacts of extreme weather events and promote biodiversity conservation and carbon sequestration. Examples of EbA actions include: restoration of mangroves to reduce flooding and coastal erosion; sustainable management of basin headwaters to maintain or improve the quality and flow of water; reforestation to stabilise earth slopes and prevent landslides; agricultural diversification to tackle the impacts of climate change; and conservation of agrobiodiversity to maintain genetic reserves that make it possible to adapt crops and livestock[11].

© Grupo Cardno Latinoamérica

Ecuador, Puná Island. Cardno Latin America is collaborating and supervising a mangrove reforestation project, led by the Fundación CALISUR in the Puná parish, province of Guayas, in the coastal region of Ecuador. The reforestation project includes 65 hectares of mangrove forest, in which the plan is to plant more than 100,000 seedlings of red mangrove (Rhizophora sp.) by 2020.

Peru[12]

EbA in Mountains Programme

Among the nature-based solutions promoted by the International Union for Conservation of Nature (IUCN) is the implementation of a mountain EbA flagship programme[13] . This is a collaborative initiative of the UNEP, the IUCN and the UNDP, funded by the German Ministry for the Environment, Nature Conservation and Nuclear Safety.[14]

In Peru, the Ministry of the Environment has commissioned the EbA programme and implements it in the Nor Yauyos Cochas Landscape Reserve, with the support of the National Service of Protected Natural Areas. The Mountain Institute (MI), commissioned by the IUCN and in coordination with the headquarters of the Reserve, was responsible for the implementation of no-regret adaptation measures and the component of strengthening local capacities in the rural communities of Canchayllo and Miraflores.[15]

As the EbA in Mountains Programme is a learning project, a core interest was to identify impacts and extract lessons and recommendations that help reflect on the opportunities offered by EbA measures, as a strategy for climate change adaptation in mountain areas, clearly expressing the favourable and unfavourable aspects of the experience, in order to contribute to the design and implementation of similar measures in the country and in other mountain regions across the world.

The implemented programme had four components:

1. To complement and strengthen decision-making methodologies and tools for Ecosystem-based Adaptation (EbA).
2. To apply the methodologies and tools to the ecosystem.
3. To implement EbA pilots in the ecosystem.
4. To present the EbA case study on a national level and integrate it into planning.

Colombia and Ecuador[16]

Regional EbA programme

The regional programme "Ecosystem-based Adaptation Strategies to Climate Change" (EbA Regional Programme), akin to the programme in Peru, was part of the International Climate Initiative (IKI) funded by the German Ministry for the Environment, Nature Conservation and Nuclear Safety.

In Ecuador, the Ministry of the Environment, with the support of the German Technical Cooperation (GIZ) and the IUCN Regional Office for South

© Thomas Muller SPDA/UICN

Peru, Huasta. Restoration of quenuales, woody trees with a thick bark covering the trunk, protecting it from low temperatures and fires. They form barriers that act as protection against drastic temperature fluctuations, night frosts and icy winds. Some species of Polylepis, which include the quenual, form forests that grow along the treeline and can even reach 15-20 metres in height and trunks of 2 metres in diameter, surrounded by croplands and shrubbery.

America, undertook the programme assisted by the Undersecretariat of Climate Change, and under the aegis of the National Directorate of Climate Change Adaptation. The programme was implemented in certain parishes of the province of Manabí, in coordination with the country's Decentralised Autonomous Governments. In Colombia, the EbA Regional Programme was executed in Cartagena de Indias, in collaboration with the Municipality of Cartagena and the Colombian Ministry of the Environment and Sustainable Development (to date, no further information is available on this case).

The EbA Regional Programme in Ecuador focussed its actions in the province of Manabí due to its high vulnerability to climate change, in view of the intensity of rainy periods, as well as prolonged periods of drought, which increase the probability of floods and mass movements.

6.5 INITIATIVE 20X20

The Initiative 20x20[17] is a project that seeks to change the dynamics of land degradation in LAC by restoring twenty million hectares of land by 2020. The initiative, launched formally at UNFCCC COP 20 in Lima, supports the Bonn Challenge, a global commitment to bring 150 million hectares of the world's deforested and degraded land into restoration by 2020, and 350 million hectares by 2030, and the New York Declaration on Forests that seeks to restore 350 million hectares by 2030[18].

