BIODIVERSITY CONSERVATION IN MEXICO

ACHIEVEMENTS AND CHALLENGES FROM THE PERSPECTIVE OF CIVIL SOCIETY (1995–2017)

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Biodiversity Conservation in Mexico

Achievements and Challenges from the Perspective of Civil Society (1995–2017)

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Table of contents

Translator's note: *All acronyms refer to the corresponding terms and titles in Spanish, unless an officially recognized equivalent exists in English, in which case, the latter is used.*

Santiago Gibert Isern

Prologue

The loss of biological diversity caused by anthropogenic factors irreversibly upsets all forms of life on this planet, including the human race. Halting the trend of environmental degradation is one of the biggest challenges that societies across the globe face in the 21st century.

As social actors and civil society organizations dedicated to securing the future of Mexico's natural heritage, our deep concern for this fact led us to reflect on the fundamental aspects of this loss, which is dramatically shrinking the natural wealth that is vital to our development and survival. Our objective was to come up with a set of recommendations and necessary adjustments to public policies to allow us to correct the course of environmental degradation and biodiversity loss, and thus achieve the conservation of the natural ecosystems that are fundamental to the construction of a prosperous future for Mexico.

Biodiversity Conservation in Mexico: *Achievements and Challenges from the Perspective of Civil Society (1995–2017)* reviews the country's compliance with the main, multilateral obligations to which we subscribed regarding the protection and sustainable use of biodiversity. It seeks to strengthen the government- and civil society-led initiatives that aim to implement these international agreements in the interest of Mexican society. To that end, we describe our country's commitments and the public policy instruments that have been adopted and applied for more than 23 years. We also identify some of the obstacles that hinder their implementation, from planning to execution of cross-sectoral programs. To evaluate compliance, we used different quantitative and qualitative indicators, as well as national reports provided by Mexico to the Secretariat of the Convention on Biological Diversity. Finally, we propose a series of impact-driven, technical, and actionable recommendations to advance Mexico's progress and position it as an international leader in conservation.

From May to November 2016, experts from all areas of conservation in Mexico reflected on the state of their respective fields. Their work culminated in a workshop in September 2016. This report is a summary of that collective discussion and the conclusions they have drawn throughout the process. The ideas presented here are the responsibility of their authors, but the document has been endorsed and signed by all those participating in the effort. These materials were then shared with social organizations defined by their professionalism and commitment to the conservation of biodiversity in Mexico, and who, in turn, also endorsed them. The comprehensive and detailed results of their assessment are publicly available for consultation at www.biodiversidad2016.org.mx.

This report covers 12 major themes. First, we present the main, global commitments to biodiversity Mexico has made. Next, we analyze the current situation, the progress made, and the challenges facing each of the following topics, and we make recommendations for how to move forward: ecological zoning of the territory, environmental impact assessments, water reserves and environmental flow, forestry policy, wildlife management, nature tourism, marine replenishment areas and fish refuges, natural protected areas, conservation and restoration of Mexican islands, the Federal Maritime Land Zone (ZOFEMAT), and conservation finance. Finally, we conclude with overall recommendations for advancing Mexico's leadership in conservation efforts.

Those of us who participated in this reflection process have done so with the sole purpose of contributing to the debate on the conservation of biodiversity, and to provide pluralistic ideas along with our expertise and knowledge. We are committed to the responsible use of our natural heritage, as we are convinced that this is the only way to achieve sustainable development and a stable society over the long term, and to conserve this wonderfully biodiverse territory and its seas – places full of life that are home to the people of Mexico.

Ralph Lee Hopkins

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We have the **opportunity** to decide **the fate** of our **natural capital** to **benefit Mexico's 120 million** people.

Santiago Gibert Isern

Introduction

The global environmental challenges that humankind must face will define the 21st century. The impact of human intervention on the workings of the planet's ecosystems is unprecedented, and scientific evidence shows that current trends cannot continue without causing potentially catastrophic outcomes.[1]

Thankfully, in terms of climate change, significant steps have been taken. The Paris Agreement opens new horizons for solving problems that, only a few years ago, were deemed nearly insurmountable. The signatory countries of the Paris Agreement, which entered into force on November 4th, 2016, committed themselves to correcting the course of climate change by developing low–carbon national economies. Technological advances and financial mechanisms offer some hope in preventing an increase of the Earth's surface temperature beyond the limit of 2°C.

Unfortunately, we cannot say the same of the efforts intended to prevent another major global issue–the loss of biodiversity. The Convention on Biological Diversity (CBD), enacted in 1993, and the instruments derived from it over the course of 24 years have been unsuccessful in getting countries to agree to stop the damage to ecosystems and the extinction of many species.

The problems posed by recurring economic and social crises have always taken priority over the environmental crisis, particularly with respect to the loss of biodiversity. Shortsighted approaches have been prevalent; however, it is clear that the loss of a nation's natural heritage only increases poverty and other social plights. Take, for example, the effect that extreme weather events, such as hurricanes and droughts, have in countries with significantly degraded soil and vegetation cover.

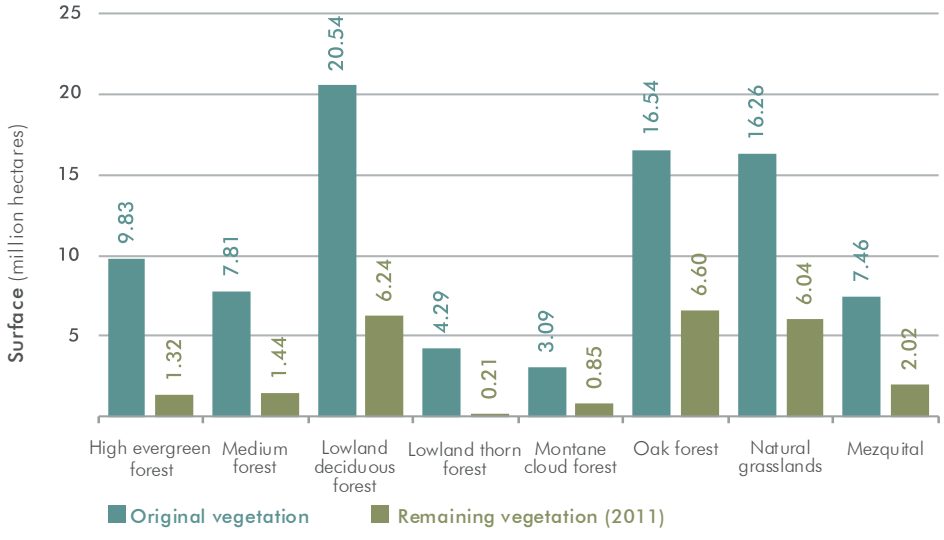
Mexico is not exempt from these trends. Our country is characterized by its vast biodiversity and cultural richness. There are more than 13 million people[2]–representing exceptional sociocultural diversity–living

in the forest regions of Mexico, and all of them use their natural environment for multiple purposes and play a key role in its management and conservation. Forested land stretches over 70% of the total land area of the country, with different types of vegetation, including forests, rainforests, arid regions, shrubs, grasslands, and hydrophilic flora. These areas are a fundamental part of Mexico's natural capital[3]; they are essential to the functioning of watersheds, carbon sequestration, and aquifer recharge. They harbor a level of biodiversity that is considered one of the most important in the world.

The original vegetation cover of terrestrial ecosystems in Mexico once represented more than 193 million hectares, counting different types of forests, rainforests, scrublands, grasslands, and wetlands, among others. By 2011, these ecosystems had been reduced to little more than 92 million hectares (Figure 1), meaning that, by that year, 53% of the original vegetation[4] had been lost. Across 43 million hectares, records show the presence of secondary vegetation, indicating that lands whose vegetation was removed are now in the process of recovery. The current status of the most humid rainforests is particularly critical. Originally, they spanned over 10 million hectares, but have now been reduced to 1.3 million hectares, mostly located in the Lacandon Jungle and in the Chimalapas. The same goes for cloud forests, which originally spanned over 3.3 million hectares, and today span only 875,000 hectares. The lowland forest, with its many endemic species, diminished from just over 4 million hectares to 207,000 hectares. In xeric scrublands, a decrease of barely 10% was recorded (close to 5 million hectares); nevertheless, since they are subject to overgrazing, their original vegetation has been replaced by species that are unpalatable for livestock, and their degradation is considered very serious.

The socio–environmental conditions described present a dual challenge to environmental policy: we must conserve biodiversity and the ecosystem services associated

Figure 1. **Deforestation in Mexican forest ecosystems**



Prepared by the authors with data from the National Institute of Statistics and Geography (2014), *Uso de suelo y vegetación Serie V.* and from SEMARNAT (2016), *La Gestión Ambiental en México*. SEMARNAT, Mexico.

Santiago Gibert Isern

with natural landscapes, and at the same time, promote social and economic well-being through the sustainable management of natural resources.

During the 20th century, the second half in particular, the way in which natural resources were used caused severe damage to the environment, which in turn affected natural ecosystems, biodiversity, and the provision of ecosystem services. The advances made by Miguel Ángel de Quevedo in the 1930s, when former President Cárdenas designated millions of hectares as natural protected areas (PAs), simply vanished, and the PAs were abandoned, becoming nothing more than nature reserves on paper over the following decades, with little to show for on the ground.

In the 1990s, the environment received significant attention from the highest levels of the Mexican Federal Government. As a result, the National Commission for the Knowledge and Use of Biodiversity (CONABIO) was created in 1992; the Ministry of Environment, Natural Resources and Fisheries (SEMARNAP) in 1994; the Mexican Wildlife Office in 1996; and the Natural Protected Areas Unit in 1996, which led to the National Commission for Natural Protected Areas (CONANP) in 2000. The General Law of Ecological Equilibrium and Environmental Protection (LGEEPA) was reformed in 1997. Additionally, the government created new policy instruments and enacted the General Wildlife Law (LGVS) in 2000, which established the wildlife conservation management units (UMA). Unfortunately, the fisheries sector was disassociated from the environmental sector in 2000—an enormous setback that has not been remedied to this day. In 2001, the Federal Government substantially increased the budget for PAs and forest resources; it also created the National Forestry Commission (CONAFOR), which represented a great leap forward.

In 2007, CONAFOR launched the payments for ecosystem services (PES) program, effectively providing a bridge between conservation and climate change. The program was made official through the General Law on Climate Change, the National Climate Change Strategy, and the

Special Climate Change Program (PECC). In 2015, CONANP published the *National Climate Change Strategy for Natural Protected Areas 2015–2020: A Call for the Resilience of Mexico*; and in 2016, CONABIO published the report, *Sectoral Strategies for the Integration of Conservation and Sustainable Use of Biodiversity 2016–2022*.

That said, there have been no advances regarding the main instrument of territorial planning–the ecological zoning plan (OET, from the Spanish *ordenamiento ecológico del territorio*). Ever since its formulation in the 1988 LGEEPA, this instrument has not been strong enough to designate guidelines for appropriate management of the territory based on ecological criteria. The OET is still in force and of paramount importance, but it is still the weakest of the management instruments.

Our achievements in terms of law enforcement and monitoring are also very disappointing. The Federal Attorney of Environmental Protection (PROFEPA) has always lacked the human and economic resources, legal instruments, and mechanisms for appropriate law enforcement. With the recent announcement of the Environmental Gendarmerie, however, authorities will hopefully be more effective in observing the Rule of Law. In addition, the justice system has recently been more involved in environmental


Santiago Gibert Isern

issues, and the Mexican Supreme Court and judges have taken significant actions that are forging a path towards openness on the matter.

More than two decades have been dedicated to the development of a policy for conservation and sustainable use of our national natural heritage, yet the indicators continue to show poor results. Deforestation and habitat fragmentation are still happening, biodiversity loss has not been abated, and erosion and pollution are increasing. The most disrupted ecosystems are rainforests, mesophilic cloud forests, and temperate forests.[5] While there has been some progress in public policy, mounting economic and social pressures are outpacing it. A development approach, in which an economic agenda takes precedence over all else, continues to prevail while the environment is sidelined. The conservation of our natural heritage, biodiversity, and ecosystem services is not among the country's priorities. Budget cuts do not consider the severe implications of eroding natural capital that is the foundation of development, nor the increase of the environmental sector's responsibilities and its relative youth. Such a situation cannot withstand budget cuts without causing significant environmental damage.

Santiago Gibert Isern

Nevertheless, Mexico has a strong institutional, legal, and public policy framework, as well as the human resources to make rigorous decisions that would benefit 120 million Mexicans and their natural heritage. The country has the real potential to become a global example for reversing the patterns of behavior that cause biodiversity loss.

The following chapters address this challenge with a critical yet constructive analysis of how the government and its citizens should work together in safeguarding Mexico's natural heritage–the bedrock of long-term, competitive, and intelligent development.

1 GLOBAL CONTEXT AND INTERNATIONAL AGREEMENTS

The United Nations Conference on Environment and Development (the "Earth Summit"), held in Rio de Janeiro in 1992, was a breakthrough in the understanding, the collective awareness, and the design and implementation of environmental policies at global and national levels. The CBD and the instruments derived therefrom, such as the Cartagena Protocol on Biosafety, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization, and the 20 Aichi Biodiversity Targets, along with other multilateral side agreements, constitute a solid platform to guide the establishment of national agendas. Each treaty or agreement has its individual but complementary objectives, and lays foundations for international cooperation.

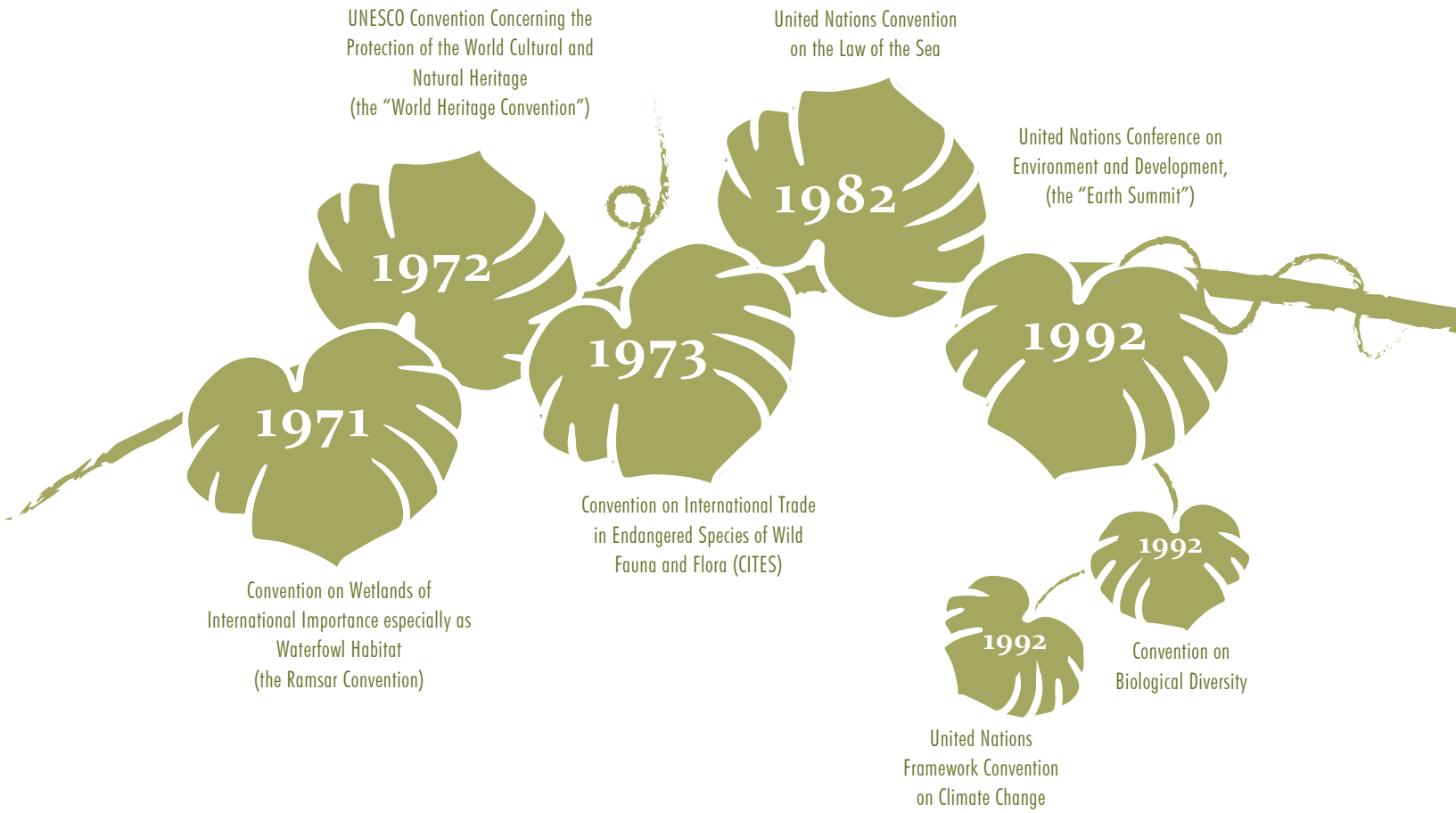
Additionally, in the year 2000, 189 nations resolved to address humankind's greatest challenges, and created and agreed upon the Millennium Development Goals. Fifteen years later–following significant accomplishments, albeit not all that had been agreed upon—these same nations reaffirmed their commitment to the 2030 Agenda for Sustainable Development, wherein the 17 Sustainable Development Goals were put forward. Goals 11 to 17 are specifically linked to biodiversity.

In Mexico, once a multilateral agreement is ratified by the Senate, it becomes part of the Mexican legal system and goes into effect at an international level. With the above agreement, Mexico agreed

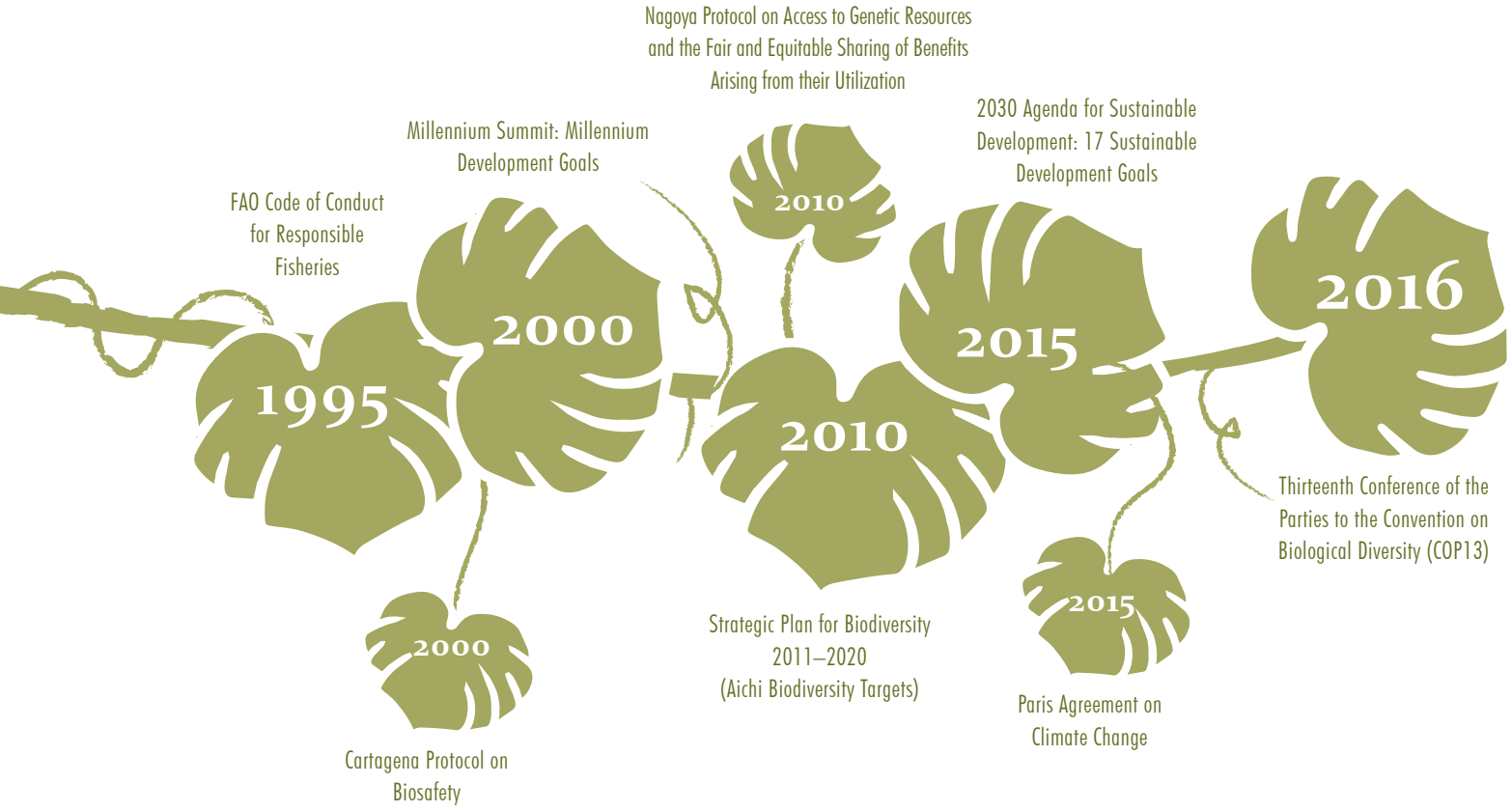
to a series of environmental goals. In order to meet them, different areas of government and society must come together to establish a national agenda and a set of accompanying policies.

The main agreements related to biodiversity that were ratified by Mexico include the following:

- Convention on Biological Diversity
- Convention on Wetlands of International Importance especially for Waterfowl Habitat (the Ramsar Convention)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora
- The United Nations Educational, Scientific and Cultural Organization (UNESCO) Convention Concerning the Protection of World Cultural and Natural Heritage
- Sustainable Development Goals
- United Nations Convention on the Law of the Sea
- The United Nations Food and Agriculture Organization (FAO) Code of Conduct for Responsible Fisheries



INTERNATIONAL AGREEMENTS AND MILESTONES



The timeline illustrates the most important commitments derived from these international agreements for the protection of biodiversity. Subsequent sections address the ways in which Mexico has turned them into public policies and instruments, and provide an analysis of their benefits and shortcomings.

Ecological Zoning Plans

The OET has the greatest cross–sectoral and policy reach, making it the ideal instrument to effectively apply the Strategic Plan for Biodiversity 2011–2020 and meet the Aichi Biodiversity Targets.