The World Resources Institute (WRI) acts as the secretariat to Initiative 20x20, within the framework of its Global Restoration Initiative[19]. In this capacity, it liaises with governments and international partners to inspire, enable and implement restoration in degraded landscapes, returning them to economic and environmental productivity. Basically, the WRI sets out to facilitate dialogue between governments, civil society and the private sector to build an effective coalition that can achieve the goals of the initiative.

So far, seventeen LAC countries[20] and three regional programmes have committed to begin restoring 53.2 million hectares (an area roughly the size of France) of degraded lands by 2020 through Initiative 20x20.

The initiative is supported by more than 40 technical organisations and institutions and a coalition of impact investors and private funds deploying USD 2.4 billion in private investment. Financial partners of Initiative 20x20, including impact investors and private companies, act as agents of change in the region by supporting innovative projects that offer social and environmental improvements with financial returns. This group is supporting the expansion of restoration across LAC by tapping into the market value of restoration products.

The initiative will support reforestation (natural and assisted) and the conservation of forests as elements of an integral restoration process. Cognisant of the various degrees of land degradation in the region, the initiative will also support efforts to recover land functionality (soil conservation and recovery; carbon storage; water retention and stable hydrologies; biodiversity conservation and recovery) through agroforestry, silvopasture, and assisted or natural reforestation. Below are some of the projects under the umbrella of Initiative 20x20.

Silvopastoral systems and the management of native forests in Paraguay

UNIQUE forestry and land use[21] is responsible for the technical management of a 13,600-hectare forestry project in Paraguay. The project, which began in 2002, was implemented in cooperation with PAYCO, a Paraguayan company engaged in agriculture, livestock and sustainable forest management. By combining the restoration of native forests and the management of existing forests with the planting of new forests and silvopastoral systems, the company creates added value. Shared value is an important aspect of the business plan. The land is rented mainly to local family-run farms, while the profits and the administration of the land are shared with the owner of the property. In addition to the expansion of food production, PAYCO has reforested 8,000 hectares of land and plans to restore an additional 20,000 hectares by 2026. The reforested areas are certified by the Forest Stewardship Council (FSC).

© Archivo/ El Telégrafo

Ecuador, Province of Pichincha. Reforesting in a community through a social forestry programme. This programme, under the responsibility of the Ministry of the Environment, is mainly aimed at organisations from various countries to promote reforestation and forest care. Photo from the Ministry of the Environment of Ecuador.

Forest restoration actions in Mexico

In 2014, the National Forestry Commission of Mexico (CONAFOR) set the ambitious goal of beginning to restore 1 million hectares by the end of 2018. This major commitment is alongside the almost 7.5 million hectares of Mexican forest included in the Bonn Challenge and Initiative 20x20. Four years later, CONAFOR has fulfilled its objective. In order to carry out this enterprise successfully, CONAFOR encouraged activities that help communities and landowners who live in priority watersheds and on lands with very degraded soils which have suffered losses of forest cover or have been devastated by fires, pests or other natural disasters. CONAFOR spent approximately 12 billion pesos (approximately USD 591 million) on the project.

Social forestry programme in Ecuador

In 2008, Ecuador had more than 9.5 million hectares of native forests, but was losing thousands of hectares each year due to deforestation. To protect an important part of its economy and conserve the critical ecosystem services provided by its forests, the Government of Ecuador decided to act by providing a response known as the Social Forestry Programme, a voluntary incentive-based scheme with combined environmental and socioeconomic objectives, which sets out to protect four million hectares, almost 16 per cent of the total land mass of Ecuador, and help between 500,000 and 1,000,000 people.