Effective zoning plans, which consider an area's potential for competitive development, its productivity, and its ecological fragility, constitute an essential and strategic step towards the long-term conservation of our natural heritage. Recognizing the best use of our national territory across all sectors, and planning for strategic, long-term preservation of areas that should be conserved, will enable our country to develop its economy and social well-being, and will ensure in perpetuity the protection of the ecosystem services that are essential for life. When it comes to coastal environments, the Ramsar Convention calls for land use planning that favors the conservation and sustainable use of wetlands. The World Heritage Convention, meanwhile, obliges Mexico to identify and protect the natural heritage within its territory.

Environmental Impact Assessments

Wherever biodiversity may be affected, the CBD requires an assessment of the potential environmental impact. It also commits the signing parties to keep adverse impacts to a minimum, and to take responsibility for and repair damage to biodiversity by means of compensation schemes.

Additionally, the CBD Decisions VIII/28 and X/33 highlight the importance of coral reefs and seagrass beds in climate change mitigation and adaptation. They urge the parties to curb coastal development and the other factors that contribute to the degradation and loss of these ecosystems, and to facilitate their recovery by managing human impact and restoring natural conditions.

Water and Biodiversity

The CBD and the Aichi Target 11 aim to protect at least 17% of terrestrial and inland water areas by 2020, especially areas of particular importance for biodiversity and ecosystem services.

Resolution XII.12 of the Ramsar Convention looks to ensure the provision of water that is required for the stability of wetlands. It presents the case of Mexico, which implements water reserves.

From the point of view of sustainable development, the United Nations (UN) developed the concept of the human right to water, and made governments agree to review the repercussions of certain activities–those that might result in the loss of biodiversity and ecosystems, and in turn might affect the availability of water, a basic human need.

Sustainable Use of Biodiversity

One of the CBD pillars is sustainable use, a term defined as the use "of the components of biological diversity in a way and at a rate that does not lead to the long–term decline of biological diversity, thereby maintaining its potential to meet the needs of present and future generations."

Sustainable use commits the Member States to prepare and apply as many corrective measures as possible in damaged areas where biodiversity has been reduced, and to promote cross-sectoral cooperation for the sustainable use of biological resources.

Sustainable Agriculture and the Reduction of Forest Loss

The CBD and the Aichi Target 5 require a reduction of the rate of forest loss by at least half, as well as a reduction of fragmentation and degradation. Target 7 promotes sustainable agricultural and livestock management.

Recovering Depleted Fish Stocks

The Aichi Target 6 aims to prevent unsustainable fishing and to establish recovery plans for species stocks that are depleted or at the limit of their exploitation, whereas Target 10 aims to decrease the anthropogenic pressures on coral reefs.

Although they are not binding, the UN Convention on the Law of the Sea and the FAO Code of Conduct for Responsible Fisheries provide sustainability criteria to guide the use of marine resources.

In-situ Conservation

The CBD obligates Member States to regulate the conservation of biodiversity within and outside protected areas, the protection of threatened species and populations, and the restoration of degraded ecosystems. Aichi Target 11 stems from this obligation, stating that "by 2020, at least 17% of terrestrial and inland water, and 10% of coastal and marine areas should be conserved through effectively and equitably managed systems of protected areas."

Federal Maritime Land Zone and Coastal Environments

The Ramsar Convention establishes that, in their planning, Contracting Parties shall consider, to the best of their ability, the wise use of wetlands in their territory. For their part, the CBD and Aichi Target 3 provide that, by the year 2020, harmful negative incentives shall be gradually eliminated, and positive measures for the conservation of biodiversity in coastal areas shall be promoted.

Aichi Target 4 requires the different actors to maintain the impacts of the use of natural resources within "safe ecological limits."

Challenges for the Compliance of International Biodiversity Agreements

In spite of the clear benefits of natural heritage conservation for the people of Mexico, compliance with international agreements (and thus the national agenda) faces several challenges and obstacles, as well as a complex web of cross-sectoral interests. Economic crises, budget cuts, insecurity, illegitimate economic interests, and other factors hinder the implementation of programs that would bring us closer to fulfilling multilateral agreements on biodiversity.

2 ECOLOGICAL ZONING PLANS

The Ecological Zoning Plan (OET) is a regulatory instrument that allows one to identify an area's suitability for use, settle conflicts between productive activities and land use, and propose a settlement model in which human populations and ecosystems can coexist in harmony.

Background

The 1996 reform of the LGEEPA established four modalities for the OET: The General Ecological Zoning Plan (OEGT), the Marine Ecological Zoning Plan (OEM), the regional OET, and the local OET. The first two fall under federal jurisdiction, whereas the regional and local ones fall under state and municipal jurisdiction, respectively (Map 1). It is important to note that community zoning plans are not recognized by the legislation, and thereby lack regulatory force. The publication of the Regulations to the General Law for Ecological Equilibrium and Environmental Protection in Matters of Ecological Zoning Plans (ROE), in 2003, made the OET a solid instrument; it introduced ecological zoning committees and a formal public record of ecological zoning plans and processes.

Over the past two decades, many OET processes have been started under each modality. That said, only a fraction have successfully launched an OET program in their region. As of July 2016, the Ministry of the Environment and Natural Resources (SEMARNAT) counted 80 local programs, 51 regional programs, and two marine programs, as well as the OEGT. As a result, nearly half of the country's surface is subject to

the regulation of this planning instrument in its regional or local modality, as well as one third of our seas and the entire land surface under the OEGT.

The design, elaboration, and approval processes of the OET are long and complex, and its implementation is highly ineffective. The OEGT was initiated during the 1988–1994 administration, yet only published in 2012. The Federal Public Administration must take this program into account when developing operational programs, public works, and budgets.[6] Yet authorities have not encouraged its effective implementation, and it has been pushed to the background as a result.

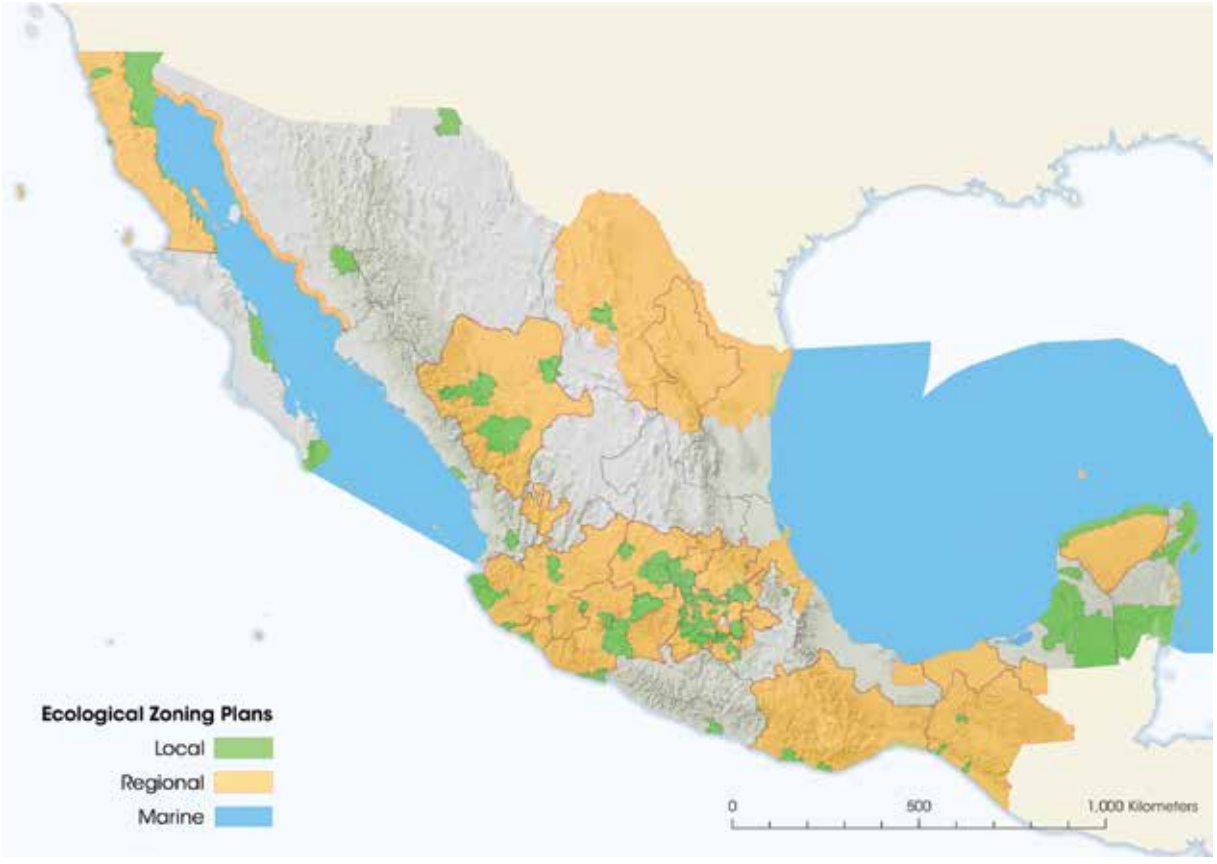
The first OEM was set in motion in the Gulf of California during the 1994–2000 administration, but was not published until 2006. During the 2006–2012 administration, OEMs were initiated in the Gulf of Mexico and Caribbean Sea, and in the North and central South Pacific. The first of these materialized in 2012. The North Pacific OEM is in the process of being launched, and the Central South Pacific OEM is being formulated.

The 2013–2018 Environment and Natural Resources Sectoral Program suggests that OETs should include criteria for climate change mitigation and adaptation and be jointly formulated with the zoning of population settlements.

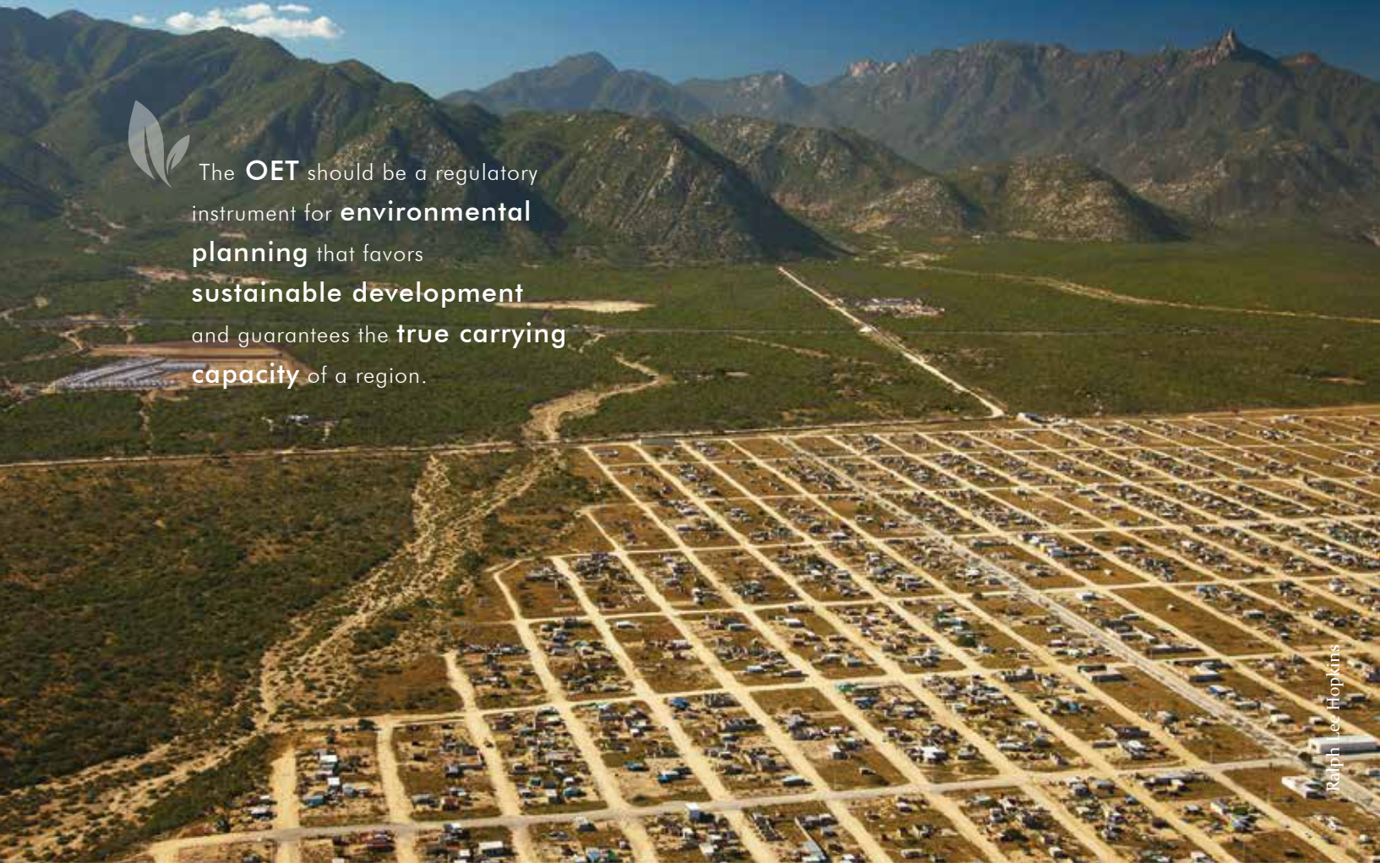
Community zoning plans have been primarily promoted by federal forestry authorities.

There are two noteworthy success stories. Although it is yet to be decreed, the North Pacific OEM generated new information during its preparation, recognized by all ac-

Map 1. **Ecological zoning plans**



Prepared by the authors with data from SEMARNAT (2016), *Ordenamientos Ecológicos Expedidos.*



tors, which proved very useful for the conservation of the loggerhead sea turtle. Similarly, the local OET in Cozumel included an important participatory component since its creation, which was effective in planning the municipality's development.

Other programs, however, have suffered in regions with severe economic and political pressures, including corruption–such as Los Cabos, Baja California Sur, and the coastal communities of Quintana Roo, where the density of hotel rooms per hectare increases with every municipal administration. Management failures on the part of the authorities, compounded by private interests, have blocked the decree of OETs in several cases. Such is the case with the regional OETs for the coast of Nayarit; the OET for the state protected area and Natural Sacred Site, Huiricuta; the state OET in Baja California Sur; and the local OET in Acapulco, Guerrero.

Challenges

Even though the OET should be the cornerstone of environmental planning, it is currently the weakest management instrument.

The effectiveness of the OET as an environmental management instrument depends on a number of factors: first and foremost, that the process is managed under the principles provided in the legal framework; secondly, that the technical studies include a comprehensive analysis of socioecological systems, and present zoning models that favor sustainable development and a site or region's actual carrying capacity; thirdly, that the program is limited to the legal powers derived from the level of government issuing it; and lastly, that it is applied correctly by means of management and stewardship tools.

The OET sets the conditions for fair competition, along with guidelines for anyone who wishes to undertake production projects. Moreover, it serves as a risk-reduction tool for investors and increases competitiveness within a prescribed area.

Additionally, the OET provides a reference point for setting environmental priorities. It has prevented the approval of projects with negative impacts and has contributed to the implementation of best practices for the initial design phase.

It is common for social sectors to lack the resources, organization, and political power needed to take part in the formulation and implementation of sound public policies, which leads to disparities and biases in OET content. As a result, it can end up benefiting the particular interests of more powerful groups. The standardization of the conditions for participation and transparency, provided in the Regulations on Ecological Zoning (ROE), was an important step in strengthening governance for sustainability. The OET is a legal instrument that has enabled society to defend public interest.

However, failure to adequately track environmental changes in areas with an OET makes it impossible to determine if certain changes are correlated to its implementation.

The challenges impeding the instrument's development may be arising during the management process or during the preparation of the technical groundwork. Two technical issues are particularly important: the absence of planning information and/or limited access to it, and the slow implementation of methods of studying socioecological systems.

In terms of management, there are factors inherent to the political and economic context that generate perverse incentives. Among these are the three–year government term and the lack of capacity within municipal administrations, as well as political differences and misalignment of administrations within and between the three government levels. Likewise, the implementation of the OET is subject to corruption. Top-down agreements are still common in order to make ad hoc modifications to OET programs, or to simply not implement them.

There are also risks related to the legal framework. For example, the regulation demands that OET provisions are included in the implementation of other planning and environmental policy instruments from other sectors that will impact land use. This is, however, not applied in practice.

Another of the instrument's weaknesses is the institutional incapacity to strengthen the execution and evaluation stages of OET. So far, all efforts have been focused on formulating and establishing programs, whereas execution is limited to issuing statements that determine whether projects properly align with the OET. Additionally, the OET has not been used as a planning instrument, and public servants and individuals have not been sanctioned in cases of non–compliance.

Lastly, no evaluations have been performed. This is partly due to limitations in the design of indicators provided in the Regulation on Ecological Zoning (ROE), and to the lack of clear definitions regarding responsibilities and funding.

Recommendations for IMPROVEMENT

In order to improve the OET's effectiveness in managing natural capital, authorities in all three levels of government should undertake the following:

- Prioritize zoning plans for development at national, state, and municipal levels, giving priority to the conservation and sustainable use of ecosystems.
- Reinforce OEGT instrumentation as the coordinator of sectoral policies at the federal level.
- Streamline and strengthen the integration of ecological zoning plans, public policy, environmental management, urban planning, and additional instruments from other sectors.
- Improve conditions for more effective public participation through access to information.
- Develop a permanent system to strengthen the instrument's capabilities and communication strategies.
- Establish policies for maintaining open, public-access data on zoning and land use.
- Develop technical studies that improve the understanding of socioecological system dynamics, and define more sustainable land use and zoning models.
- Implement monitoring systems based on indicators to assess the OET's performance.
- Promote the creation of community zoning plans. Moreover, the following reforms of the legal framework are suggested:
- Establish a single, legal instrument for zoning plans in Mexico, which would coordinate the zoning and urban development programs–all under the umbrella of a single agency.
- Clearly identify the synergetic roles of the three levels of government.
- Define applicable sanctions in the event of violations of the zoning plans (or, failing that, include a provision in the coordination agreements between the federal, state, and municipal environmental authorities).[7]

Santiago Gibert Isern

3 ENVIRONMENTAL IMPACT ASSESSMENTS

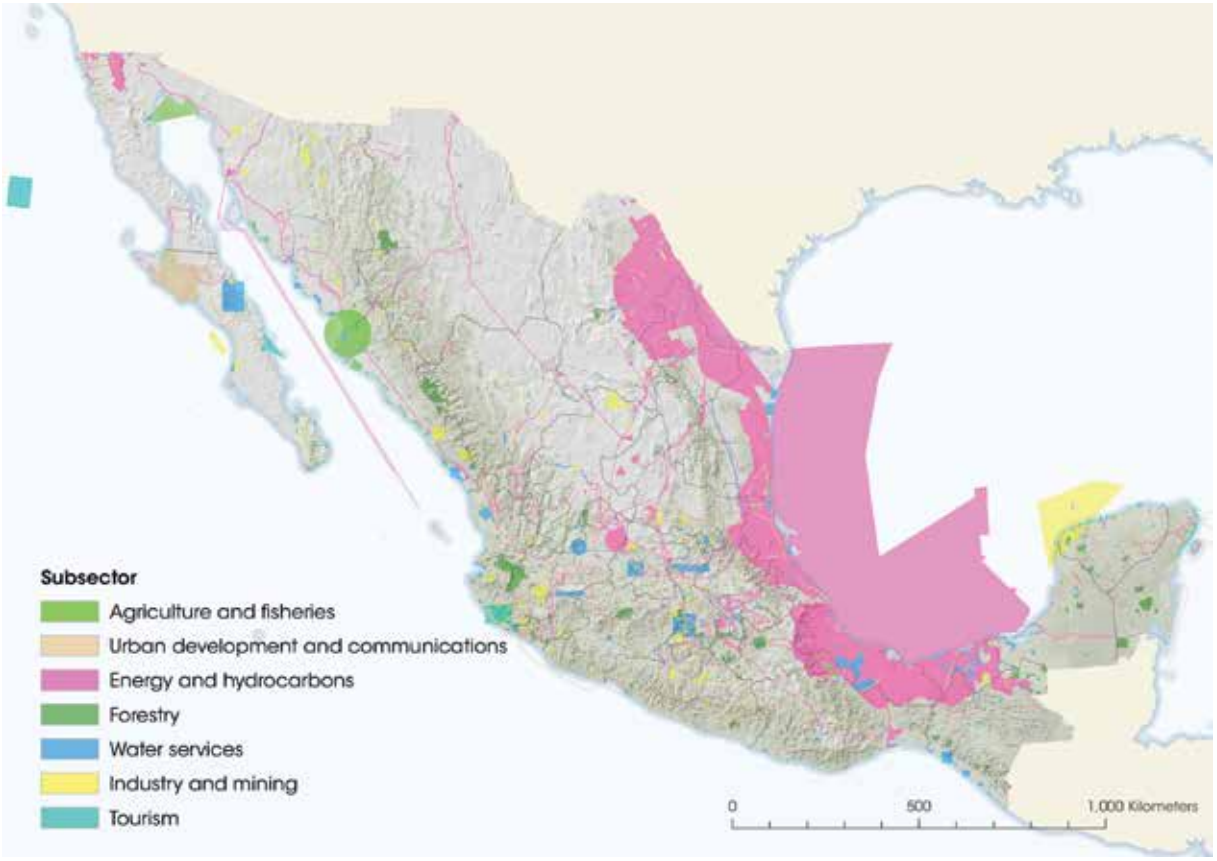
The Environmental Impact Assessment (EIA) is an administrative procedure that evaluates a project proposal according to the ecological imbalance it might cause. It determines if the proposal exceeds any of the limits and conditions set forth to protect the environment. EIAs are intended to prevent negative environmental impacts, or at least reduce them to minimal levels. The EIA determines if a project can be carried out as proposed, if it must be adapted or altered to prevent damage, or denied altogether. SEMARNAT's Environmental Impact and Risk Office (DGIRA) is responsible for the implementation of EIAs, and as of recently, it shares the task with the Safety, Energy, and Environment Agency (ASEA). As stated in Article 15, Section VI of the LGEEPA, the EIA applies a preventive approach, which recognizes that "preventing the causes of ecological imbalances is the most effective way of avoiding them."

Background

The EIA first appeared in Mexican legislation in 1982. The concepts of *environmental impact* and *environmental impact statement* (EIS) were defined six years later, when the LGEEPA was enacted.