Ecological restoration in the Chacabuco Valley, Chile

In Chile's Patagonia region, grasslands were severely degraded after years of uncontrolled sheep and cattle grazing. In 2004, however, Fundación Patagónica started its important conservation work in the region by purchasing a 69,000-hectare farm known as Estancia Valle Chacabuco, located in Chile's Aysén region. This area is a unique transitional ecosystem between the dry Argentinian grasslands to the east of the Andes and the temperate humid forests to the west. The area under conservation has continued to expand with the subsequent acquisition of adjacent lands. Today, Conservación Patagónica governs 81,000 hectares, and, together with the neighbouring Jainemeni and Tamango National Parks, will form the future Patagonia National Park, an unbroken expanse of 292,000 hectares. Conservación Patagónica is restoring this large swath of land for its famous beauty, the promise of ecotourism and the conservation of its native wildlife.

Restoring pastureland and producing biofuel in Paraguay

According to data from the World Resources Institute's Global Forest Watch, Paraguay lost 22 per cent of its tree cover between 2000 and 2017. This represents 5.46 million hectares of natural forest. First, the Amazon was hit. Now, deforestation has spread to the Gran Chaco. The loss of millions of hectares of forest in the heart of LAC has had a devastating impact on the regulation of the climate and water cycles, as well as carbon sequestration. LAC governments are already taking steps to reduce the pace of deforestation, but not all of them can afford to provide monetary incentives for reforestation.

Canopy Energy has now committed to filling that space. Canopy seeks to simultaneously harness silvopastoral systems to sequester carbon, generate economic growth and increase cattle productivity. To reduce livestock-related deforestation, Canopy and its local partner Investancia have combined grazing land with pongamia trees that produce vegetable oil. This nitrogen-fixing tree species has the ability to restore soil fertility, limit erosion and create a favourable climate for native species. Biofuel manufactured from the vegetable oil can be refined into diesel fuel. Investancia benefits from the biofuel revenue, while trees planted on pastureland will sequester carbon, improve soil fertility and reduce animal stress. Finally, these new agricultural activities will provide jobs and positively impact local communities. The vegetable oil meets the growing biofuel demand while the trees capture and store greenhouse gases.

Petrópolis, Brazil. Reforestation with agroforestry and organic food production. Vegetables are cultivated between the rows of trees, including lettuce, Swiss chard, tomatoes and others.

Restoring the Chihuahuan Desert grasslands in Mexico

The Chihuahuan Desert of northern Mexico is a continentally important wintering area for grassland birds – the most rapidly declining group of birds in North America. More than 90 per cent of migratory grassland bird species breeding in western North America spend at least half their life cycle concentrated in the limited grasslands of the Chihuahuan Desert region. American Bird Conservancy's project is designed to work with ranchers within the Valles Centrales Grassland Priority Conservation Area in Chihuahua state to improve ranching practices that encourage forage production for cattle, which simultaneously increases habitat for grassland birds.[22]

REFERENCES

1 Arid, semi-arid and dry sub-humid lands according to the definition of the UNCCD.

2 Antigua and Barbuda, Cuba, Dominican Republic, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Grenada, Barbados, and Trinidad and Tobago.

3 Unless otherwise indicated, much of this section is found in the document "Euroclima+ en Acción – Avances y logros (enero-septiembre 2018)", 2018.

4 The other areas of interest of Euroclima are energy efficiency, water management with an urban resilience perspective, management and reduction of disaster risks, urban mobility and resilient food production. Euroclima: http://euroclimaplus.org/index.php/es/inicio-es/quienes-somos

5 Two of the projects focussed on the Amazon region are excluded.

6 Exchange rate on 13/03/2019 (Internet): 1 EUR = 1.13 USD.

7 Sources for this section: European Commission - B4Life 2018. Report from the launch of the ZICOSUR programme "Conservation, sustainable use and good governance of biodiversity in four vulnerable biomes in the centre of South America and the European Commission 2017: Proposals from CERDET, CIPCA, FCBC, Fundación Proyungas and WWF Brazil in the framework of the ZICOSR programme "Conservation, sustainable use and good governance of biodiversity in four vulnerable biomes in the centre of South America".