The reform of the Regulations to the General Law for Ecological Equilibrium and Environmental Protection in Matters of Environmental Impact Evaluation (REIA), passed in 2000, expanded the categories of activities and projects that would require prior authorization because of their impact on the environment. Two EIS categories were established–one for individual projects and another for regional assessments. The REIA also allows SEMARNAT to request non-bind-

Map 2. **Environmental impact assessments by subsectors**



Prepared by the authors with data from SEMARNAT (2016), *Proyectos sometidos a evaluación ambiental.*

ing technical opinions, if deemed necessary, and states that PROFEPA will carry out inspections to verify compliance with environmental impact provisions.

The Mexican Government has yet to adopt the CBD's voluntary guidelines on biodiversity–inclusive impact assessments, even though incorporating them into SEMARNAT's guidelines for preparing an EIS would mean that biodiversity and ecosystem services would be considered in the decision-making process. Implementing the CBD guidelines would also provide significant guidance in the assessment of the ecosystems affected in each case.

Today, the instrument is often considered biased because its procedures are inconsistently followed, decisions can appear contradictory, evaluation criteria are only partially met, and because other regulations are violated.

The instrument's success should not be measured according to the approval or rejection of a project, but according to whether it accomplishes the aim of the EIA. In other words, its success–or failure–should not be determined solely in terms of the procedure of the assessment, but rather based on whether the negative effects on the environment have been prevented or minimized throughout the duration of the activity in question. These effects should be measured prior to carrying out the activity, and after its completion. Map 2 illustrates the areas considered for the 13 thousand projects that have undergone environmental impact statements over the last 16 years.

The EIA often fails when the local community's input is not taken into account, which can cause unease and lead to confrontations that result in the cancellation of

projects. Similarly, the EIA fails when developers submit incomplete, false, or outdated information; when unqualified consultants are hired–frequently presenting an obvious conflict of interest; or when compensatory measures are not executed or duly monitored, resulting in unmitigated environmental damage.

Challenges

The EIA is a preventive measure and is not properly equipped to face the country's current environmental challenges. It has not been effective enough in protecting ecosystems and natural resources. It is becoming technically outdated, leading to negative environmental, social and economic impacts.

The environmental legal framework is scattered and far from cohesive–the limited effectiveness of EIAs reflects as much. It contains ambiguities, contradictions, and omissions. In fact, rather than being a robust and technically sound preventive measure, it has been relegated to a list of formalities required for the approval of a project.

Additionally, EIA procedures do not always consider other planning tools, such as urban development plans and OET programs. The LGEEPA does not consider Strategic Environmental Assessments (SEA) as a means to evaluate the potential impacts of a set of projects. If SEAs were taken into account, some projects that currently require an EIA could instead be reviewed using that instrument.

Another threat is the poor efficiency within the administrative bodies responsible for processing EIAs. Problems include limited staff, insufficient resources to implement the regulations, and a lack of technical skills,

Ralph Lee Hopkins

knowledge, training, and autonomy. Additionally, there is a general lack of accountability when unsatisfactory projects are submitted, and little effort is made to come up with alternative solutions. As a result, projects are not assessed efficiently, and poorly demonstrate that the chosen option does, in fact, have the lowest possible environmental impact. Moreover, if we take into account that natural resources are being used without determining the actual cost of externalities, we can only conclude that this public policy instrument fails to meet its objective.

The EIS's prepared by consultants or experts that are hired by a project developer do not always consider all the potential negative impacts; nor do they comply with applicable legal provisions; nor value measures proposed to prevent, mitigate, and offset such impacts. Lastly, they do not acknowledge the joint responsibilities of the projects' direct and indirect stakeholders.

Many projects undergoing an EIA do not have all their components clearly defined, hindering the implementation of the assessment and further restricting its usefulness as a preventive measure. Authorities rarely monitor the compensation measures and conditions imposed on a project, which is why it is not possible to verify the project's compliance or measure its effectiveness in preventing, mitigating, or offsetting negative impacts. In some instances, the responsible authority is instructed by a supervisor to authorize certain projects–projects with an extremely negative impact, such as mining or coastal developments–in protected areas or neighboring regions.

Recommendations for IMPROVEMENT

Environmental, economic, and social conditions have changed over the past two decades, making it necessary to adapt the EIA process accordingly in order to maintain its relevance. It must incorporate new technologies and the assessment of ecosystems and their services within its purview, and work to decrease society's vulnerability to climate change. In order to move toward these goals, the following are necessary:

- Undertake a comprehensive review of the legal framework applicable to the EIA in order to bring cohesion to the wide range of existing legislation–ambiguities must be clarified, contradictions reconciled, and omissions corrected.
- Integrate human rights standards, access to information, and direct social involvement into the EIA in order to prevent negative environmental impacts and address the potential social and economic impacts of the projects under review.
- Align the EIA with international performance standards, including those on biodiversity and those of multilateral banks and other institutions that follow the Equator Principles.
- Review the complementarity between the EIA and other land use management instruments, such as urban development plans and the OET.

- Use strategic environmental assessment as a mechanism to evaluate possible impacts through the creation of policies, strategies, plans, or programs.
- Include, without exception, other land use management instruments in EIA procedures, like urban development plans and OET programs.
- Include the obligation to evaluate alternative solutions.
- Include the review of hydrocarbon-related projects within the DGIRA in order to avoid dividing the environmental impact assessment between two agencies.
- Differentiate between projects that do and do not require a full environmental impact statement, and put expediting mechanisms in place.
- Establish a council with members of academic institutions, in order to provide access to experts in different subjects to support the review of EIAs and to support the measures to be included in the resolutions.
- Make the process for accessing EIS's transparent, and provide public access to all of the information online in real time and georeferenced.
- Establish provisions and instruments that force developers to determine the actual cost of externalities.
- Incorporate the liability of direct and indirect stakeholders (developers and funders).
- Ensure long-term monitoring mechanisms for the compensation measures and conditions imposed by a project's authorization.
- Look for a procurement and payment mechanism that could significantly reduce the conflicts of interest between consultants and developers. Since these are supplier–client relationships, the contracting party's interests are placed above the public interest, and natural and cultural resources are not adequately protected.

4 WATER RESERVES AND ENVIRONMENTAL FLOW

Water reserves and environmental flow refer to the establishment of limits for water extraction, introduced after the publication of the Mexican Standard for Determining Environmental Flows in Hydrological Basins (NMX-AA-159-SCFI-2012).[8] These are in accordance with the LGEEPA and the National Water Law. They establish that water–a public necessity (National Water Law Art. 6-I and Art. 7-V)–should be reserved for ecosystems in order to ensure hydrological sustainability in vital ecosystems and to restore balance in water-related ecosystems.

Background

In 2004, the World Wildlife Fund (WWF) and the Gonzalo Río Arronte Foundation I.A.P. established the project Developing New Water Management Models in Mexico. It laid the groundwork for the formulation of NMX-AA-159-SCFI-2012, published in 2012. The Standard proved to be an innovative legal instrument that considered the variability of the hydrological regime (above and below ground) and resulting environmental flows, ultimately becoming a useful tool for sustainable water management.[9]

The concept of Potential Water Reserves (RPA) arose out of a feasibility assessment for establishing environmental flows in Mexico. Out of the country's 730 watersheds, the exercise identified 189 with high water availability and a high degree of biodiversity [10] (Map 3). In 2012, these watersheds contained nearly all the water that was not already under concession–in other words, water for the future–

and that supports much of our biodiversity. RPAs cover 23% of the country. They overlap with 97 PAs and 55 Ramsar sites, and protect watersheds that drain into coastal areas that account for 43% of the total mangrove cover. Their geographical reach demonstrates the strategic value of having a water management tool: water reserves strengthen the protection of the country's biodiversity.

With the issuance of NMX-AA-159-SCFI-2012 and the identification of PAs, the National Water Commission (CONAGUA), supported by the Inter-American Development Bank and with participation from CONANP, established the National Water Reserves Program (PNRA). The program was piloted in 43 watersheds from the San Pedro Mezquital, Copalita-Zimatán-Huatulco, Pánuco, and Papaloapan rivers, as well as the Chamela region.

The environmental flow proposals show the feasibility of assigning an environmental flow across the country, and the results show the program's far–reaching impact. These water reserves cover 92,000 km^2, contain 4,500 km of channels, and maintain adjacent riparian corridors. They directly impact 31 aquifers, 17 PAs, and 13 Ramsar sites. In terms of biodiversity, 99 sites were analyzed while identifying the reserves and it was estimated that they provide habitats for 546 protected species (according to NOM-059-SEMARNAT-2010 or the International Union for Conservation of Nature (IUCN) Red List of Threatened Species). The studies involved 138 experts and officials from 58 institutions and organizations.[9]

The PNRA was included in the 2013–2018 National Development Plan as an indicator for the 2013–2018 Environmental and Natural Resources Sectoral Program (strategy 3.1, indicator 8) and for the 2014–2018 National Water Plan (target 2, indicator 2), and was part of the Special Climate Change Program 2014–2018.

Lorenzo J. de Rosenzweig Pasquel

Lorenzo J. de Rosenzweig Pasquel

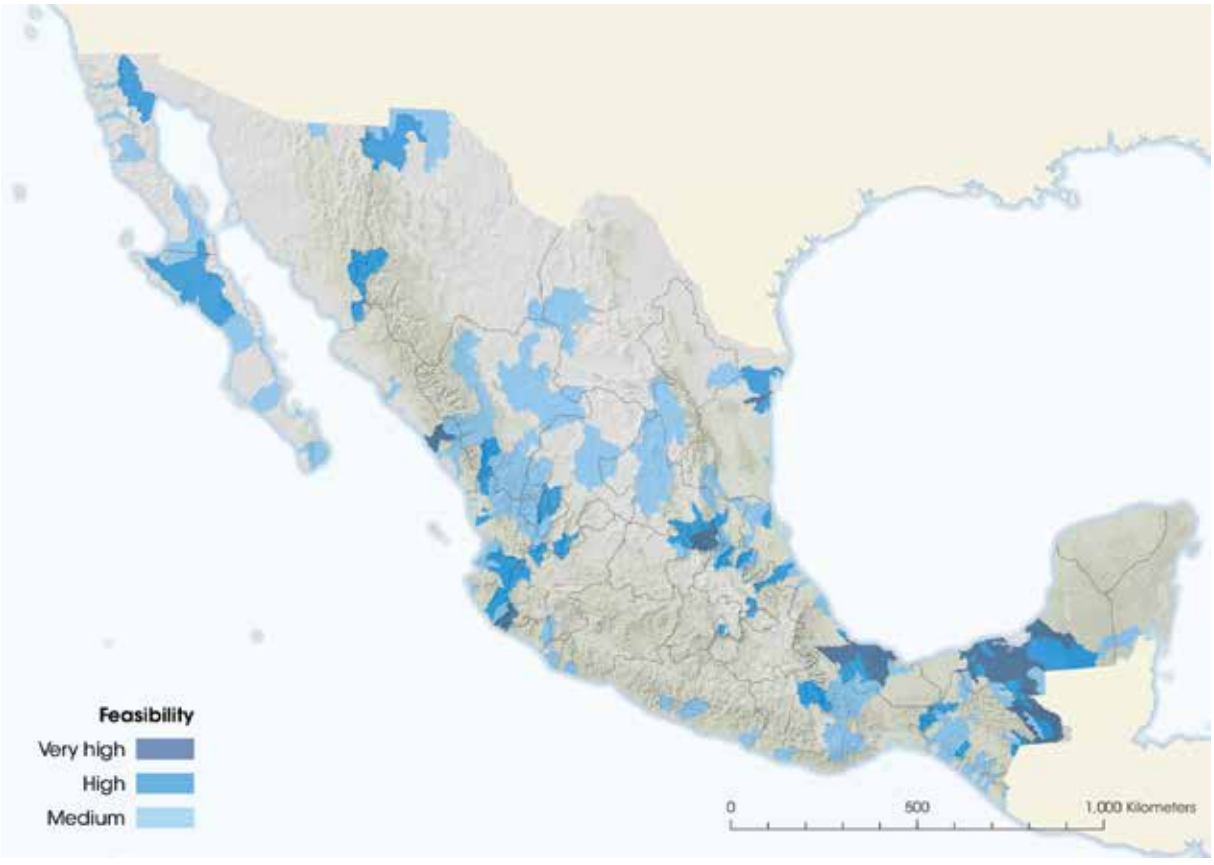
So far, the model for an environmental water reserve is the San Pedro Mezquital river basin (Durango, Zacatecas, and Nayarit). It is a unique river system, mostly free of infrastructure, that runs through the Sierra Madre Occidental and drains into Marismas Nacionales, a biosphere reserve and Ramsar site located in Nayarit. With the publication of the decree of water reserves on September 15, 2014, the Mexican government lifted the ban on water concessions that was established in 1955, which freed volumes of water for any given use. The decree also established a frame of reference for granting water concessions with a lifetime of 50 years, and the mandatory enforcement of NMX-AA-159-SC-FI-2012; the integration of the environmental water reserve into the management program of Marismas Nacionales Nayarit Biosphere Reserve; and a strengthening of the environmental impact assessment process.

Challenges

In the last 25 years, overexploitation of water has led to more than a loss of biodiversity. It has led to a permanent condition of scarcity under which the country must manage its water resources, consequently compromising development, limiting access to water, and affecting the population's health.[3,11]

Water in the environment has both strategic and competitive implications, and should be considered the cornerstone of the country's water resource management. It is an ecological issue in the widest sense of the word: It must be managed as a common asset, as part of our national heritage, and as the lifeblood of our natural capital. The failure to ensure the provision of water for the environment has had considerable negative impacts and is

Map 3. **Feasibility of potential freshwater reserves**



Prepared by the authors with data from CONAGUA (2016), *Reservas potenciales de agua para el medio ambiente.*

largely due to a limited understanding of the importance of maintaining equilibrium within watersheds. Not only is this needed to conserve biodiversity, but also to sustain water management itself, and, with that, the country's social and economic development.

One of the main explanations for the water scarcity that Mexico is facing is that water concessions surpass the sustainable limits of the hydrological cycle. In Mexico, CONAGUA grants concessions to use surface water up to 100% of the mean annual runoff, well over the internationally accepted 40% limit.[12] Year after year, this model of water scarcity management compromises water security and equal access. The implications of such high concession values are even more alarming when one takes into account the absence of an environmental flow, illegal water extraction, imprecise or inadequate information, and climate variability.

Santiago Gibert Isern

Recommendations for IMPROVEMENT

Today, Mexico faces the enormous challenge of transforming water management in such a way that would support the country's development, secure the basic human right of access to water, account for climate change, and conserve biodiversity. However, overexploitation is increasing and shows no signs of abating. Between 2009 and 2014, the volume of surface water in concessions increased by 64%,[8,13] clearly demonstrating the urgency for immediate action.

The experiential knowledge garnered over the past few years has set a basis by which to assign environmental flows to every watershed and aquifer in the country. To move in this direction, the following steps are essential:

- Ensure that any modifications to the legal framework commit the State to enforcing the protection of water for ecosystems, and provide the necessary conditions to establish, within a predefined timeframe, an environmental flow and water reserve system that recognizes the importance of conserving every watershed in the country.
- Encourage entities in the environmental sector to work together to define the volume of water reserves that would be in line with the country's strategy to protect biodiversity.
- Integrate water reserves with PA management programs and the EIA process.
- Include active participation from the academic and research community to generate knowledge of our limnological systems and make the NMX-AA-159-SCFI-2012 an Official Mexican Standard (NOM).
- Inform the public, including local communities, about water reserves, as part of efforts to maintain transparency and accountability in the management of the country's water resources.

Recently, CONAGUA identified 330 watersheds that, because of their hydrological connection to RPAs, should require the integration of an environmental flow by the current administration (2012–2018). Considering these watersheds cover almost half the territory, this would constitute a far-reaching vision for the establishment of water security in Mexico.

Santiago Gibert Isern

5 FORESTRY POLICY

Forestry policy seeks to promote social and economic well-being and the conservation of biodiversity and related ecosystem services through the management of forest ecosystems. To achieve this, Mexican institutions regulate extraction activities in forests, and develop strategies and initiatives aimed at fostering the forestry sector's development while protecting, restoring, and conserving forests, rainforests, shrublands, grasslands, and their related resources.

Sustainable forest management in a country suitable for forestry, like Mexico, has an enormous potential to contribute to the revitalization of local economies and the improvement of living standards. It also promotes compliance with international commitments regarding the conservation of biodiversity and the fight against poverty (Map 4).

Background

Forestry policy in Mexico has a long history beginning in the early 20th century, and has since evolved significantly. Following the Earth Summit, both government institutions and CSOs experienced significant changes in their awareness and understanding of the importance of the environment and of the conservation and sustainable use of natural resources.[14]

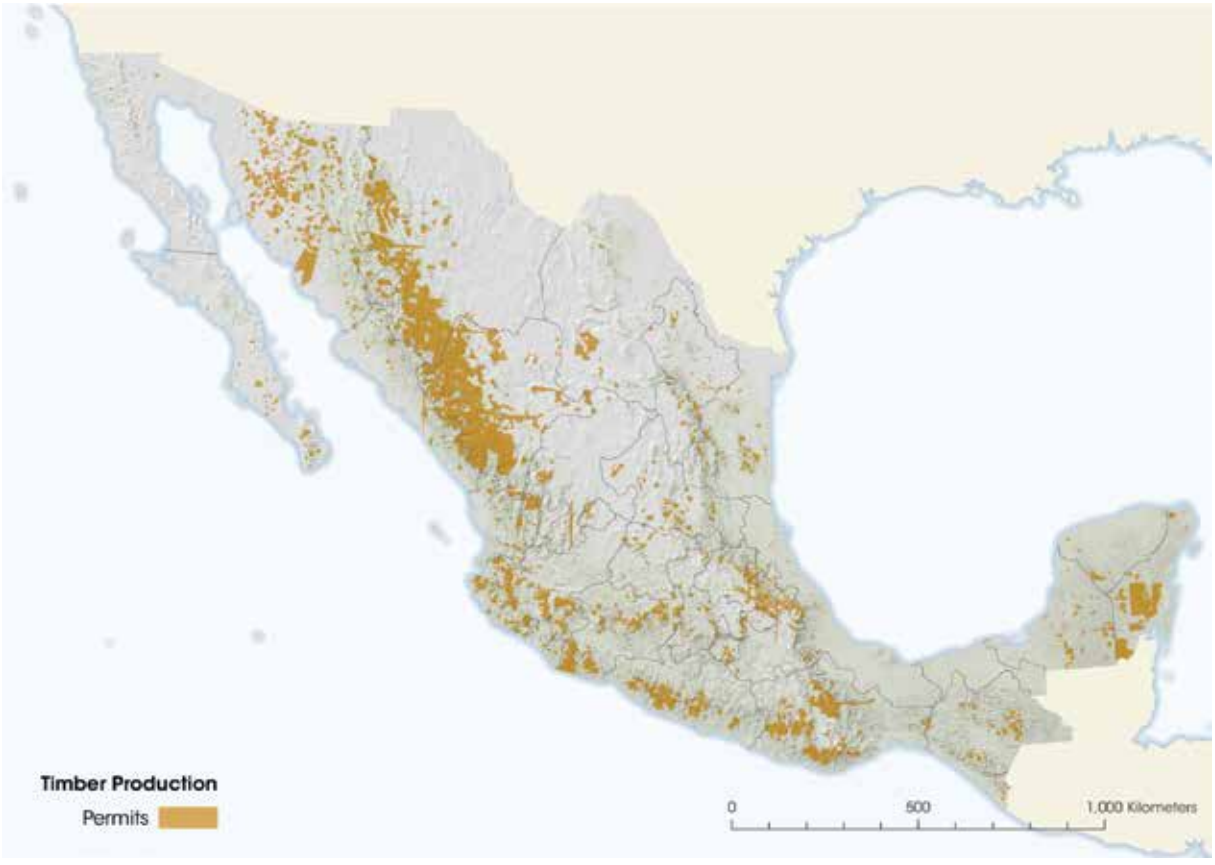
As a result, over the last 20 years, Mexico has developed a significant institutional structure focused on the sustainable management and conservation of forests, including SEMARNAT, PROFEPA, CONAFOR, CONABIO, CONANP, and the National Institute of

Ecology (INE) and Climate Change (INECC). Each has its own set of roles and responsibilities, infrastructure, staff, and resources. Although remarkable progress has been made towards the creation and development of these institutions, government intervention in several regions has been insufficient to comply with the mandate of promoting sustainable forestry development, as shown in the sector's performance indicators.

Mexico's Strategic Program for the Forestry Sector 2025 establishes that broadening the scope of forest management will increase forest resources and timber productivity, and stop the degradation of the country's natural forest wealth.[15] According to the program, an estimated 21.6 million hectares in Mexico could be included in forest management plans, but no progress has been made in the last 15 years. In the year 2000, an estimated 8.6 million hectares were under management. By 2005, that figure was reduced to 6.1 million hectares, and remains unchanged to date.