8 ZICOSUR, which in English translates as the Integrated Zone of the Centre West of South America, is a common economic, commercial and cultural, intergovernmental and business cooperation project that encompasses the subnational regions of seven countries neighbouring the Tropic of Capricorn. Its Committee on the Environment, Sustainable Development and Climate Change creates and forms the benchmark programme whose geographical scope is limited to the four countries stated in the main text.

9 CBD COP5 Decision V/6: http://www.cbd.int/decision/cop/default.shtml?id=7148, quoted in IUCN 2014.

10 CBD, 2009. "Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change". Montreal, CBD Technical Series No. 41, quoted in IUCN 2014.

11 CBD, 2009, quoted.

12 Zapata, F; Torres, M; Gómez, A; and Podvin, K. 2016. "Informe de sistematización de la experiencia: Implementación de las medidas robustas de Adaptación basada en Ecosistemas en las comunidades campesinas de Canchayllo y Miraflores (Reserva Paisajística Nor Yauyos Cochas)". Lima: Instituto de Montaña and UICN.

13 Website of the EbA Programme: www.AbEflagship.org.

14 Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (BMUB).

15 No-regret measures are "... measures taken by communities [and/or facilitated by organisations] which do not worsen vulnerabilities to climate change or which increase adaptive capacities and measures that will always have a positive impact on livelihoods and ecosystems regardless of how the climate changes". Quoted in the aforementioned document by Zapata, Florencia et al., 2016.

16 MAE, UICN and GIZ, 2018. Nuestra experiencia de Adaptación basada en Ecosistemas en Manabí – Sistematización. Programa Regional AbE. Prepared by Mónica Moya Herrera, William Zúñiga Tello, Daniel Orellana, Karen Podvin (UICN), Martin Calisto Friant (UICN) and Aracely Salazar Antón (GIZ).

17 Initiative 20X20, http://initiative20x20.org/.

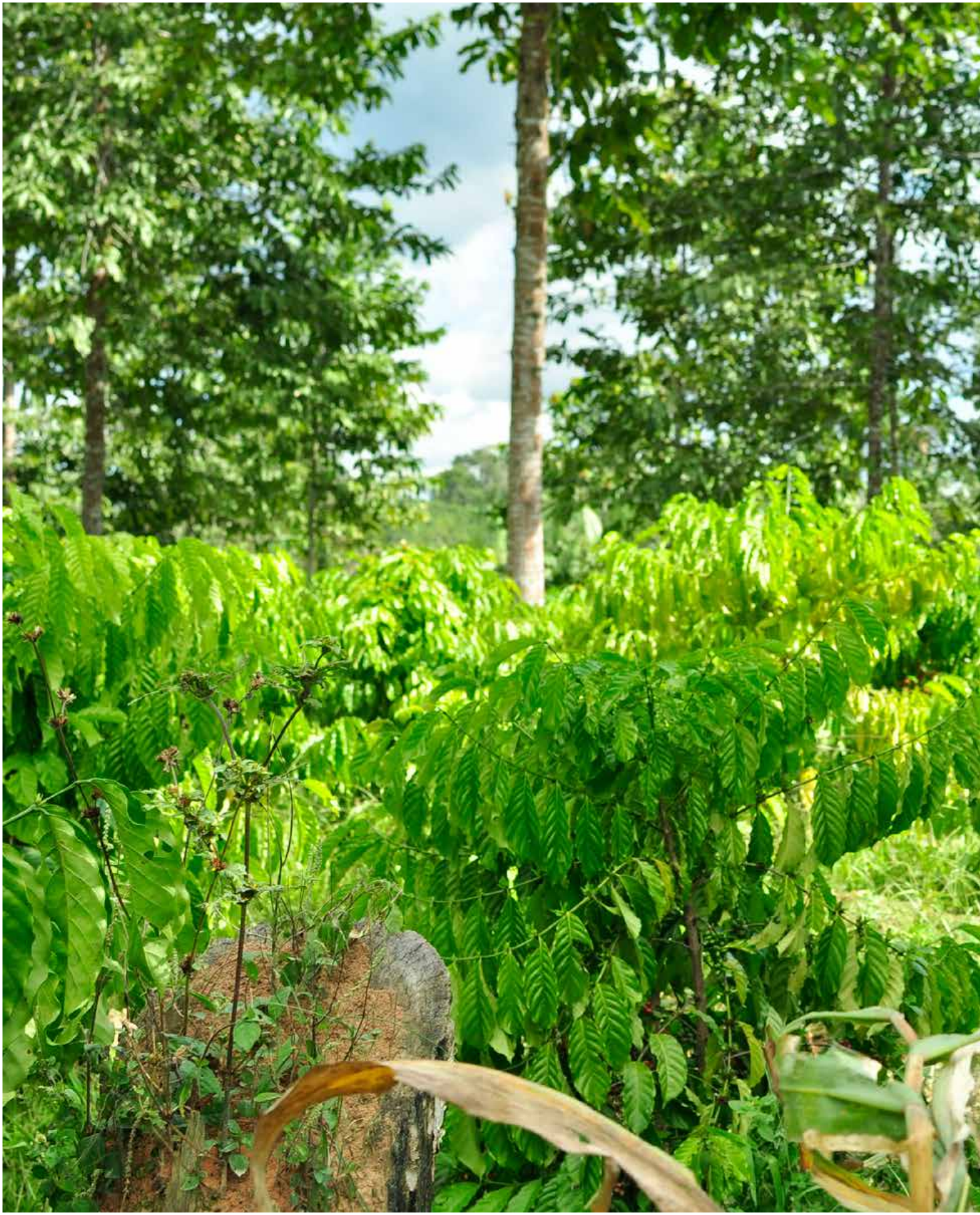
18 Bonn Challenge, http://www.bonnchallenge.org/content/challenge.

19 Global Restoration Initiative, https://www.wri.org/our-work/project/global-restoration-initiative.

20 Countries: Argentina, Belize, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru and Uruguay.

21 UNIQUE forestry and land use GmbH is a leading international consulting firm that provides expert services and advice on forest management and sustainable land-use. Unique is headquartered in Freiburg, Germany and has offices in LAC (Paraguay and Argentina).

22 https://abcbirds.org/in-mexico-grassland-birds-thrive-under-a-new-approach-to-cattle-ranching/



© Icaro Cooke Vieira/CIFOR

7. CONCLUSION

More than 3 billion people are impacted by land degradation today and up to 143 million of them could be forced to leave their countries before 2050 to escape water scarcity and failing crop productivity due to the slow-onset impacts of climate change.[1]

Predominant, unsustainable production and consumption patterns generate ever-increasing pressure on soil, water and biodiversity, in addition to the demographic changes triggered by urbanisation. This creates increasing demands on basic services such as health, water, energy, housing, natural ecosystems and the management of chemicals and waste. Failure to deal with all these driving forces is likely to have far-reaching environmental and socioeconomic consequences.

The forests of the LAC region, which contribute to regulating temperature and precipitation, produce oxygen, and which are natural carbon dioxide sinks, are today being threatened by the development of urban infrastructure and by productive models necessary to sustain a growing population.

LAC is home to a significant portion of the planet's natural wealth. The future of regional economies, as well as their capacity to fight poverty and reverse inequality, crucially depends on the natural capital available and on the ability of governments to manage it prudently, effectively and inclusively.

In LAC, the degradation of terrestrial ecosystems is the result of the unsustainable productive management of the land. The regional and international demand for food, wood and petroleum products, together with restrictive socioeconomic conditions and the need to attract foreign investment, are elements that exert pressure on governments and decision-makers. Faced with this situation, they tend to prioritise short-term goals, thereby enabling the degradation of land resources where these goods and services are produced. Governments need to implement laws which prevent illegal or insufficiently

regulated activities, such as mining and logging, as these activities have very severe impacts. The reduction of deforestation in the Brazilian Amazon is an example of how adequate government policies can reduce environmental impact.

The LAC region must tackle processes of land degradation and depletion of fresh water sources that have become more acute as a result of the style of economic growth based on the production and export of raw materials. The high rates of deforestation and degradation of lands and waters, as well as the accelerated loss of biodiversity that occurs in the main biomes of the region, seriously threaten the life of the planet as a whole.