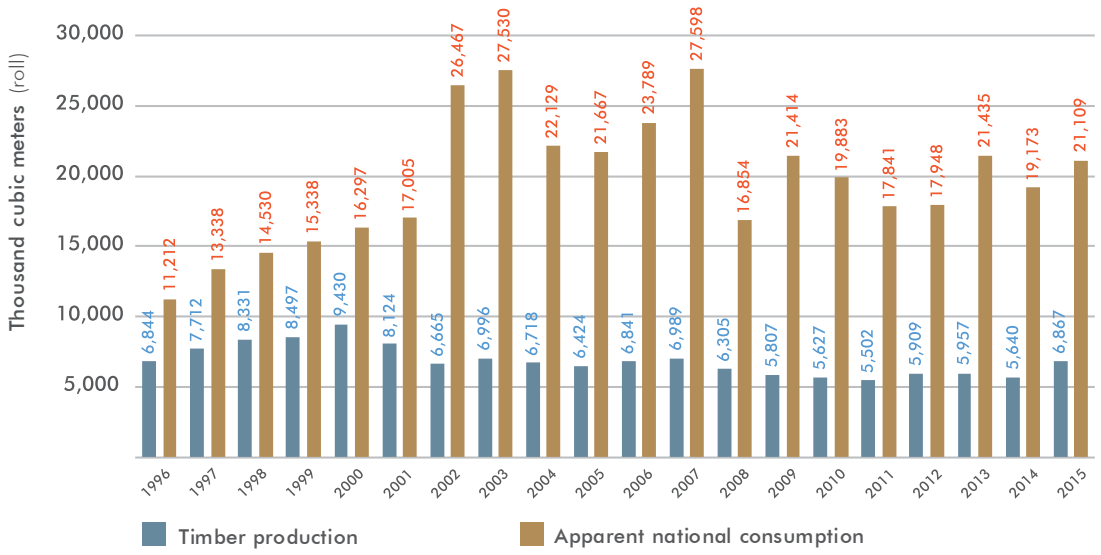
According to the program, the annual potential for timber production is 12 million cubic meters. Considering that timber production attained its highest level in 2000, when it reached 9.4 million annual cubic meters, progress has been insufficient. Since then, production has decreased to 5.5 million annual cubic meters in 2011,[16] and only experienced a small increase in 2015. Despite a thirtyfold increase in subsidies for the forestry sector, the downward trend in production continues, while domestic consumption increases significantly. The failure to increase timber production in

Map 4. **Permits issued for timber forestry**



Prepared by the authors with data from SEMARNAT (2016), *Autorizaciones de aprovechamiento forestal maderable en terrenos forestales.*

Figure 2. **Production and consumption of timber products** (1996–2015)



Prepared by the authors with data from SEMARNAT (2014), *Anuario estadístico de la producción forestal 2013*.

an environment of economic growth caused a serious deficit in the trade balance–reaching over US $6 billion per year.[17]

Illegal timber continues to hold an important market share. In Mexico, 28% to 60% of timber is estimated to be illegal, representing at least 1.6 million cubic meters (Figure 2). Several studies confirm that the supply of illegal timber today is widespread, and that it significantly affects competitiveness for forestry companies with legal operations.[18,19]

Recent studies estimate that there are about 992 community-based forestry companies[20] in Mexico, managing approximately 5 million hectares. Progress in community forest management is attributed to several factors, such as land titling and the strong social capital of *campesino* communities, as well as successful government intervention, as was the case with the Conservation and Sustainable Management of Forest Resources Program (PROCYMAF) in Mexico. PROCYMAF began operating after challenges faced by *ejidos* (community-owned land) and farming communities were acknowledged. It categorized types of producers, carried out regional diagnostic evaluations, and included a series of tools proven to favor local governance.[21,22] During PROCYMAF, companies made important progress in obtaining control over production processes. It allowed hundreds of them to abandon leasing schemes wherein forests were managed by external contractors. Companies were therefore able to build essential capacity in the timber, industrial, and business sectors. In the last few years, however, progress in community forestry has come to a noticeable halt. Communities and ejidos have faced multiple obstacles, and many have decided to abandon forestry altogether. Instead, these community companies focus on managing subsidies, or have decided to go back to the leasing model. As a result, there are fewer opportunities to build capacity and maintain ownership of production processes.

Deforestation in temperate forests has decreased significantly, whereas industrial agriculture,

Forestry subsidies have **increased thirtyfold** while **production decreases** or remains the same.

Santiago Gibert Isern

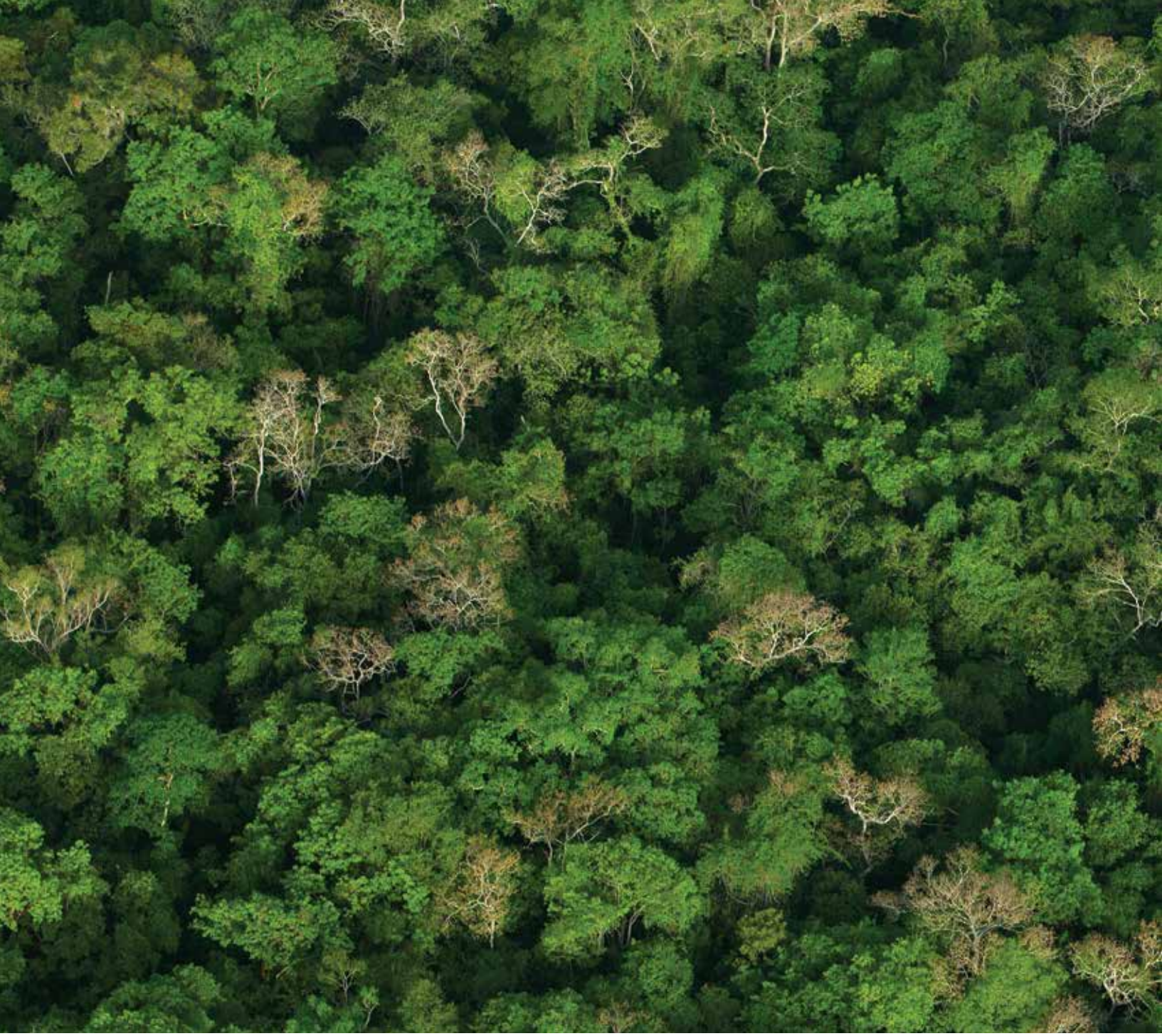
mining, farming, tourism, and urban development are growing and encroaching on forest ecosystems, posing a very serious threat.

Challenges

One of the government's most important instruments in enforcing forest management is the legal authority to grant or deny permits for the use, extraction, and transport of timber and non–timber products. Controlled by SEMARNAT, the instrument seeks to ensure the conservation of forests, rainforests, and their ecosystem services. It also aims to stop their degradation, reduce illegal markets, and incorporate land use activities into management programs. Although it is a fundamental regulatory instrument, its application and over–regulation have turned it into a burden that discourages the use, management, and conservation of forests.

SEMARNAT has made a few efforts toward simplifying paperwork, such as the creation of a standard technical document that combines the environmental impact study with the forest management program. Yet the paperwork surrounding the legal management of forests is still highly complex, time consuming, and expensive, and it continues to have consequences that are contrary to its initial purpose. Ironically, the measures aiming to ensure the conservation of forests and their biodiversity are the same that discourage conservation because of how they are implemented.

Subsidies for owners of forested land are the second instrument of forest policy. A recent analysis of subsidies shows that resources destined for non-production activities represented more than 70% (Figure 3). The approach in distributing these is mostly based on welfare, with a narrow emphasis on building capaci-



ty, energizing local economies, or promoting production processes related to the use of forest resources.

Reforestation initiatives over the past five years have received up to 37% of the total subsidies, generating important economic revenue and temporary employment, but with marginal results in forest restoration. This is due to significant technical problems and a failure to integrate community restoration processes.

On the plus side, the PES program, which receives 29% of the resources from CONAFOR, has managed to put a stop to rapid changes in land use in areas that are strategically important for biodiversity. It has also helped to compensate owners of forested land in PAs and other biologically important areas. Unfortunately, in other regions with a strong potential for forestry, the instrument is not linked to the sustainable man-

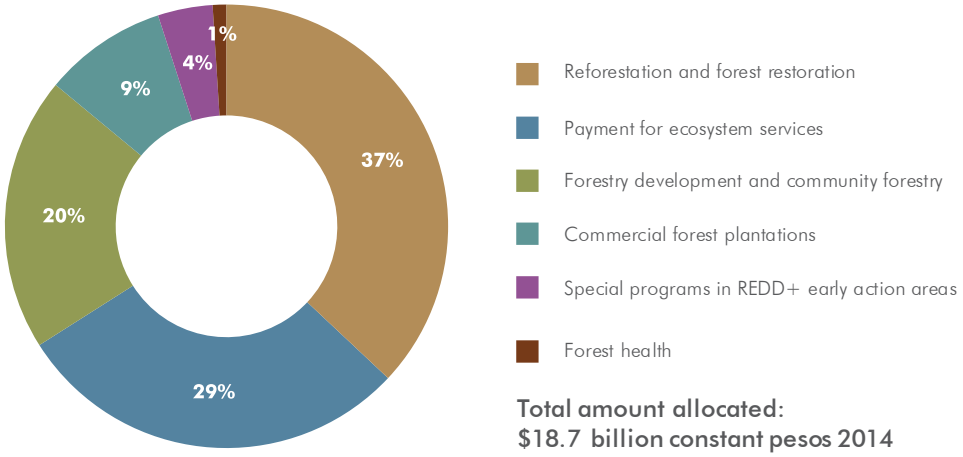
Santiago Gibert Isern

agement of forest resources and is therefore not energizing production processes that are the assets of forests. This is resulting in a culture of leasing and subsidy dependence.

The subsidy system is designed to have an external agent in charge of enforcing its technical guidelines: the technical services provider. In practice, this agent has become a fundamental part of CONAFOR's operation, but the agent's economic gain comes before that of the landowners. Consequently, the system is ineffective, generating negative impacts in local and regional governance and squandering the opportunity to build economies and development.

PROFEPA's role is to monitor the production and trade of forest products. Enforcement is mainly punitive, with a special emphasis on the inspection

Figure 3. **Subsidies allocated by CONAFOR by activity** (2010–2014)



Mexican Civil Council for Sustainable Forestry (2015), *Análisis de los subsidios al sector forestal mexicano.*

of legal operations in the form of frequent site visits. Producers are commonly fined or suspended because of small differences in timber inventories, or sanctioned for failing to comply with requirements and formalities. This approach discourages forest owners from choosing legal courses of production.

Government intervention in forest regions is handled by different institutions–each of which has its own targets and goals, leading to sectored and disjointed intervention. Forest owners can receive, for example, support for both livestock production and reforestation for the same parcel of land.

Several analyses of government management in forest regions recommend a move toward models that are in line with government intervention.[23,24] So far, this has been nonexistent, and there are conflicts in local land use policies and in land management strategies.

In summary, the public policy instruments for *campesino* forest regions show limited interest in developing their production capacity.

Recommendations for IMPROVEMENT

Substantial progress has been made in the creation of institutions that support the forestry sector and promote the conservation and sustainable use of forests and rainforests. That said, government intervention has been ineffective in enforcing the country's mandate to foster sustainable forest development and promote it as an option to preserve forests, generate income for their inhabitants, and conserve biodiversity and ecosystem services. The following will be necessary to reverse these trends:

- Promote programs that develop production capacity, and help forest owners operate within a global society and within a complex and competitive market.
- Review the delivery model for technical services; the bureaucracy, approach, and prioritization of subsidy programs; financing mechanisms, inspection, and compliance; as well as the support of government intervention in forest regions.
- Develop training and financing mechanisms for community-based forestry companies, along with financial models (such as guarantees) to provide access to commercial loans.

These efforts should use as their guiding principle the model for land use and conservation developed by forest communities. The lessons offered by the advances in forestry certification, local PES mechanisms, and experiences with sustainable management of rural landscapes should also be taken into account.

Hunting UMAs in Coahuila, Nuevo Leon, Tamaulipas, and Sonora **provide a significant source of revenue** for ranch owners and also **create biological corridors** for wildlife.

Lorenzo J. de Rosenzweig Pasquel

6 WILDLIFE MANAGEMENT

Our country's biodiversity–its striking plant and animal species in particular–is an essential part of our culture, and a cornerstone for many traditional ways of life. It is also a natural asset that places Mexico in a competitive position in both domestic and international markets for alternative tourism activities, such as bird watching, hunting, recreational diving, and nature photography.

The current System of Wildlife Conservation Management Units (SUMA) was launched in 1997. UMAs are alternative production models for wildlife species. Their goal is to ensure that renewable natural resources within the scope of their geographic location are used wisely and with adequate planning. Through these models, the conservation of biodiversity seeks to be compatible with Mexico's production and socioeconomic development needs. (Map 5).

The Conservation Program for Endangered Species (PROCER) promotes the recovery of endangered species in Mexico, whereas the Species Conservation Action Program (PACE) defines the strategies and particular actions necessary to achieve the conservation and recovery of the species represented within PROCER.

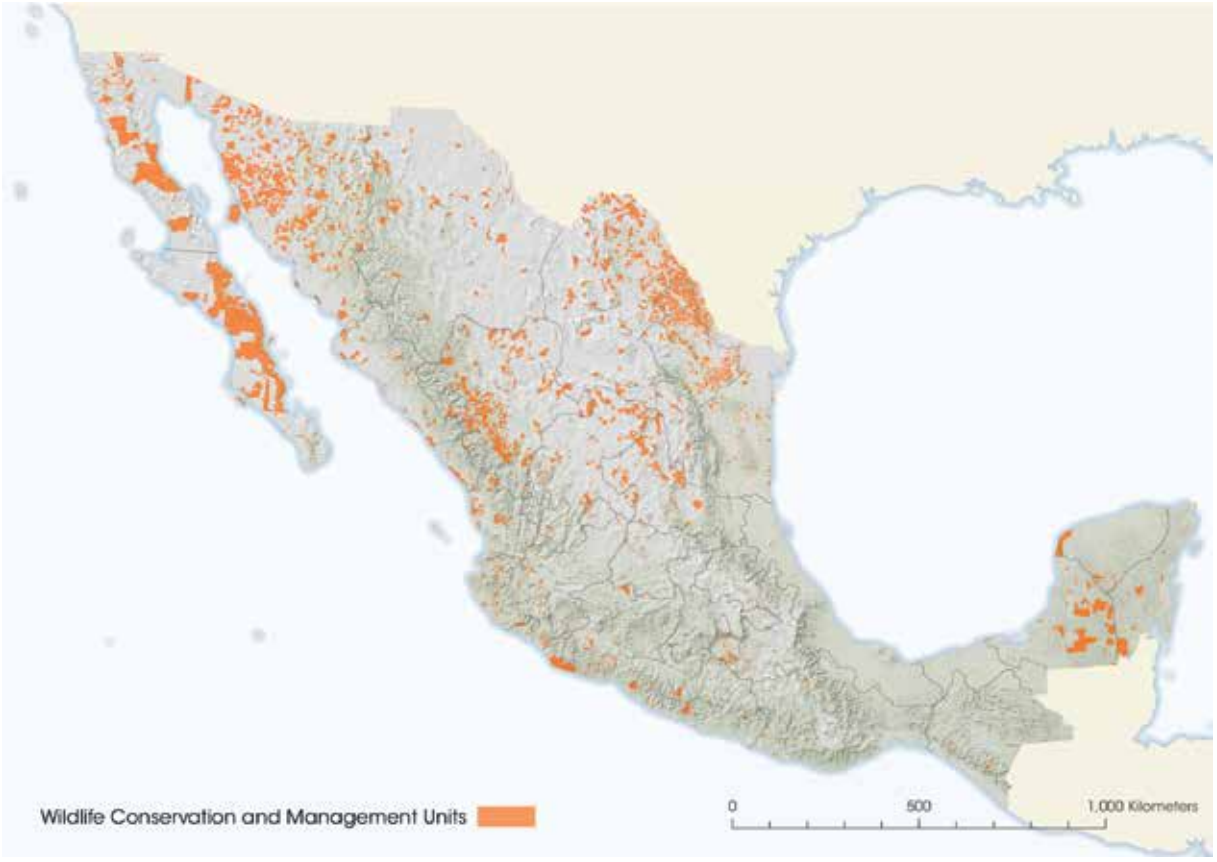
Background

Mexico's experience creating public policies for wildlife management is relatively new. It wasn't until the end of the 20th century that organized efforts were made to devise models for the sustainable use of biodiversity, and that the idea of joint responsibility for the care of wildlife was promoted. Previously, wildlife was only considered from

the hunting perspective, with the 1951 Federal Game Act forbidding trade and exports of live animals, their products, and by-products. This restrictive view prevented the conservation of species and their habitats. The focus changed once the LGEEPA[25] was modified in 1996, when *wildlife* was defined for the first time. It included both terrestrial and aquatic flora and fauna, and incorporated the concept of sustainable wildlife use. The 2000 General Wildlife Law (LGVS) caused a paradigm shift in that it appropriately outlined the relationship between landowners and the natural habitats that need protecting. It also set conservation and the sustainable use of wildlife as national policy goals, and established the concepts of *priority species* and *populations for conservation,* and *endangered species and populations*. Finally, it described the categories of endangerment and the mechanisms to assess them.

In 1996, the Wildlife Department was created and the 1997–2000 Wildlife Conservation and Production Diversification in the Rural Sector Program (PCVSDP) was published. Its goal was to reconcile the need for the conservation of wild flora and fauna with the basic needs of human populations, especially in rural areas. SUMA was established for that very purpose and, in turn, gave rise to the UMAs as units designated to manage different species of economic interest. The UMAs make sustainable use of these species possible through the conservation and management of habitats and populations. The PCVSDP also included the Conservation and Recovery of Priority Species Projects (PREP), which ultimately led to the creation of PROCER.

Map 5. **Wildlife conservation management units (UMA)**



Prepared by the authors with data from SEMARNAT (2015), *Unidades de manejo para la conservación de la vida silvestre.*

Pilar Sada de Caballero

As of July 31, 2016, there were 12,675 registered UMAs that covered 38 million hectares, equivalent to 19.35% of the national territory.

PROCER was launched in 2007 as a public policy instrument for the conservation of priority species. It coordinates the efforts of the different sectors.[26] Its implementation is carried out through species-particular programs within PACE that define specific strategies and develop activities to conserve, protect, and restore populations and habitats. They were designed with the help of experts and relevant actors and stakeholders for each species. These programs reintroduce some of the species and carry out actions initially suggested by PREP, but have expanded PREP's scope and include a wider diversity of stakeholders. As a result, they can include a larger number of priority species. At the beginning, 30 species were given priority attention. As of the beginning of 2017, the program covers 45 species (Table 1) and seeks to support 60 species by the end of the 2012–2018 federal administration.

One of PROCER's main achievements has been its capacity to coordinate with CONANP's Regional Offices and the different PAs. PROCER has experienced substantial growth thanks to the greater involvement of PAs, either through actions within each PA or through coordinated projects between several PAs focused on one species. These efforts, in particular, contributed to greater habitat connectivity and population recovery at a regional scale.

The participation of academics and local actors has been encouraged. In 2015, close to 200 institutions and organizations helped outline project strategies, with the support of more than 100 communities from 19 states. The latter generally take part in environmental monitoring committees, which are an essential contribution to conservation. Among other responsibilities, they work to control and eradicate invasive species.

There are numerous examples of PACE programs that have successfully brought together all parties involved to coordinate and carry out initiatives designed to eliminate the threats to their target endangered species. Some examples include the golden eagle (*Aquila chrysaetos canadensis*) PACE, which leverages the relationship between PROCER and UMAs to send golden eagle feathers from UMAs, where the species is found, to the Huichol communities. Another successful example is the Mexican wolf (*Canis lupus baileyi*) PACE, which promotes the binational actions between Mexico and the United States launched in the 1980s to recover the species through the participation of local stakeholders in northern Mexico.

Challenges

The PCVSDP was designed with an ambitious and long-term vision. For the first time, it considered community involvement as essential to achieving effective wildlife conservation. However, with the new administration that entered into force at the end of 2000, the consistency required to attain those long–term goals was lost, and this forward–thinking vision was abandoned.

In addition, a series of modifications made to the LGVS beginning in 2002 (19 reforms) changed the focus of the law to one that is now contrary to its original goals and logic. Its jurisdiction over non-timber forest resources was eliminated–a decision that caused confusion within the forestry sector over which authority is in charge of conserving those plant species that are important to the habitats of endangered species. The law went from promoting sustainable use to effecting drastic restrictions on the trade and consumption of products and by-products of certain species, completely disregarding the needs of the human populations using these resources. General indifference towards habitat and species conservation ensued–which is the exact opposite of the law's original intention. The lack of monitoring capacity by the Wildlife Department and other competent bodies further facilitated the loss of critical populations due to illegal trafficking and habitat loss. Such has been the case with parrots and mangroves.

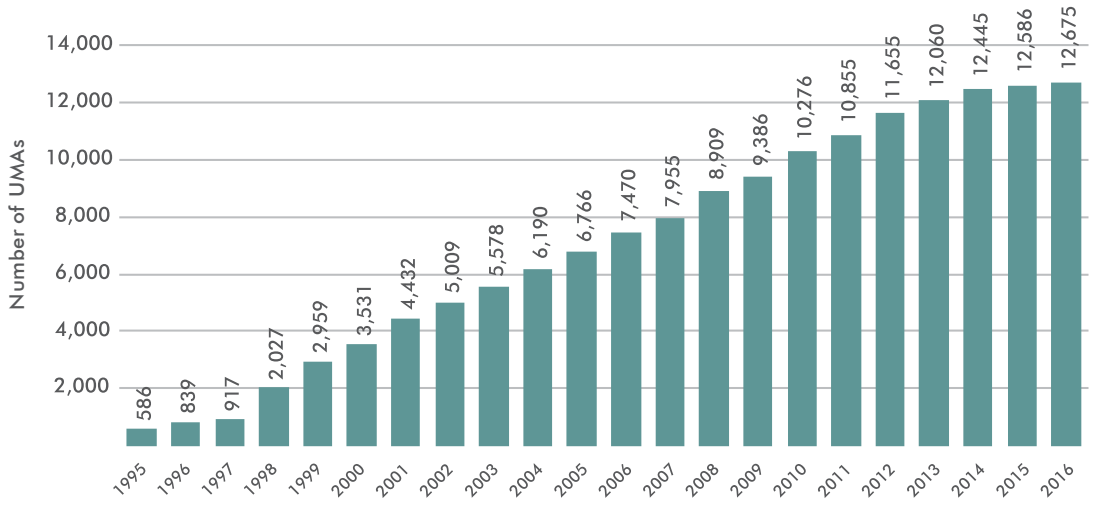
UMAs, however, continue to exist today (Figure 4). The hunting UMAs in Sonora, Coahuila, Nuevo León, and Tamaulipas represent a substantial source of income for ranch owners who, as a whole, have ecosystems that are in a remarkable state of conservation. These also double as national and international biological corridors. UMAs aim to promote alternative production models that make thoughtful use of renewable natural resources and are in line with environmental awareness and stewardship. They seek to create opportunities that complement conventional productive activities like agriculture, farming, or forestry. This provides alternative sources of income for rural

communities, places value on all that constitutes biological diversity, and maintains essential ecosystem services within an UMA and its adjacent areas. They champion a better understanding of the benefits derived from the conservation of biodiversity.

A significant weakness of SUMA is that a comprehensive assessment of its results has not been performed. Likewise, the program's monitoring, enforcement, and management capabilities have been reduced, given the decrease in human and material resources suffered by the Wildlife Department.

These problems stem from a lack of follow-up and the failure to evaluate, update, and strengthen a program that would have provided continuity to PCVSDP. A lack of guidance in the enforcement of policies also played a role. Furthermore, market diversification and the economic impact of developing UMAs were not explored, nor have their valuable contributions to the primary sector's gross domestic product (GDP) been appropriately monitored.

Figure 4. **Wildlife conservation management units registered through July 31, 2015**



38 million ha were under habitat management plans through UMAs.

Prepared by the authors with data from SEMARNAT (2016), *Unidades de manejo para la conservación de la vida silvestre.*

Table 1.

Species Conservation Action Program

	Common Name	*Scientific Name*
Birds	California condor	*Gymnogyps californianus*
	Golden eagle	*Aquila chrysaetos*
	Harpy eagle	*Harpia harpyja*
	Ornate hawk-eagle	*Spizaetus ornatus*
	Black hawk-eagle	*Spizaetus tyrannus*
	Black and white hawk-eagle	*Spizaetus melanoleucus*
	King vulture	*Sarcoramphus papa*
	Yellow-headed parrot	*Amazona oratrix*
	Yellow-naped parrot	*Amazona auropalliata*
	Maroon-fronted parrot	*Rhynchopsitta terrisi*
	Thick-billed parrot	*Rhynchopsitta pachyrhyncha*
	Scarlet macaw	*Ara macao*
	Military macaw	*Ara militaris*
	Horned guan	*Oreophasis derbianus*
	Resplendent quetzal	*Pharomachrus mocinno*
Mammals	Jaguar	*Panthera onca*
	Mexican wolf	*Canis lupus baileyi*
	American black bear	*Ursus americanus*
	White-lipped peccari	*Teyassu pecari*
	Pronghorn	*Antilocapra americana*
	American bison	*Bison bison*
	Baird's tapir	*Tapirus bairdii*
	Geoffroy's spider monkey	*Ateles geoffroyi*
	Yucatan black howler	*Alouatta pigra*
	Mantled howler	*Alouatta palliata*
	Black-tailed prairie dog	*Cynomys ludovicianus*
	Mexican prairie dog	*Cynomys mexicanus*
	Volcano rabbit	*Romerolagus diazi*
	North American beaver	*Castor canadensis*
	Neotropical otter	*Lontra longicaudatus*
	Vaquita	*Phocoena sinus*
	Blue whale	*Balaenoptera musculus*
	Humpback whale	*Megaptera novaeangliae*
	Caribbean manatee	*Trichechus manatus*
Reptiles	Kemp's ridley sea turtle	*Lepidochelys kempii*
	Leatherback sea turtle	*Dermochelys coriacea*
	Hawksbill sea turtle	*Eretmochelys imbricata*
	Loggerhead sea turtle	*Caretta caretta*
	Green sea turtle	*Chelonia mydas*
	Olive ridley sea turtle	*Lepidochelys olivacea*
Marine fish	Great white shark	*Carchodon carcharias*
	Whale shark	*Rinchodon tipus*
Corals	Staghorn coral	*Acropora cervicornis*
	Elkhorn coral	*Acropora palmata*
Vascular plants	Black sapote	*Diospyros xolocotzii*

Recommendations for IMPROVEMENT

Instruments like UMAs have enormous potential to build bridges between various initiatives and programs, but have yet to be fully utilized. Even though they are specifically mentioned in the 2013–2018 Environment and Natural Resources Sectoral Program, in the 2014–2018 Special Climate Change Program, and in the National Crusade Against Hunger, their biggest impact so far only has to do with the management of game species in the northern part of the country.

The instruments discussed in this section demonstrate a more holistic vision, primarily by considering the social needs that are tied to resources. The highly restrictive measures have caused a loss of public interest in the conservation of species, and, given the lack of capacity within the relevant governing agencies, they have become counterproductive.

In light of this, we make the following recommendations:

- Link UMAs with other instruments related to PES programs, sustainable forestry, and sustainable silvopastoral agroforestry management, which would establish a powerful strategy against the effects of deforestation and climate change.
- Implement novel and comprehensive models that combine the different instruments analyzed in this document. It is clear that individually, these tools will not be able to provide all the necessary solutions for the conservation and sustainable use of wildlife.

However, a model with a single implementing body that brings together PROCER, UMAs, and existing biological corridors could produce encouraging results for the conservation of endangered species, especially given the low associated costs (the instruments are already in place) and the potential for synergy between these tools.

- Provide political and financial support to create financial, endowment, and direct expenditure mechanisms that enable the implementation of PACE's work and the monitoring activities of PROCER, as is the case with the Endangered Species Fund (FONCER), which is currently being designed and implemented by CONANP and its private institutional partners.
- Develop a national communication campaign to broadcast our emblematic species, particularly those that provide valuable income for communities and landowners and those that are endangered, and use them as emblems to spread awareness of conservation in Mexico.

7 NATURE TOURISM

Nature tourism in Mexico, which includes adventure tourism, ecotourism, bird watching, and rural tourism, among other types, is a productive activity with tremendous potential considering the increase in national and international demand and the wide variety of landscapes, ecosystems, species, and cultures in our country. The growing interest of domestic and international visitors for direct experiences with nature should be seized in order for Mexico to become one of the main destinations for nature tourism in the world. This type of tourism contributes to regional development by creating jobs for those who own and live in or near natural ecosystems. Most of all, it ensures the conservation of our natural heritage and frames it as a valuable asset.

Background

Nature tourism in Mexico generates almost 4 billion pesos per year, and if promoted correctly, this amount could increase significantly. Recently, the Ministry of Tourism (SECTUR) has been turning its attention to this commercial segment.

The National Social Tourism Strategy sets a framework for sustainable and socially responsible tourism. Additionally, Goal 5 in the 2013–2018 Tourism Sector Program suggests the need to "promote sustainable development in tourist destinations and to broaden the social and economic benefits of host communities,"[27] and adds that, in order to do so, it is necessary to "identify the vocation and the potential of natural and cultural capital through a touristic

zoning plan" (Strategy 5.1). The Program's Strategy 5.3, in particular, commits to "strengthening the contribution of tourism to the conservation of natural heritage and its sustainable use."

Fourteen years ago, CONANP understood that nature tourism could be a tool for the conservation of Mexico's natural heritage and that PAs have tremendous potential for promoting this activity. It designed a set of guidelines–many of which are included in the management programs for each PA–and established the National Strategy for Sustainable Tourism Development and Recreation in Natural Protected Areas in Mexico. The National Commission for the Development of Indigenous Peoples has been an important source of funding for some of the communities that live in these natural areas, who largely depend on the revenues of ecotourism.

The Lacanja–Chansayab Community and the Marqués de Comillas Municipality, both in the Lacandon Jungle, are examples of ecotourism projects that benefit the owners of natural ecosystems while promoting nature conservation. Each has different camping sites and eco lodges owned and operated by the ejidos and their communities. The Lacanja–Chansayab Community offers tours to the Bonampak Archeological Site and different activities in the Montes Azules Biosphere Reserve.[28] Other examples include La Ventanilla, located in the Santa

María Tonameca coastal wetland in Oaxaca, as well as a recent, ambitious conservation project for coastal watersheds and riparian corridors that provides important ecosystem services to tourist destinations like Puerto Vallarta. This project involves INECC, CONANP, and CONAFOR. As for coastal communities, projects of note include the gray whale-watching initiatives in the coastal lagoons of Guerrero Negro, San Ignacio, and Magdalena Bay in Baja California Sur; whale shark–watching off the coast of Quintana Roo; and of course, the iconic case of Cabo Pulmo, a rocky reef and protected area where former fishermen have provided a model for conservation and sustainable use, both for Mexico and the world.

Sustainable development and the promotion of nature tourism could trigger long–term, holistic rural development, and could help us make significant strides towards the Sustainable Development Goals and the Aichi Targets for Biodiversity.

Challenges

Regardless of the existence of programs, guidelines, rules, institutions, and economic resources promoting nature tourism, the concept lacks a single, coordinated policy that identifies priorities. Instead, the sector is completely scattered across public administration.

Ralph Lee Hopkins

The term is also overused. Without specific sustainability criteria, any project or activity that takes place in a rural environment can self–identify as ecotourism, regardless of whether it has any component of social or environmental responsibility. While there have been advances in defining a clean tourism industry and in creating the distinctive "S," the NMX-AA-133-SCFI-2013, or even the *Pueblos Mágicos*, there are still no serious assessments nor solid methodologies in place to certify nature tourism projects that are actually committed to the conservation of natural ecosystems and that would effectively guarantee their protection. When poorly managed, nature tourism can have extremely damaging outcomes, such as deforestation, pollution, and the removal of native flora and fauna, among others.

Nature tourism does not fall under any zoning or land management plans, and it is not promoted according to ecological zoning plans. In several instances, municipal urban development programs fostering tourism have come into conflict with other environmental planning criteria, as was the case in Tulum, on the coast of Quintana Roo.

It is also common for adventure tourism to be promoted by third parties who profit from natural attractions that actually belong to the local ejidos or communities. If there is no direct benefit for the actual owners of the natural resources, they will not commit to the conservation of the ecosystems they live in. Ideally, they should use but not degrade the ecosystem, taking into account their own interests and that of all Mexicans.

Javier de la Maza Elvira

Recommendations for IMPROVEMENT

To make the most of nature tourism's tremendous potential, it is essential to have a clear and defined policy to ensure the conservation of natural areas and their inhabitants' well–being, especially in ejidos and other local communities.

The following are necessary to achieve this purpose:

- Create tourism zoning plans in accordance with environmental legislation and public policies, specifically for OET and urban development programs, and explore the effectiveness of having these instruments merged into one.
- Select pilot sites in priority regions based on their biodiversity and ecosystem services, and on their social, economic, and cultural characteristics, in order to apply all of the instruments that encourage environmentally responsible production. This will allow nature tourism to strengthen sustainable regional development. It will require cross–sectoral and interinstitutional coordination across all three levels of government; partnerships between the social, private, and government sectors; and economic incentives.
- Extend the legal framework associated with sustainable tourism so that it includes nature tourism.
- Design a certification and implementation procedure for nature tourism activities, with basic qualification requirements, such as: low impact on the environment; direct benefits for the owners or primary users of natural ecosystems; promotion of

the conservation of ecosystems; contribution to the education of both visitors and operators; and inclusion of sustainability criteria which are already regulated (NMX-AA-133-SCFI-2013). Additionally, the instrument should include assessment and follow-up indicators.

- Strengthen service operators' management capacity, in particular in ejidos and local communities, in order for them to offer excellent services and earn recognition as top tourist destinations.
- Create and implement an international communications strategy that promotes nature tourism in Mexico, publicizes its natural wonders as destinations, and teaches best practices to visitors regarding resource use and conservation.

8 MARINE REPLENISHMENT ZONES

Marine replenishment zones, proposed by the fishing, environmental, and social sectors, are tools that apply an ecosystem approach to recover fish stocks and positively impact the conservation of marine biodiversity. Mexico has established replenishment zones within the core zones of marine protected areas (MPAs), managed by CONANP, within fish refuges managed by the National Commission of Aquaculture and Fisheries (CONAPESCA), and within voluntary marine reserves. Additional areas, such as refuge areas for endangered species and national security exclusion zones (for example, PEMEX's oil rigs in the Sound of Campeche), can also contribute effectively to restoring the country's fishing resources (Map 6).

Background

A total of 589 marine species are fished in Mexico,[3] many of them overexploited or at the maximum sustainable yield. The National Fisheries Charter is the instrument that evaluates the status of each fishery. However, most are not studied in sufficient detail nor regularly updated.

For this reason, and because of the absence of precise and updated scientific information on fish stocks, the MPA core zones, fish refuges, voluntary marine reserves, and national security exclusion zones are crucial for the recovery Mexico's fisheries.

If we combine the conservation and fisheries management areas with the prevention and exclusion zone of the Campeche

Table 2. **Total area under fishing restrictions**

	Zone	Area (km^2)
Restricted fishing	Fish refuges	19,978
No extraction permitted	Fish refuges	157
	MPA core zones	8,433
	Voluntary marine reserves	15
	Sound of Campeche (national security)	9,657
	TOTAL	18,262

Prepared by the authors with data from CONANP, SAGARPA y SEMAR (2016).

Sound, 18,262 km² of Mexico's marine territory is in no-take zones, where fishing is completely prohibited (Table 2). This is equivalent to 0.08% of the territorial sea and 0.6% of the exclusive economic zone. Of these 18,262 km², 46% are located within the core zones of 25 MPAs, where the removal of any element from the ecosystem–whether coastal, oceanic, or deep–water–is prohibited. These core zones extend from one hectare up to 1,000 km².

Fish refuges span 20,135 km². The removal of marine resources, however, is only completely prohibited across 157 km², with the rest of the areas having partial restrictions. The main purpose of fish refuges is "to conserve and contribute, either naturally or artificially, to developing fishery resources through reproduction, growth, or recruitment, as well as to preserve and protect the surrounding environment."[29] The first fish refuges were decreed in 2012, and by 2016 another five refuges were established, either as single sites or as networks of sites. Their surface areas span 0.1 km² up to 19,934 km².

An estimated 15 km² are voluntary marine reserves that protect giant kelp forests and their associated species in the Pacific Ocean. Because they are implemented by the community, voluntary reserves are robust tools for conservation in terms of social acceptance, but they lack a sufficient legal framework.

Finally, there are fishery exclusion zones for reasons of national security. These are located near oil and power facilities. In 2003, thanks to an agreement between several Mexican government agencies, all fishing activities were banned around the Campeche Sound, an area covering 19,657 km². In October 2016,[30] 10,000 km² of the Sound were opened to fishing. The remaining 9,657 km² still represent 53% of the total area of marine replenishment zones in the country.

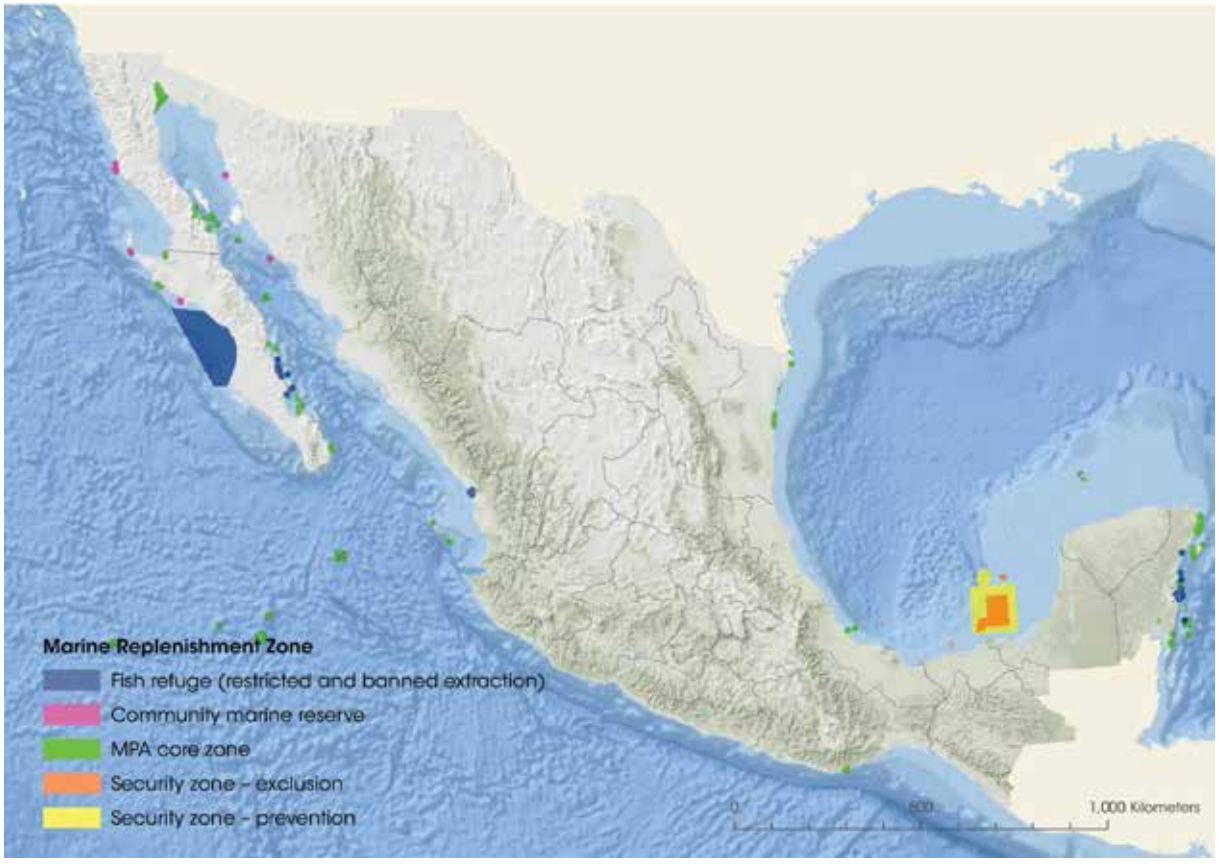
Cabo Pulmo National Park is the best example of the effectiveness of these MPA core zones. Two decades after being declared a protected area, fish biomass has increased by 400%.[31] CONANP is currently systematizing efforts to measure the effectiveness of PAs in biophysical, socioeconomic, and governance

terms. In parallel, CONAPESCA and the National Fisheries Institute (INAPESCA), along with civil society actors, are designing a process to evaluate fish refuges. Although the study is not yet finished, some data is already available, showing that 14 fish refuges in Quintana Roo are protecting 13 endangered species (per the NOM-059-SEMARNAT-2010 and the Convention on International Trade in Endangered Species of Wild Flora and Fauna). In the case of voluntary marine reserves, the benefits, apart from those associated with the increase of commercial species, include stronger governance and the growing awareness of stakeholders. No information is available concerning the areas where extraction is prohibited for reasons of national security, although it is likely that they have a positive impact on ecosystem recovery.

Marine replenishment zones are an important step towards complying with the international agreements of the United Nations Convention on the Law of the Sea, the Code of Conduct for Responsible Fisheries, Goal 14 (Life Below Water) of the 2030 Agenda for Sustainable Development, and the Aichi Biodiversity Targets.

Fish refuges are clear examples of the integration of biodiversity conservation in the productive sector– in this case, fisheries. They stem from a need to ensure the long-term sustainability of economically valuable natural resources, but have a more far-reaching impact at the level of ecosystems. These areas offer an

Map 6. **Marine reserves**



Prepared by the authors with data from CONANP, SAGARPA y SEMAR (2016).

Artisanal fisheries along our coasts are **more resilient** thanks to **marine reserves.**

Lorenzo J. de Rosenzweig Pasquel

opportunity to steer the fisheries sector towards *blue growth*, by reconciling natural resource use with conservation, and by converting consumers into allies in the protection of ecosystems and ecosystem services. The same approach should be applied to MPA core zones, voluntary marine reserves, and other such areas.

According to the Food and Agriculture Organization (FAO), the design and implementation of financial support mechanisms is one of the main ways to secure the long-term operation of marine replenishment zones. Efforts such as the Biodiversity Finance Initiative (BIOFIN),[32] supported by the United Nations Development Program (UNDP), the European Commission, and the German and Swiss governments, focus on finding novel mechanisms that meet the financial needs of biodiversity conservation without completely depending on government funding. The fisheries sector is now being included in such efforts.

Redesigning subsidies to support long-term, profitable fishing activities is another funding mechanism. In 2014, the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA), through CONAPESCA, released 20 million pesos in subsidies for the design, promotion, implementation, and monitoring of fish refuges.[33] The Mexican Fund for the Conservation of Nature (FMCN) and CONAPESCA have initiated discussions to formalize an agreement to establish one or several endowment funds to support long-term monitoring costs and invest in their design and implementation.

Challenges

No-take zones have proven to be a robust tool for restoring populations of both commercial and non–commercial species and their associated ecosystems. However–despite advances in regulations for the implementation of such zones–a multi–sectoral approach, paired with a collective vision that combines the different efforts to recover fisheries and ecosystems, is still lacking. There are no processes in place for the design, implementation, assessment, and adaptation of replenishment zones. If they are established, they also need to take into account the associated environmental,

socioeconomic, and governance variables affecting these areas.

The financial sustainability of marine replenishment zones, especially in terms of monitoring, assessment, and enforcement, is not considered as much of a priority as it is in the forestry sector, where local communities receive subsidies to maintain forests and ecosystem services.