Recent reports from the world's leading institutions and specialised agencies underline the need to decouple economic growth from natural resource consumption, thereby seeking to guarantee the sustainability of this capital. It will be necessary to strengthen the resilience of ecosystems and of their services, in order to adapt to future environmental changes. In this context, investment into ecological infrastructure will play an important role in reducing vulnerability to future environmental and socioeconomic crises.

Soil governance, management and planning are central elements to be considered as part of soil care, as this is still an irreplaceable natural resource. The increase in competition and the growing number of stakeholders involved – each with disparate visions, interests and decision-making powers – have led to a complex decision-making structure. In this context, today's resource-based conflicts may well increase when soil resources become further restricted.

The Land Degradation Neutrality initiative, devised and promoted by the UNCCD, points precisely in the right direction, which is to avoid, reduce and reverse land degradation on the planet, making use of environmentally-friendly practices.

LAC has a rich history of coherent traditional and ancestral knowledge for this purpose. Even though in some countries there are very interesting advances in the matter, everything suggests that it is necessary to reinforce, scrutinise and expand the progress achieved. Traditional knowledge should be integrated, whenever possible, with conventional scientific knowledge, produced locally, so as to provide producers with the technological resources requisite to rise to today's challenges.

Major efforts have been made in terms of environmental programmes and projects financed by international funds. An analysis shows that external funding has persuaded countries to invest in these projects themselves, with amounts that quadruple external contributions. These projects also have the power to focus domestic public opinion on major national environmental problems.

© Neil Palmer (CIAT)

REFERENCES

Associação para o Desenvolvimento da Ciência e da Tecnologia "Programa de ação estadual de combate à desertificação e mitigação dos efeitos da seca no estado da Paraíba". 2011.

A. López-Feldman, J. M. Torres and G. Kerrigan Richard, "Estimación del impacto del cambio climático sobre los principales cultivos de 14 países del Caribe" (LC/TS.2018/100), Santiago, Economic Commission for Latin America and the Caribbean (ECLAC), 2018.

Alagoas, Secretaria de Estado do Meio Ambiente e dos Recursos Hídricos. "*Plano de Ação Estadual de Alagoas para o Combate à Desertificação e Mitigação dos Efeitos da Seca*".

Conservation, sustainable use and good governance of biodiversity in four vulnerable biomes in the centre of South America and the European Commission 2017: Proposals from CERDET, CIPCA, FCBC, Fundación Proyungas and WWF Brazil in the framework of the ZICOSR programme "Conservation, sustainable use and good governance of biodiversity in four vulnerable biomes in the centre of South America.

CEPAL. "The sustainability of development in Latin America and the Caribbean: challenges and opportunities". 2002.

Cherlet M., Weynants Mélanie Marie A; Kutnjak Hrvoje. "Interpretation of maps on the assessment of the Human-Environment system productivity into dedicated land degradation maps". JRC, JRC100874. 2016.

Cherlet M.; Zdruli P.; Lal R.; Kapur S. "New World Atlas of Desertification and Issues of Carbon Sequestration, Organic Carbon Stocks, Nutrient Depletion and Implications for Food Security". JRC, *JRC105373*. 2016.

CBD COP5 Decision V/6: http://www.cbd.int/decision/cop/default.shtml?id=7148

CBD, 2009. "Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change". Montreal, CBD Technical Series No. 41, Quoted in IUCN 2014.

De Sy, V.; Herold, M.; Achard, F.; Beuchle, R.; Clevers, J. G. P. W.; Lindquist, E and Verchot, L. V. 2015. "*Land use patterns and related carbon losses following deforestation in South America". Environmental Research Letters*, 10(12): 124004. Quoted in FAO (2016).

Euroclima. The other areas of interest of Euroclima are energy efficiency, water management with an urban resilience prospective, management and reduction of disaster risks, urban mobility and resilient food production. Euroclima: http://euroclimaplus.org/index.php/es/inicio-es/quienes-somos

FAO. "Scarcity and abundance of land resources: competing uses and shrinking land resource base".

FAO. "El estado de los bosques del mundo". 2016.