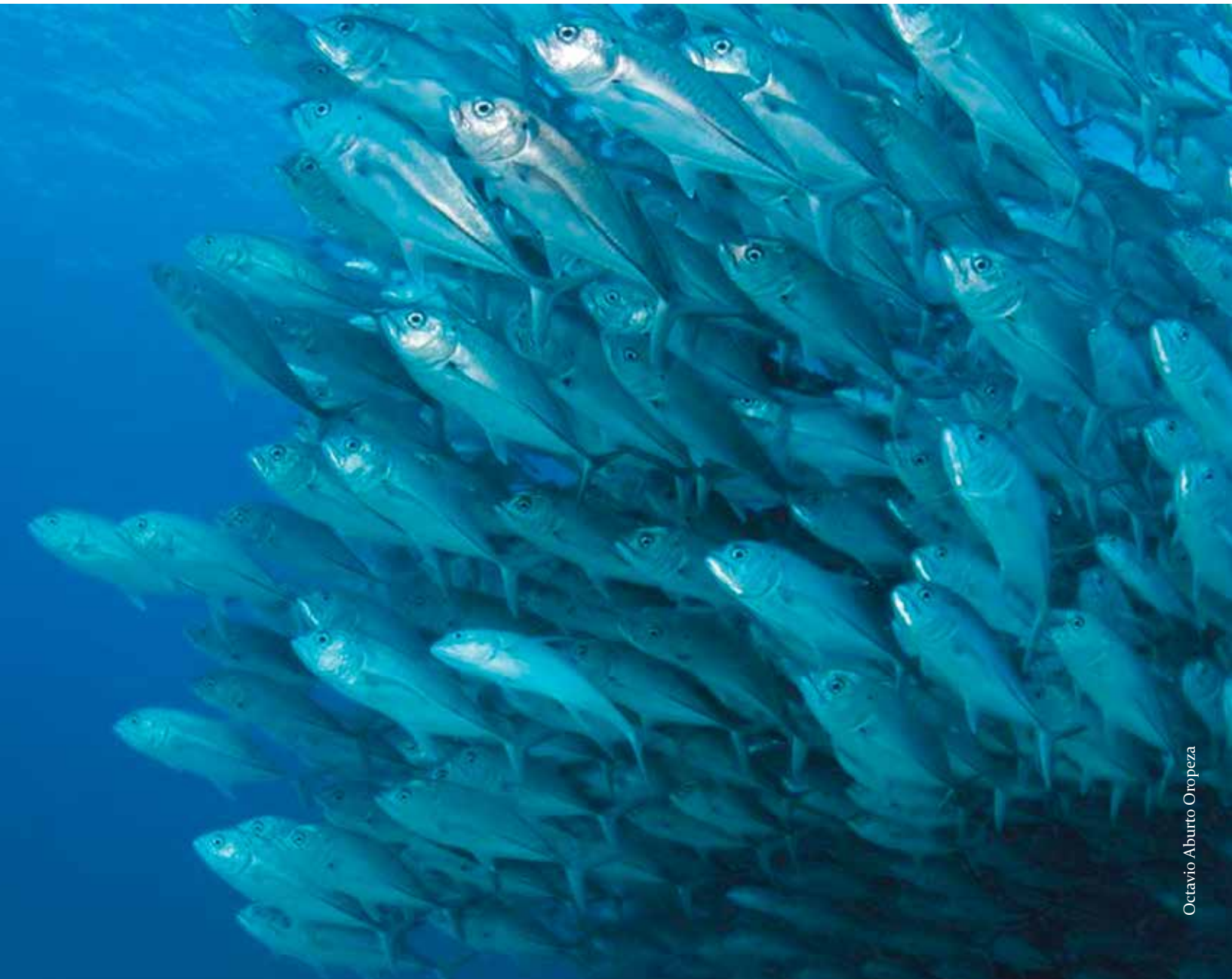
Individuals or communities who have taken it upon themselves to help restore fish stocks and associated ecosystems are neither acknowledged, nor given legal or economic incentives. The same can be said of initiatives led by fishing communities and citizen groups within replenishment zones supported by government agencies.

Recommendations for IMPROVEMENT

Marine replenishment zones in Mexico have demonstrated their potential for positive economic impacts, especially in fishing communities. The success of these areas will depend heavily on the participation of fishermen and other civil society actors, as well as on coordinated and transparent support from the government. We make the following recommendations in order to move forward:

- Facilitate access to the regulatory and administrative instruments needed to begin the process of establishing a voluntary reserve that is designed, evaluated, and monitored by a community; continue the process of formalizing the reserve by establishing short–term replenishment zones, where both users and government commit to temporary periods during which fishing is prohibited in the area; and finally, depending on the results of the previous steps, convert them to permanent refuges. The probability of success for this process depends on the extent of institutional participation and collaboration.
- Create more incentives to increase the coverage of marine replenishment zones, and explore novel mechanisms for funding their operation. There is a wide window of opportunity here to involve the private sector, civil organizations, and international institutions in funding these programs.

- Systematize, publicize, and integrate all of the existing efforts and successes of marine conservation and sustainable fishing in order to maximize their reach, and specifically promote exchanges of experience and knowledge among peers–between fishing communities and between individual fishermen.



Octavio Aburto Oropeza

9 NATURAL PROTECTED AREAS

Natural Protected Areas, or Protected Areas (PAs), refer to government–decreed protected land. They aim to ensure the conservation of a significant sample of ecosystems, biodiversity, and ecosystem services. They are also used to protect the natural environments of archeologically and historically important land and monuments, in addition to areas that are culturally significant to the nation and to indigenous peoples (Map 7).

PAs are the most widely used instrument for biodiversity conservation in Mexico and the world. They are proven to be effective in reducing deforestation and the degradation of natural capital when they are adequately funded and have access to sufficient staff and institutional support.

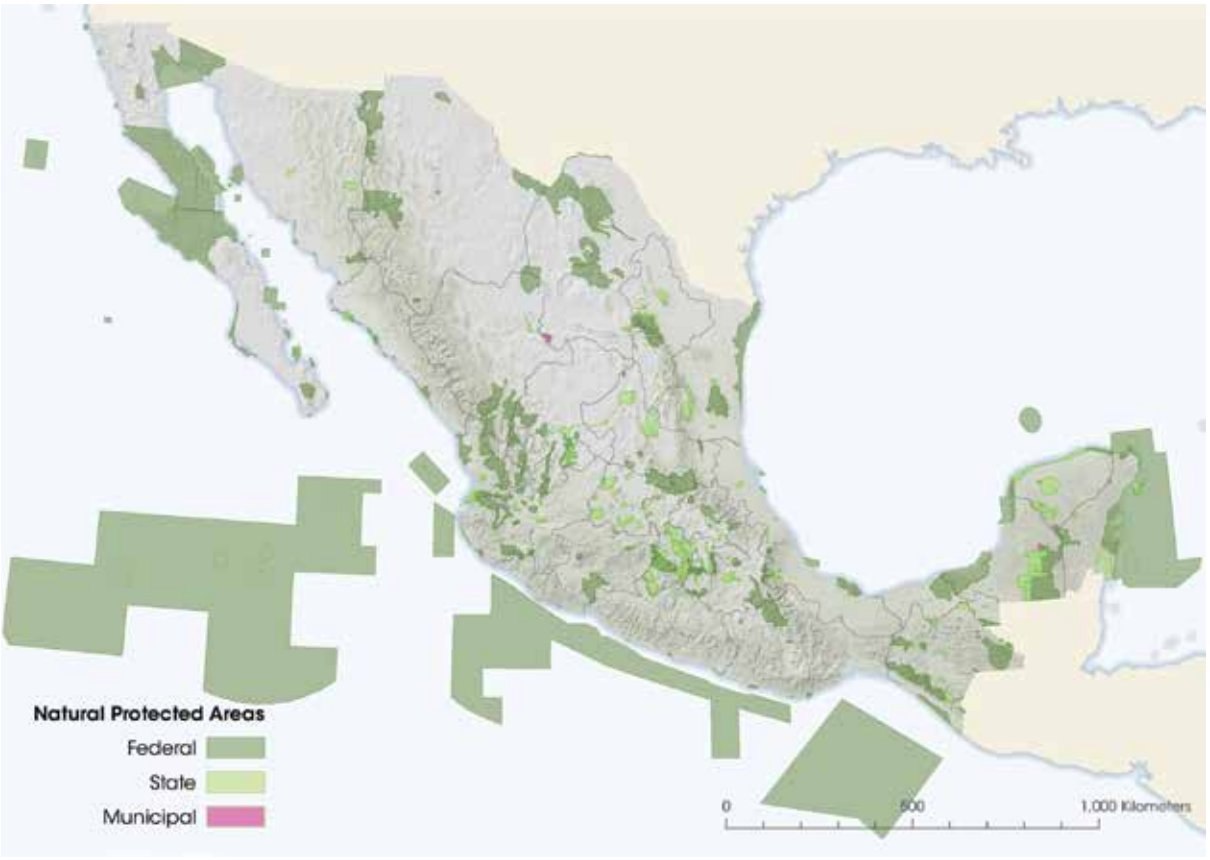
Background

The surface area in Mexico that is under the PA system is the result of a long list of efforts by the government and civilians. In 1876, the Desierto de los Leones National Park was established as a reserve. At the beginning of the 20th century, Miguel Ángel de Quevedo protected the forests in the watersheds of important cities, and used national parks and forest reserves as a way to acknowledge spaces with scenic and environmental value. Years later, the Lázaro Cárdenas administration established 36 additional forest reserves. Between 1940 and 1976, only seven more national parks were created. In 1982, the Ministry of Urban Development and Ecology created the National System of Protected Areas and established biosphere

reserves covering 3 million hectares. Between 1995 and 2000, the Ministry of the Environment, Natural Resources and Fisheries (SEMARNAP) launched the National Protected Areas Program; expanded the area under protection; established the National Council for Natural Protected Areas and the PA advisory councils; designed management programs; reformed the legal framework; and, together with the World Bank and FMCN, created the Fund for Protected Areas (FANP). This process eventually culminated in the creation of CONANP in 2000, the appointment of new staff, and the allocation of additional financial resources.

After establishing a legal, institutional, and social framework for the management of PAs, CONANP has forged on with this work and expanded its budget and staff. Between 1995 and 2016, funding for PAs increased from 11 million to 1.359 billion pesos.[34] However, despite overall growth, this funding has tapered off since 2011. Human resources dedicated to PAs also increased over this period. While the institutions in charge of PAs barely had any staff in 1994, CONANP had 1,245 employees in 2016 working in the 177 PAs established before December 5, 2016. The Regulations to the General Law for Ecological Equilibrium and Environment Protection in Matters of Natural Protected Areas, issued in 2000, strengthened CONANP's capacity by clearly outlining which technical qualifications to search for when hiring PA directors.

Map 7. **Natural protected areas**



Prepared by the authors with data from CONANP (2016), *Áreas naturales protegidas* and CONABIO (2016), *Áreas naturales protegidas estatales, municipales, ejidales y privadas de México 2015.*

The funding and support for participatory management of PAs are part of the commitments that Mexico agreed to as part of the CBD. In order to align with the goals set by the CBD's signatory countries, Mexico must have 17% of its land area and 10% of its marine territory under PA management. As of January 2017, protected areas cover 13.11% of land area and 22.05% of marine territory, including areas decreed by municipal, state, and federal governments, as well as private and community-protected areas. The federal system of PAs has the widest coverage. As of 2016, it includes 181 PAs that cover 90.64 million hectares,[35] representing 10.8% of land area, and 22.04% of the marine territory. Added to this figure are 399,643 hectares across 370 areas that were voluntarily designated for conservation and registered by CONANP. Fifty–one federal PAs, nine state PAs, and seven sites outside of the PA network belong to the World Network of Biosphere Reserves, a part of the UNESCO Man and the Biosphere Programme (MAB). The country also has 123 sites listed as Wetlands of International Importance under the Ramsar Convention.

In 2017, 56% of federal PAs have management programs that designate which types of land use activities are allowed inside these areas, and which instruments will support them.

As of 2017, 48% of federal PAs have advisory boards. The advisory boards provide spaces for social participation in the development of the PA management pro-

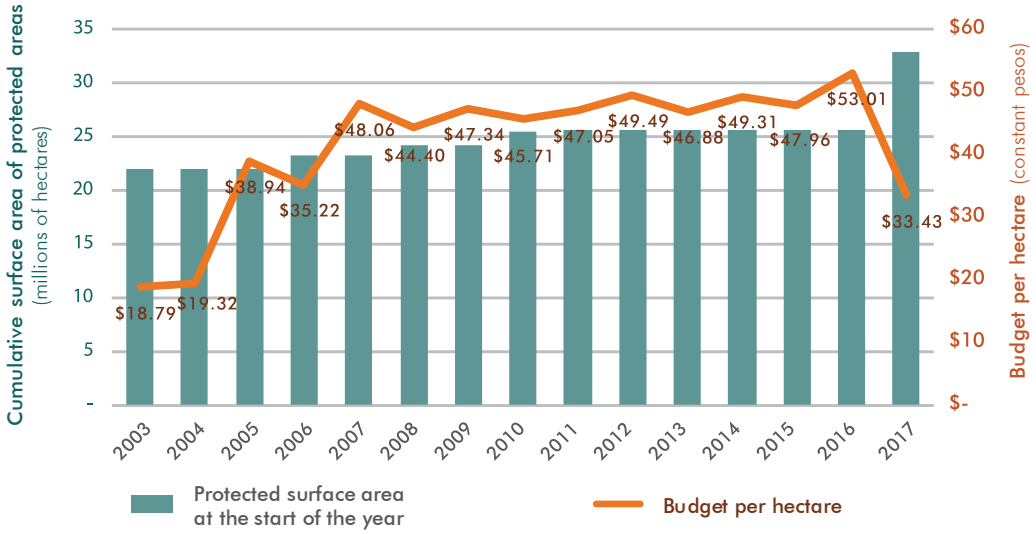
gram. These boards represent the different sectors that are active or living inside PAs, and engage in dialogue with the federal authority in charge. When they function effectively, advisory boards promote the coordination of investments from these different sectors. As a result, PA investments that are compatible and in line with their conservation mandate increase.[36]

The National Council for Natural Protected Areas, a provision of the LGEEPA, is composed of more than 42 expert citizens representing different sectors. Their role is to counsel the Secretary of SEMARNAT, as well as the director of CONANP. Following its success, several state PA systems have adopted the model of social participation and informed monitoring and support.

Sixty-five percent of 17 of the biosphere reserves in Mexico have demonstrated a decrease in deforestation compared to their surroundings.[37] The Monarch Butterfly Biosphere Reserve succeeded in reducing deforestation by 11%[38] with a combination of legal protection and financial compensation for landowners who protect their forests. In 2015, the Global Environment Facility (GEF) evaluated the impact of its investments, selecting Mexico because of its high data availability.[39] The research concluded that Mexican PAs funded by the agency reduced deforestation by 23%. This funding, in Mexico's case, is the result of the private-public partnership that founded FANP and its collaboration with the different sectors working with those who live in PAs.

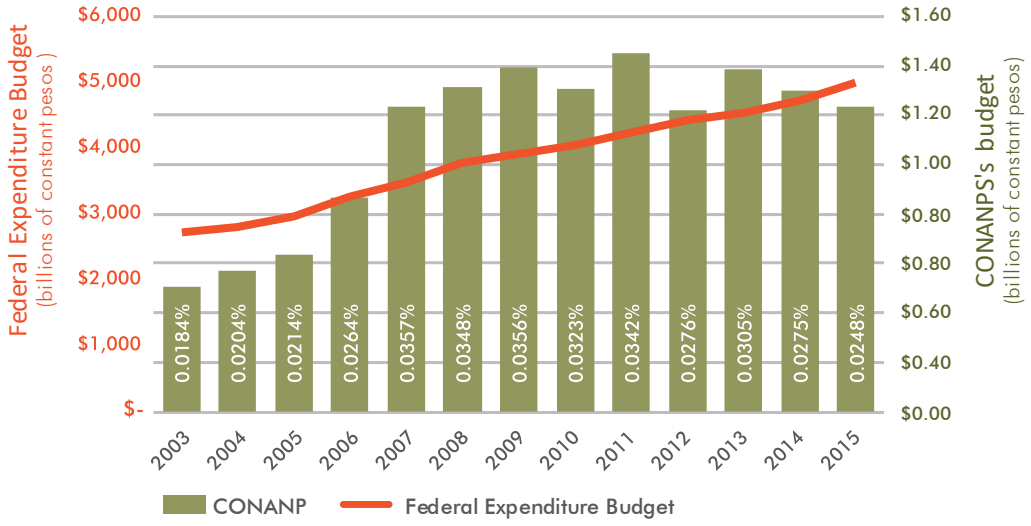
CONANP's publication, in 2015, of the report *Climate Change Strategy for Protected Areas: A Call for the Resilience of Mexico 2015-2020* was an important achievement. Also worthy of mention is the establishment of the Environmental Gendarmerie in 2016, which, together with the Natural Security Commission, aims

Figure 5. **Estimated annual budget per hectare of protected land**



Prepared by authors with data from the Ministry of Finance and Public Credit (2003-2015), *Cuenta Pública.*

Figure 6. **Comparative analysis of CONANP's budget with the federal expenditure budget (PEF)**



Percentages indicate the proportion of the federal budget that CONANP's allocation represents.

Prepared by authors with data from the Ministry of Finance and Public Credit (2003-2015), *Cuenta Pública.*

to support the fight against illegal logging, poaching, unlawful settlements, wildlife trafficking, and other criminal acts within our PA system.

Challenges

In contrast to national parks in other countries, protected areas in Mexico maintain the original land tenure. While the PA designation restricts the use of natural resources, most of the land within PAs (92%) belongs to *ejidos*, communities, and private property owners with whom natural resource and conservation authorities must work. Social conflicts and the rejection of PA restrictions are common, especially when landowners do not receive support during their transition towards the sustainable use of their natural resources, which would allow them to have revenues without negatively affecting their natural capital. PA management programs and corresponding advisory boards specifically address these issues by facilitating dialogue with local stakeholders and residents. However, this does not work for all PAs. Today, 79 PAs still lack management programs and 94 do not have an advisory board. Among these, the Yum Balam protected area is of particular concern. Another issue is that obsolete management programs are still in effect, like in the Puerto Morelos Reef National Park and the El Vizcaíno Biosphere Reserve.

Today, the increase in PAs is incompatible with the cuts in the fiscal budget destined for CONANP, or with the recent cutbacks to technical and field staff (Figure 5). It is clear that CONANP faces important challenges if it is to effectively protect 17% of the territory and fully meet the Aichi Targets for Biodiversity.

The staff managing PAs has increasingly large territorial responsibilities, but fewer and fewer tools to

face the growing threats against natural resources, which stem from the expansion of unsustainable land use and the impacts of climate change.

In 2010, CONANP analyzed the financial gap of Mexican PAs and concluded that a budget increase of 287% was necessary between 2010 and 2018. This funding has not been allocated; on the contrary, it has been decreased (Figure 6). The current estimate of the financial gap stands at 475 million pesos by 2022.[40]

Studies in 93 PAs around the world show that investing in park rangers is the variable most closely correlated with a decrease in deforestation.[41] CONANP is the only entity in the country with permanent staff in the field. By way of comparison, the United States' Yellowstone National Park employs 780 people to manage 898,300 hectares,[42] whereas Mexico has 500 rangers for an area 37 times larger. Additional staffing would represent an investment in the coordination of federal programs with state, international, and private programs in favor of conservation, and would ensure the welfare of populations within PAs and the long-term availability of natural resources.

Recommendations for IMPROVEMENT

In order to properly recognize the importance of PAs and exploit their potential as a fundamental, strategic instrument for biodiversity conservation and management, it is necessary to do the following:

- Transform protected areas into incubators for sustainable rural development in order to achieve the social well-being of their inhabitants, while protecting their natural heritage. PAs must receive sufficient funding, have the adequate, specialized staff they need, a functional institutional structure that promotes collaboration, and economic instruments that benefit sustainable production and compensate local landowners.
- Increase the budget threefold to address the financial gap, provide the necessary human resources to ensure the effectiveness of the PAs to reach the target of 17% of land area and maintain the 22% of seas already under protection.
- Allow for successful sustainable models (sport fishing in Punta Allen, ecotourism in *El Vizcaíno* and *Montes Azules*, or *El Triunfo* organic coffee) to scale up to a landscape level through three strengthened instruments: a zoning plan at a basin level, with the participation of social actors to coordinate investments from different sectors; a revamping of the environmental impact approach that follows international standards; and law enforcement to enforce the Rule of Law and sanction anyone who threatens Mexico's natural wealth.

- Negotiate separate access fees for PAs for domestic and international visitors with the Ministry of Finance and Public Credit (SHCP), and secure the reinvestment of these fees into the operations of the corresponding PAs. This model would allow protected areas that receive many visitors (for example, Contoy Island, Monarch Butterfly Biosphere Reserve and Cuatro Ciénegas) to have sufficient resources to effectively manage tourism in their region.
- Develop partnerships with civil society actors to design and operate supplementary financial mechanisms that would cover up to 15% of the PA system's total cost of operation in perpetuity, allowing CONANP to close its financial gap.
- Design and launch a smartphone app to generate awareness of PAs and crowdfund for their effective management.
- Encourage complementary conservation models: for example, foster conservation and stewardship in private lands that maintain biological connectivity between PAs, and increase resilience within these biological corridors.
- Incorporate biocultural landscapes into the protected area model.

Santiago Gibert Isern

10 CONSERVATION AND RESTORATION OF MEXICAN ISLANDS

Islands in Mexico are highly valued natural areas. Our country has 4,111 islands and islets: temperate and semi–arid islands along the California Current; desert islands in the Gulf of California; and both dry and humid tropical islands in the Pacific Ocean, Gulf of Mexico, and Caribbean Sea. Covering 0.2% of the country's total surface area, islands provide habitats for 8.3% of the country's terrestrial vertebrates and vascular plants.[43] Proportionally, they harbor 14 times more endemic species that the rest of the territory.[44,45] What's more, waters adjacent to these islands are rich in marine resources that are used sustainably by fishing cooperatives with artisanal fisheries. Islands are particularly important for Mexico as they extend its exclusive economic zone to 3.27 million km^2, placing it in 13th place globally. This carries important implications in terms of sovereignty. A total of 150 islands are home to fishing and urban communities, and to members of the Naval Secretariat (SEMAR), representing 269,236 people in all.[46]

Background

Island ecosystems are fundamental to the conservation of the planet's biodiversity. They provide important nursery and refuge areas for different marine species, including birds, turtles, and pinnipeds. Additionally, they perform complex ecological functions at an ecosystem level.[47] Islands around the world suffer disproportionately in terms of species extinction rates, and Mexico is no exception.[48] The main threats to biodiversity and ecosystem services on islands are invasive species. Invasive

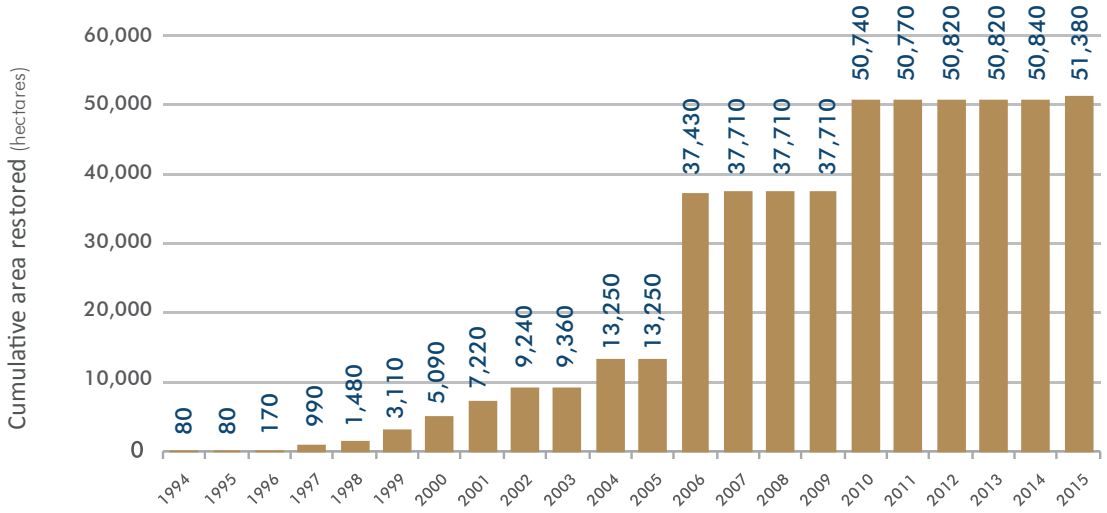
mammal species like rodents, cats, and ungulates are particularly harmful, and have caused the extinction of 17 of the 21 island species lost in Mexico.[49] Invasive species also cause the extirpation of seabird colonies.[50] Globally, one out of three plant species listed in the International Union for Conservation of Nature Red List of Threatened Species are native to islands, as are one out of five bird species.[51]

Conservation and restoration work is very demanding and highly specialized. Over the last two decades, Mexico has developed a collaboration and integration model to carry out lasting restoration efforts (Figure 7). At the center of this diverse, collaborative network is the non-profit organization Island Conservation and Ecology Group (GECI), which carries out an ambitious conservation agenda together with the federal agencies CONANP, CONABIO, SEMAR, INECC, SEMARNAT and the Ministry of the Interior (SEGOB). GECI's activities and partnerships developed strategically and organically over time, and its holistic approach ensures that results are sustainable in the long run. Projects include: the eradication of invasive species; the restoration of plant and marine bird communities; applied research; the integration and management of new public policies; and environmental stewardship through education.

The collaboration between GECI and SEMAR, which handles complex logistics, has been crucial in these efforts. The island conservation network also includes domestic and international academic institutions, local communities, fishing cooperatives, other CSOs, and domestic and international donors from the private and public sectors.[52] Australia, Brazil, Canada, Costa Rica, Cuba, the Dominican Republic, Ecuador, Germany, New Zealand, Spain, and the United States, among others, participate in international collaborations to ensure the future of island ecosystems around the world.

The eradication of invasive species stands out from the other methods of restoration because it is highly effective, especially when dealing with endangered species and major disturbances to native ecosystems. Because islands are inherently self–contained systems, the eradication of invasive mammals is an excellent way to reduce current extinction rates.[53]

Figure 7. **Restored surface area of islands**



Prepared by the authors, unpublished data.

Mexico is at the forefront of invasive species eradication and island restoration. To date, the country has successfully eradicated 58 populations of invasive mammals across 37 islands. Eradication techniques must be adapted to the type of invasive species and the geography of the island–the larger the island, the bigger the challenge. Methods range from the traditional, such as trapping and hunting, to the more advanced: aerial distribution from helicopters of species-specific poison using differential GPS, telemetry, so-called "Judas" animals, and aerial shooting, among others.[44] The eradication of the black rat (*Rattus rattus*) in 2015 in Cayo Centro (part of the Chinchorro Bank) set a world record for tropical island restoration considering the extent of the area and the complexity of the habitat dominated by mangroves.[54]

The results of these eradication projects are significant and tangible: They are helping to protect at least 147 taxa of endemic mammals, reptiles, birds, and plants, and have already helped to restore 227 highly vulnerable seabird colonies.[44] Furthermore, the actions help Mexico comply with its commitments to international agreements, such as the Aichi Biodiversity Targets.

The removal of invasive species is only the first step towards full restoration of native ecosystems. For example, following the successful eradication of 11,000 feral goats on Guadalupe Island, a comprehensive ecosystem restoration program was implemented, with support from CONANP and CONAFOR. The work includes reforestation with endemic forest, shrub, and grassland species; soil quality improvement; and wildfire prevention. Systematic, long–term monitoring of terrestrial birds is also being carried out, and social attraction methods are being implemented to help restore historical colonies of marine birds. This work is an international collaboration with the United States. Special equipment and biological stations, such as the one on Guadalupe Island, have enabled the continuous presence of field staff in these areas since 2003.[55]

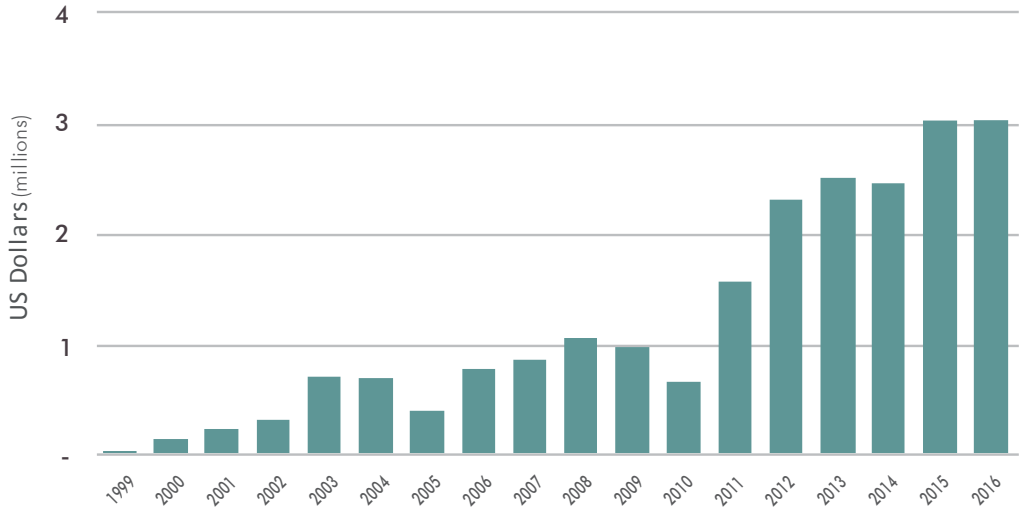
Islands are also part of ecoregions that go beyond national boundaries. For example, several species of marine birds, which nest in the Pacific islands off the Baja California peninsula, have distributions that stretch from the Aleutian Islands and the Bering Sea to the Pacific Ocean off the coast of Mexico. Mexico is the third most diverse country in terms of marine bird species, with one third of them found in the country, and it is the second most diverse in terms of endemic ones.[56] To protect this richness, Mexico and its conservation organizations have developed the National Seabird Conservation Program. Its objective is to restore seabird populations using innovative techniques, such as attraction with decoys, artificial burrows and boulders (to recreate nesting colonies), and the enhancement of nesting habitats by removing unwanted undergrowth and scrub.

Challenges

The goal of all these efforts is to free Mexican islands of invasive mammals by 2030. This task is already 50% complete, with 83 populations of invasive mammals remaining across 34 islands. To continue moving forward, multi-criteria decision analyses, which evaluate the value of biodiversity and project feasibility, were carried out in order to establish eradication priorities.[57]

Biosafety–defined as a set of measures and actions taken to prevent the introduction of invasive species–is a key element for long–term success, and must be implemented in parallel with eradication efforts. This requires institutional collaboration across a wide network and a commitment at the national level. All of the above require the support of a broad strategy to

Figure 8. **Funds secured for island restoration**



Prepared by the authors, unpublished data.

strengthen learning, stewardship, and a culture of environmental awareness–within local island communities, and among the people who appreciate or depend on the resources in these areas.[44] GECI and CONABIO are currently collaborating on a project funded by the GEF and with logistical support from SEMAR.

The future of Mexican islands involves sustainable economic activities grounded in best practices, including fishing, alternative energy, and nature tourism. To help meet this vision, Mexico has declared all islands PAs. The most recent declaration in December 2016 for the Pacific islands of Baja California is the result of collaboration between the federal government, the environmental sector of civil society, and the region's fishing cooperatives.

The National Strategy for the Conservation and Sustainable Development of the Mexican Insular Territory is the first of its kind in the world. It was developed through a participatory process and outlines the steps that need to be taken in order to attain its long–term vision and objectives. The Strategy integrates three concepts: 1) sovereignty, 2) conservation, and 3) sustainable development. It also includes four related themes: 1) funding, 2) cross-institutional and multi-sectoral collaboration, 3) public policy, and 4) knowledge. These provide the necessary framework to implement comprehensive plans that account and prepare for the complex issues surrounding Mexico's island territories.[58]

All of the efforts and outcomes mentioned above were made possible by steady funding, which has supported a well–integrated team of full–time professional staff. The present and future of this endeavor depends on consistent funding and a long-term approach (Figure 8).

Recommendations for IMPROVEMENT

In the effort to strengthen conservation of island ecosystems in Mexico, the following challenges and opportunities are of primordial importance:

- Broaden opportunities for basic and applied research on Mexican islands. Research activities have long been set aside in these regions; in some cases, the information gaps span decades. This research must be focused on restoration and applied ecology, and be closely linked to academic institutions.
- Establish research centers for island science to secure long-term funding from the National Council for Science and Technology (CONACYT). These would benefit young scientists and experts in island conservation, and would also help retain valuable human resources. Consistent funding and a long-term vision are key factors for success. The financing should include project funding, public funding for fixed costs such as salaries, and public and private funding from both domestic and international sources.
- To complement the previous recommendation and diversify financing sources, create a for–profit company that specializes in research and development for island conservation and restoration, and implements projects in Mexico and abroad.
- Strengthen the National Biosafety Program by CONABIO and CONANP, with active involvement by SEMAR and all the stake-

holders of island resources. Preventing the introduction of invasive species is a fundamental component of the national strategy; it requires complete cross-sectoral cooperation and commitments from all social actors.

- Review and update the National Strategy for the Conservation and Sustainable Development of the Mexican Insular Territory using the same participatory approach that led to its creation. There is a clear need to consider the specific issues of island territories within the public policy and legal frameworks, and even to establish a legal framework specific to island restoration.

Santiago Gibert Isern

11 FEDERAL MARITIME LAND ZONE AND COASTAL ENVIRONMENTS

The Federal Maritime Land Zone (ZOFEMAT) is a 20-meter-wide stretch of land located between a beach and the adjacent private property. It runs contiguous to the beach and is accessible. Cays and reefs located in territorial seas also form part of the ZOFEMAT.

Coastal environments harbor unique ecosystems, such as mangroves, rocky reefs, marshlands, sea grasses, and coastal lagoons. The ecosystems provide a diversity of ecosystem services, such as high primary productivity and biological richness, and serve as habitats for native, endemic, endangered, and migratory species. They supply food, shelter, and nursing grounds for crustaceans, mollusks, reptiles (such as turtles), marine mammals, and birds, in addition to many other fish species that support some of the most successful fisheries in Mexico.

Coastal environments have a high aesthetic and recreational value. They secure coastlines by controlling erosion and providing a buffer against storms and hurricanes; they act as biological filters to improve water quality; and they maintain natural processes.

Background

ZOFEMAT was inherited from legislation transferred to New Spain during the colonial era, making it one of the oldest administrative tools in Mexico. In the early 19th century, a royal decree defined beaches as "every space touched by the sea during its daily ebb and flow, in addition to the area twenty yards above the high tide line." The creation of the ZOFEMAT stemmed from the desire to include areas of common use within the limits of royal property.[59]

During the 1970s, the administration of the ZOFEMAT was integrated into settlement planning processes using criteria from coastal population centers for urban development. In the 1980s, the ZOFEMAT evolved into a tool that supports environmental goals. In the 1990s, ZOFEMAT grew to include the management of coastal environments. By the end of the century, ZOFEMAT access fees were implemented, and continue today to generate high revenues for coastal municipalities that attract tourism.

Public works, tourism infrastructure and development, harbors, residential developments, fishing, and aquaculture are the primary activities within the ZOFEMAT. It also hosts oil, naval, and power facilities, among others (Map 8).

According to the National Coastal and Marine Policy published by SEMARNAT in 2006, approximately 20,000 tenancies were recorded within the ZOFEMAT nationwide. Less than 3% of these had the appropriate authorization or permits to operate within the zone.[60] The most common infractions were illegal occupation, violation of concession titles, illegal land sales, disputes over overlapping *ejido* land allocations, and non–payment of corresponding usage fees, as established in the Federal Duties Law.

Challenges

In 2006, efforts to systematize information regarding the administration of the land within the ZOFEMAT were scarce, and control over occupancy was non–existent. The identification of the physical zone was problematic and the authorities were unaware of its exact borders. These circumstances led to conflicts, such as overlapping concessional areas.

Santiago Gibert Isern

According to the sustainability criteria in use in 2007 to guide the ZOFEMAT,[61] the goal was to "not only protect, conserve, and restore the environment and its resources, but also promote productive activities that do not exceed the resilience capacity of ecosystems, while improving the quality of life of the communities who own the resources."

The administration of the ZOFEMAT has focused almost exclusively on the real estate sector, due to municipalities' strong interest in collecting usage fees. Transparency websites and the SEMARNAT[62] reference local committees and the collection of fees. The goals set by municipal offices in the ZOFEMAT focus on increasing revenues from these fees.

Given the imminent effects of global climate change on the environment, the ZOFEMAT cannot simply be considered as real estate. Hydro-meteorological events will change the geographies of beaches and the ZOFEMAT, and can entail severe damage to infrastructure in harbor communities.

If the ZOFEMAT is diligently managed according to criteria that promote protection and conservation, and if permits and concessions are granted with the goal of minimizing the negative impacts of the zone's activities, coastal communities will be safeguarded from strong winds, known as Nortes, violent storms, and hurricanes.

SEMARNAT did not include goals or indicators for the management of the ZOFEMAT in the 2013–2018 Sectoral Program for the Environment and Natural Resources.[16] It is limited to the definition of actions that "promote the integration of different conservation schemes, and foster best productive practices and the sustainable use of natural resources."

The National Coastal and Marine Policy (updated in 2015) also omits strategies and goals for the ZOFEMAT. In fact, it is mentioned only once, in the line of action 3.3.1: "Promote the creation of a legal instrument to establish 'buffer zones' adjacent to the federal maritime land zone and land reclaimed from the sea, and with these, contribute to securing the integrity of biophysical structures and the operation of coastal ecosystems, as well as the security of human populations and urban and service infrastructure."[61]

The Regulations for the Use of Territorial Seas, Waterways, Beaches, Federal Maritime Land Zone, and Land Reclaimed from the Sea[63] have not been updated in 25 years, even though the General Act of National Assets, from which it is derived, has been updated frequently during this same period. This misalignment causes problems in the application of the legal framework.

One of the biggest issues is that the legal framework defining ZOFEMAT does not include any guidelines based on sustainability criteria. Additionally, it presents several discrepancies that stem from the legislation's historical development. Indeed, the legal framework for the ZOFEMAT has evolved according to how the zone has been perceived throughout time. It was originally considered an area that helps protect national security, and then was seen as a means to ensure open access to marine and river waterways, as well as an area associated with maritime trade, tourism development, and fishing–this perception prevailed until the 1980s.

There are few examples of how the management of the ZOFEMAT has been used as an environmental policy instrument. In 1997, the INE granted the first conservation and management agreement for the ZOFEMAT in the Pulticub zone, in the Sian Ka'an Biosphere Reserve.[64] Since then, and until 2014, the Federal Administration of the Federal Maritime Land Zone and Coastal Environments has granted agreements to INE or CONANP for more than 50 locations. Of these, 23 were located in PAs, and nine in areas under similar conservation decrees. Together they cover 2,033.28 hectares.[35] It is worth mention-

ing one instance in 2010 wherein concessions in the ZOFEMAT and agreements were obtained for CONANP in the Gulf of California, covering 150 hectares (75 km of coastline) and 1,303 hectares (651 km of coastline), respectively. The budget for the effort totaled about 400,000 dollars and was raised by private foundations in California, by FMCN, and by another six Mexican CSOs.

It is important to note that the Federal Duties Law exempts concessions granted for conservation purposes from paying fees.

There have also been negative experiences, in which concessions within the ZOFEMAT in coastal PAs were granted to private individuals, without consulting CONANP. And even when consultation does occur, final decisions do not necessarily coincide with the conclusions and recommendations of the consultation, given that it is not yet legally binding. Additionally, concessions are sometimes granted even when there is no EIS or construction permit granted by the appropriate authority.

Map 8. **Federal Maritime Land Zone**

Prepared by the authors with data from SEMARNAT. 2016. *ZOFEMAT.*

Recommendations for IMPROVEMENT

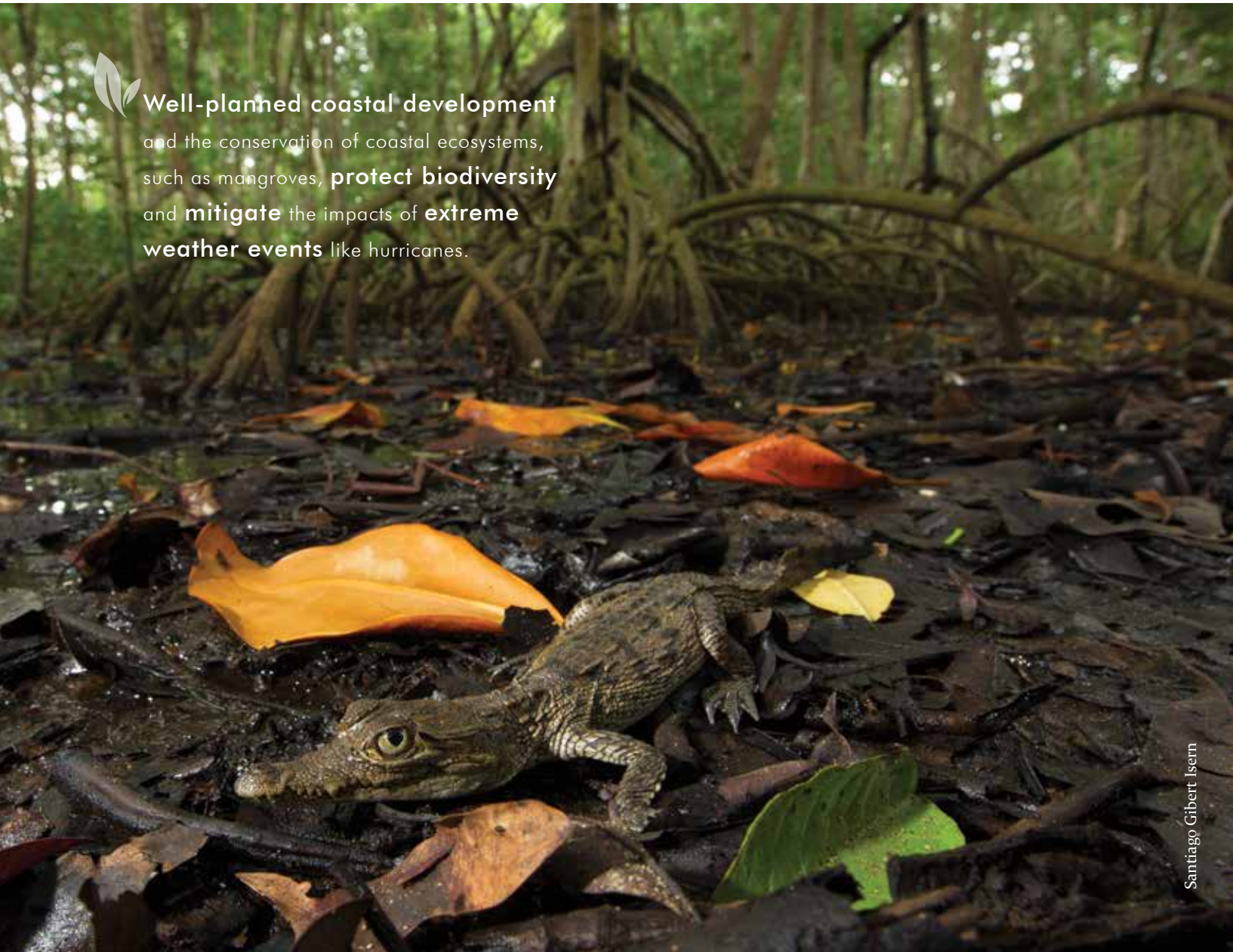
The ZOFEMAT is an essential element in establishing sustainable development strategies in the country. However, it is necessary to develop policies that incorporate comprehensive management of coastal areas, that have an up-to-date legal framework, and that balance environmental and socioeconomic considerations. In order to do so, a legal definition of *coast* or *coastal area* must be established. Such definitions must account for the integrated nature of the areas, their influence both seaward and inland, the size and distribution of mangroves, watersheds, and other relevant physical, biological, socioeconomic, and administrative criteria.[59] Likewise, its strategic role in climate change preparation must be taken into account. We recommend the following:

- Define goals, strategies, and indicators of success for the ZOFEMAT, both in the 2013–2018 Sectoral Program for the Environment and Natural Resources and in the National Coastal and Marine Policy.
- Update the ZOFEMAT's environmental policy and include regulations that benefit the conservation and sustainable use of coastal ecosystems, such as mangroves, marshes, and sea grasses.
- Align the ZOFEMAT's provisions with coastal zoning plans by appropriately managing real estate assets and taking into consideration the activities feasible within any given length of coastline, for

example: physical protection, fishery productivity, public use, and infrastructure for marine activities and tourism, among others.

- Provide exemptions to usage fees for areas dedicated to conservation activities, and streamline the procedures required to obtain this kind of land–use concession.

Even without modifying the ZOFEMAT's legal structure, its relationship with current coastal management instruments should be an integral part of sustainability policy and be used as a legal and fiscal mechanism that, although lacking in a specific environmental component, still strengthens the application of management and administration tools.



Santiago Gibert Isern

12 CONSERVATION FINANCE

The term "conservation finance" is less than two decades old. Broadly speaking, conservation finance leverages both private and public financial instruments to mobilize and manage capital for the conservation of ecosystems and their biodiversity. Funding for conservation comes from public sources (e.g. government budget allocations, fees, compensation schemes, and payments for ecosystem services) and private sources (e.g. individual contributions, domestic and international foundation donations, or returns on endowments). The more recent model of impact investing provides a new opportunity for investors to place capital in socially or environmentally responsible enterprises.

Economic growth and competitiveness in Mexico are closely tied to its natural resources. Under the current economic model, exploitation of these resources will inevitably lead to the degradation and depletion of our natural capital. While average economic growth in Mexico increased by 2.5% annually from 2003 to 2014, the associated environmental costs increased to 7%, on average, of annual GDP in this same period. Meanwhile, the country's expenditures for environmental defense and remediation amount to only 0.8% of the annual GDP. This means that barely 11.4% of the estimated cost of externalities derived from productive activities is spent on environmental protection[65] (Figure 9).