FAOSTAT 2014; FONTAGRO-BID 2014; Chomitz et al., 2007; MercoPress 2013 quoted in WRI, 2016.

FAO (Food and Agriculture Organisation of the United Nations), 2015. "Global Forest Resource Assessment 2015". Rome: FAO; Hansen et al., 2015; Chiabai et al., 2011; INPE 2010, Kaimowitz 2008; Hecht 2012. Quoted in WRI, 2016.

FAO. "The state of the world's land and water resources for food and agriculture".

Governo do Estado de Alagoas, *Secretaria de Meio Ambiente e Recursos Hídricos*. "Plano de Ação Estadual de Alagoas para o Combate à Desertificação e Mitigação dos Efeitos da Seca – PAE-AL". 2011.

Governo do estado do Maranhão, Secretaria de Estado de Meio Ambiente e Recursos Naturais. "Programa de ação estadual de combate à desertificação e mitigação dos efeitos da seca do Estado do Maranhão". 2012.

Groundswell. "*Prepararse para las migraciones internas provocadas por impactos climáticos*". Washington, DC: World Bank.

Hosonuma, N.; Herold, M.; De Sy, V.; De Fries, R. S.; Brockhaus, M.; Verchot, L.; Angelsen, A.; and Romijn E. 2012. "*An assessment of deforestation and forest degradation drivers in developing countries". Environmental Research Letters*, 7(4): 0044009, 12. Quoted in FAO (2016).

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES/6/L.9/Rev.1, March 2018.

JRC. The World Atlas of Desertification, Joint Research Centre, European Union, 2018. Cherlet, M.; Hutchinson, C.; Reynolds, J.; Hill, J.; Sommer, S.; von Maltitz, G. At: https://wad.jrc.ec.europa.eu/about_atlas

Kumari Rigaud, K.; de Sherbinin, A.; Jones, B.; Bergmann, J.; Clement, V.; Ober, K.; Schewe, J.; Adamo, S.; McCusker, B.; Heuser, S. and Midgley, A. 2018. "Millennium Ecosystem Assessment, Ecosystems and Human Well-being: Synthesis". 2005.

MAE, UICN and GIZ, 2018. Nuestra experiencia de Adaptación basada en Ecosistemas en Manabí – Sistematización. Programa Regional AbE. Prepared by Mónica Moya Herrera, William Zúñiga Tello, Daniel Orellana, Karen Podvin (UICN), Martin Calisto Friant (UICN) and Aracely Salazar Antón (GIZ).

Ministério do Meio Ambiente Secretaria de Extrativismo e Desenvolvimento Rural Sustentável Coordenação de Combate à Desertificação. "Plano de ação estadual de combate à desertificação e mitigação dos efeitos da seca de Minas Gerais". 2011.

Morales, C.; Araníbar, Z.; Agar, S.; Mora, L., Morera R.; Kerrigan G.; López Cordovez L.; Rebolledo M.; Candia R.; Dascal G.; Parada S.; Damianovic N.; Estupiñán R. "Los costos de la inacción ante la desertificación y degradación de las tierras en escenarios alternativos de cambio climático". LC/W.499, CEPAL & Global Mechanism, UNCCD. 2012.

Morales, C.; Dascal, G.; Aranibar, Z. "Estudio de los costos de la desertificación y degradación de las tierras en el departamento de Piura (Perú)". LC/W.565. CEPAL, GIZ. 2013.

Morales, C.; Dascal, G.; Aranibar, Z. "Chile: los costos de inacción de la desertificación y degradación de las tierras". PNUD, ISBN: 978-956-7469-72-7. 2016.

ONU Medio Ambiente 2016. GEO-6 ALC. "Evaluación regional para América Latina y el Caribe". Programa de Naciones Unidas para el Medio Ambiente (PNUMA), Panama City, Panama

Olson, D.M., Dinerstein, E., Wikramanayake, E.D., Burgess, N.D., Powell, G.V., Underwood, E.C., D'amico, J.A., Itoua, I., Strand, H.E. and Morrison, J.C. (2001). "Terrestrial Ecoregions of the World: A New Map of Life on Earth - A new global map of terrestrial ecoregions provides an innovative tool for conserving biodiversity". BioScience 51(11), 933-938 http://bioscience.oxfordjournals.org/ content/51/11/933.full.pdf+html. (Quoted in PNUMA 2016).

Pernambuco. Secretaria de Ciência, Tecnologia e Meio Ambiente. "Programa de Ação Estadual de

Pernambuco para o Combate à Desertificação e Mitigação aos Efeitos da Seca". 2009.

PIAUÍ, Secretaria Estadual do Meio Ambiente e Recursos Hídricos, Programa de Ação Estadual de Combate à Desertificação, PAEPI, Teresina: Ministério do Meio Ambiente / Secretaria Estadual do Meio Ambiente e Recursos Hídricos, 2010.

"Saberes y haceres andinos deben ser revalorados frente al cambio climático". http://www.biodiversidadla.org/Documentos/Saberes_y_haceres_andinos_deben_ser_revalorados_frente_al_cambio_climatico

Stockholm International Water Institute (SIWI): Facts and Statistics, Water Resources and Scarcity http://www.siwi.org/media/facts-and-statistics/1-water-resources-and-scarcity/

Secretaria do Meio Ambiente do Estado de Bahía. "Plano Estadual de Combate à Desertificação e Mitigação dos Efeitos da Seca". 2014.

Secretaria de Estado do Meio Ambiente e dos Recursos Hídricos. "Programa de ação estadual de combate à desertificação e mitigação dos efeitos da seca do Rio Grande do Norte".

"Sergipe, programa de ação estadual de combate a desertificação". Secretaria de Estado do Meio Ambiente e dos Recursos Hídricos de Sergipe.

World Resources Institute. *The Economic Case for Landscape Restoration in Latin America* by Walter Vergara, Luciana Gallardo Lomeli, Ana R. Rios, Paul Isbell, Steven Prager and Ronnie de Camino. Washington, DC. 2016

UNCCD, 2014, Land in Numbers.

UNCCD. "Informes PRAIS de los países de América Latina y Caribe".

World Resources Institute. 2014. "*Atlas of Forest and Landscape Restoration Opportunities*". 2014.

Washington, DC: World Resources Institute; Potapov, P.; Laestadius, L and Minnemeyer, S. 2011. "*Global Map of Forest Condition*". Washington, DC: World Resources Institute. Available at <www.wri.org/forest-restoration-atlas>. Quoted in WRI, 2016.

World Development Indicators, World Bank, 2017 (online): https://data.worldbank.org/data-catalog/world-development-indicators

Zapata, F; Torres, M; Gómez, A; and Podvin, K. 2016. "Informe de sistematización de la experiencia: Implementación de las medidas robustas de Adaptación basada en Ecosistemas en las comunidades campesinas de Canchayllo y Miraflores (Reserva Paisajística Nor Yauyos Cochas)". Lima: Instituto de Montaña and UICN.

©Neil Palmer (CIAT)

Bold decisions and investments made today will determine the quality of Life on Land tomorrow. This Global Land Outlook thematic regional report serves as a timely reminder of the steps we can take to shape a prosperous and more secure future.
A future based on rights, rewards and above all respect for our precious land resources.

GLOBAL LAND OUTLOOK

The United Nations Convention to Combat Desertification (UNCCD) recognizes that addressing and reversing land degradation is one of the key sustainable development priorities for many countries, particularly in the developing world. In response, the UNCCD secretariat and its partners created a strategic communications publication and platform, entitled the Global Land Outlook (GLO), to facilitate insights, debate and discourse on a transformative vision for land management policy, planning and practice at various scales.

The aim of the GLO is to communicate and raise awareness of evidence-based, policy-relevant information and trends to a variety of stakeholders, including national governments formulating their responses to commitments to better manage and restore land resources, including the SDGs and associated targets, such as Land Degradation Neutrality (LDN). The evidence presented in the Global Land Outlook thematic regional reports demonstrates that informed and responsible decision-making can if more widely adopted help to reverse the current worrying trends in the state of our land resources.

United Nations
Convention to Combat Desertification