For the System of Economic and Ecological Accounts of Mexico, operated by the National Institute of Statistics and Geography (INEGI), environmental costs are incurred because of the depletion or degradation of natural resources. Depletion costs refer to the monetary value

of the deterioration or loss of a resource (i.e. depreciation) derived from its use in productive processes. In turn, degradation costs are the monetary value required to restore environments that are deteriorated because of economic activities. For example, the environmental cost of water refers to the amount in pesos required to prevent or reduce its pollution.

This document analyzes the public expenditures related to environmental protection. Despite its strategic involvement, private funding accounts for significantly less, and is not taken into account in this analysis.

The main environmental cost of economic activity in Mexico is environmental degradation. Over the 2003–2014 period, it averaged 75% of total environmental costs.

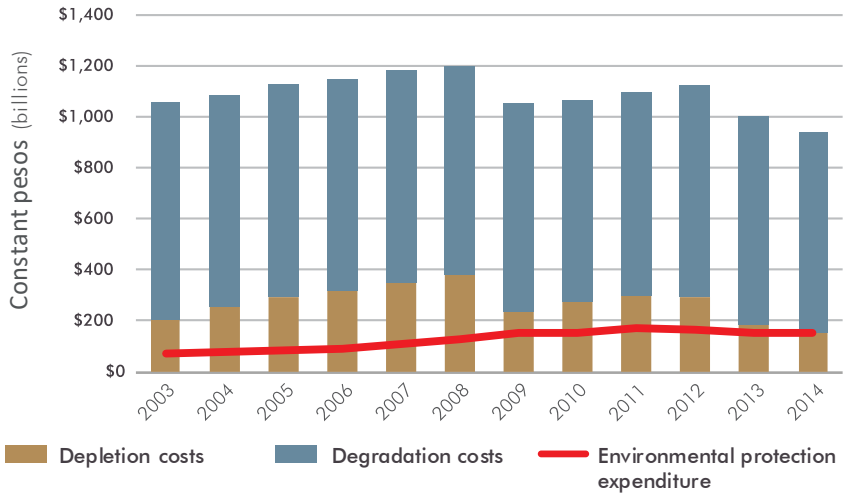
The estimate of environmental costs is disaggregated by sector in order to visualize relative negative impacts on the environment (Figure 10).

The total cost of environmental protection is comprised of the outlays of the federal government, public companies, and state and municipal governments on environmental defense and remediation. It is possible to link an amount spent on environmental protection to the sector that caused the damage in question, making it possible to compare the cost of externalities and the cost of environmental protection by sector. It is therefore possible to know that, for every peso invested in environmental remediation in the mining sector, 11 are spent on externalities caused by mining, for example. For every peso invested in the environmental protection of the agricultural, forestry, and fisheries sectors, externalities amount to 75 pesos.

The average annual expenditures for environmental protection from 2003 to 2014 amounted to 126.2 billion pesos, distributed across eight different categories. The proportion of expenditures per category for this period is detailed in Table 3.

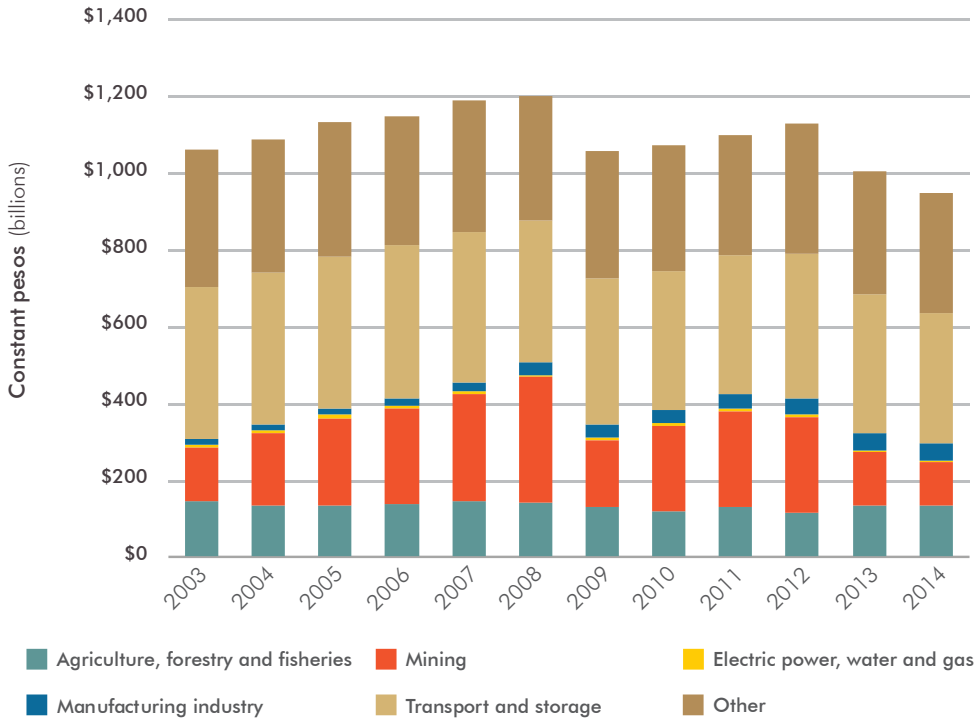
The average annual budget allocated to SEMARNAT by the federal government represents 1.3% of total annual expenses in the Federal Expenditures Budget (PEF) for the period of 2003–2015. It amounts to only 0.3% of GDP (Figure 11).

Figure 9. **Costs and expenditures for environmental protection**



Prepared by the authors with data from the National Institute of Statistics and Geography (2014), *Sistema de Cuentas Nacionales de México. Cuentas Económicas y Ecológicas de México.*

Figure 10. **Environmental costs by sector**



Prepared by the authors with data from the National Institute of Statistics and Geography (2014), *Sistema de Cuentas Nacionales de México. Cuentas Económicas y Ecológicas de México.*

However, SEMARNAT's budget has been cut by 50% since 2014. In addition, SEMARNAT has gone from spending 100% of its budget or more before 2013 to only 82.8% in 2015, according to the most recent data available (Figure 12).

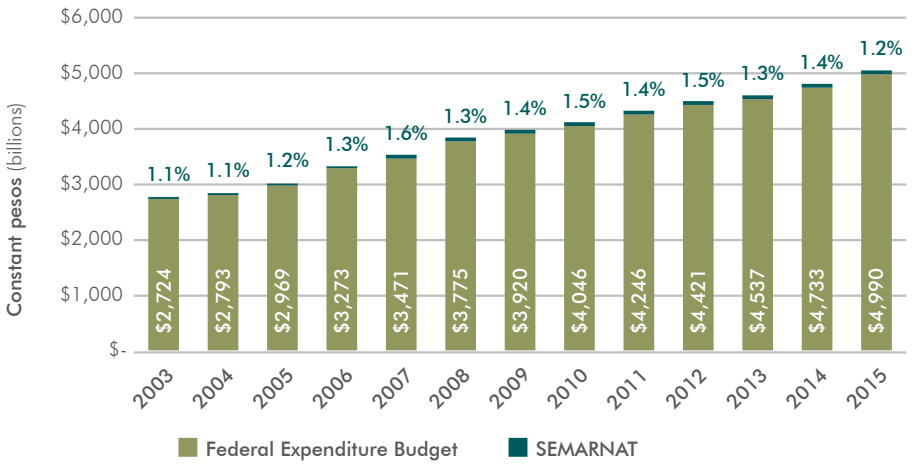
Within SEMARNAT's budget, resources are allocated to different environmental agencies. While allocations to each agency may change year by year, the overall budget remains mostly the same (Figure 13).

Table 3. **Average distribution of expenditures for environmental protection by activity** (2003–2014)

Line item	Average expense
Wastewater management	15.7 %
Research and development	13.8 %
Protection of biodiversity and landscape	8.4 %
Waste management	8.1 %
Protection of the atmosphere	6.5 %
Protection and remediation of land and of surface and groundwater	3.9 %
Protection against radiation (excluding external safety)	0.1 %
Other environmental protection activities	43.5 %

Prepared by the authors with data from the National Institute of Statistics and Geography (2014), *Sistema de Cuentas Nacionales de México. Cuentas Económicas y Ecológicas de México.*

Figure 11. **Spending by SEMARNAT in comparison with the Federal Expenditure Budget**



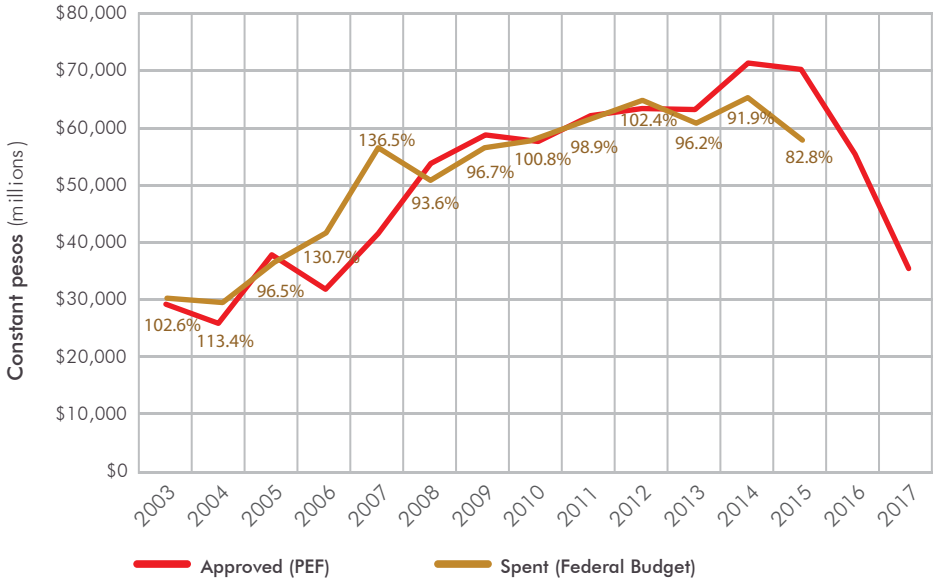
Prepared by authors with data from the Ministry of Finance and Public Credit (2003-2015), *Cuenta Pública.*

It is important to mention that, while the proportional allocations within SEMARNAT's budget remain relatively stable, minimal percentage changes actually represent hundreds of millions of pesos for a single agency. CONANP's resources over the last several years can be analyzed as the ratio of its budget to the PEF, and therefore serve as a benchmark for biodiversity conservation.

CONANP's budget has decreased by 15% since 2011. When comparing the proportion of CONANP's budget within the PEF–apart from the former being insignificant–it has experienced a 31% decrease since 2007 (Figure 14).

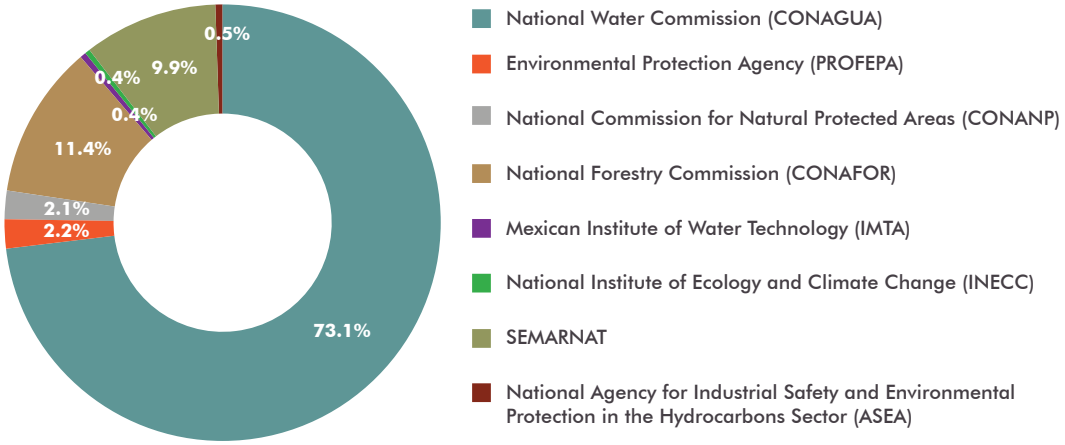
CONANP's budget is significantly smaller than that of the National Commission of Physical Culture and

Figure 12. **Annual budget approved and spent by SEMARNAT**



Prepared by authors with data from the Ministry of Finance and Public Credit (2003-2015), *Cuenta Pública* and from the Ministry of Finance and Public Credit (2017), *Presupuesto de Egresos de la Federación.*

Figure 13. **SEMARNAT's budget by agency** (2015)



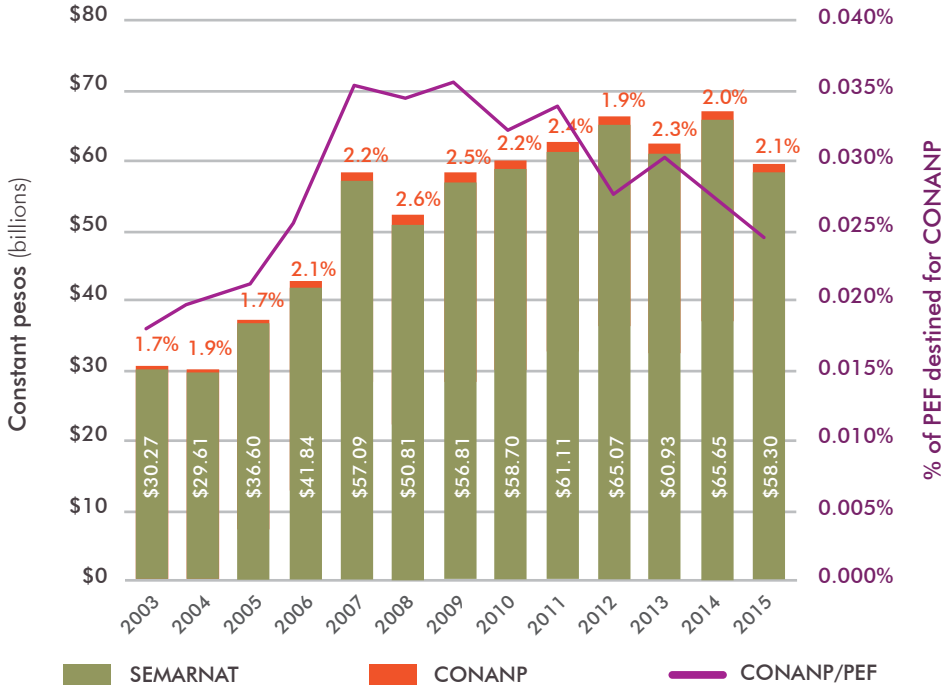
Total amount for the year: $58,298,227,536.45 constant pesos

Prepared by authors with data from the Ministry of Finance and Public Credit (2003-2015), *Cuenta Pública.*

Sport (CONADE) or the federal government's communications and media budget as illustrated in the following graph. And yet CONANP exercises responsibility over 12% of the national territory. In order to adequately manage the many geographical regions within the PA system, most of which are remote and difficult to access, CONANP requires adequate and timely funding (Figure 15).

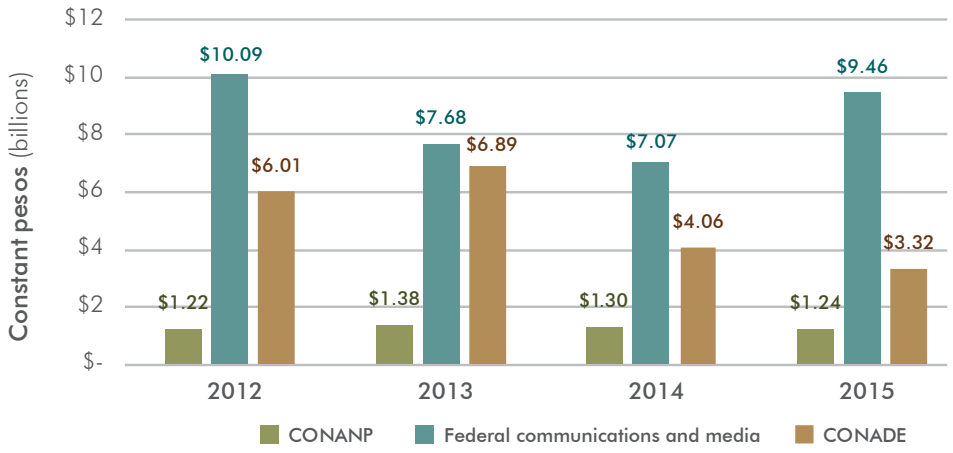
Based on the agency's projections and an analysis of its operating costs, CONANP estimates a financial gap of nearly 560 million pesos to adequately manage the 177

Figure 14. **CONANP and SEMARNAT budgets**



Prepared by authors with data from the Ministry of Finance and Public Credit (2003-2015), *Cuenta Pública.*

Figure 15. **Comparison of CONANP's budget with those for federal communications and media and the National Commission for Physical Culture and Sports (CONADE)**



Prepared by the authors with data from the Ministry of Public Administration (2012-2015), *Reportes de gastos de comunicación social de las dependencias y entidades de la Administración Pública Federal* and from the Ministry of Finance and Public Credit (2003-2015), *Cuenta Pública.*

PAs under its responsibility. Moreover, it expects to add 10 more PAs to its system. Based on current trends, budget projections for the year 2027 indicate that CONANP would ideally need 3.7 billion pesos to operate effectively. The federal government would fund about 85% of this amount, with the remaining 15% funded by complementary contributions from CSOs and the private sector. The following graph and corresponding Table 4 illustrates how this public-private partnership could finance the network of PAs in Mexico.

We can analyze public funding for conservation in Mexico from a different perspective by comparing it with trends in other countries belonging to the Organization for Economic Co–operation and Development (OECD). Based on the available data, public funding ranges from 0.3% to 1.5% of annual GDP. In Mexico, the average has been closer to 0.8%. It is necessary, however, to put this data into context: first in terms of each country's geographical and biological characteristics, and second, in terms of the environmental performance of their public

Table 4. **Project Finance for Permanence, a synergistic public-private funding mechanism to eliminate the financial gap by 2027 in the NPA network operating budget.**

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Projected Operating Budget	1,741	2,344	2,466	2,585	2,687	2,811	2,944	3,087	3,240	3,368	3,545	3,737
Estimated Federal Contribution	1,360	1,600	1,818	2,033	2,044	2,260	2,469	2,644	2,767	2,863	3,004	3,157
Private Contributions												
Civil society	115	115	115	115	115	168	174	180	186	193	201	210
Private donation to protected areas		50	50	50	50							
Private donation to develop syndicated funding mechanisms		19	19	19	19							
Interest on C6 matching endowment funds			4	8	12	17	17	17	17	17	17	17
Syndicated funding mechanisms					140	160	182	207	236	270	307	350
Total Private Contributions	115	184	188	192	336	345	372	404	439	479	525	577
Financial Gap	266	579	479	379	326	206	103	39	34	26	16	3

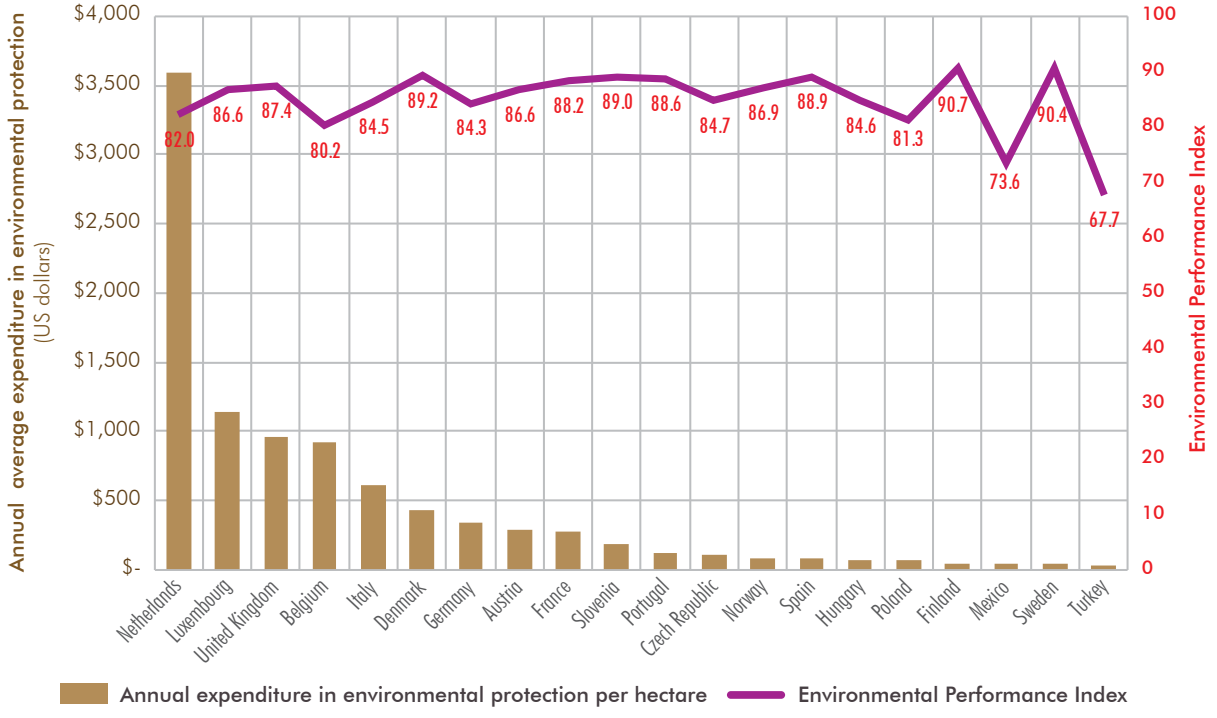
Millions of pesos

Mexican Fund for the Conservation of Nature (2016), Project Finance for Permanence.

policy. To do so, we compared the average annual expenditures for environmental protection from 2003 to 2014 to the terrestrial surface of a selection of OECD countries. We used the Environmental Performance Index (EPI), generated by the Yale Center for Environmental Law and Policy, to determine environmental performance. The EPI measures the countries' environmental performance in two areas: protection of human health and conservation of ecosystems (Figure 16).

First, our analysis determined the average, annual expenditures on environmental protection per hectare. The Netherlands leads the pack, with US $3,550/ha. Luxemburg, the United Kingdom, and Belgium are close behind, with close to US $1,000/ha. In contrast, Mexico barely spends US $43/ha, and its EPI is 73.6 out of 100. It is also important to consider the case of Sweden: with only US $41 spent per hectare, its EPI is 90.4. This suggests that an efficient use of resources can go a long way in protecting the environment. Factors that influence better environmental performance are not just better management, but also better infrastructure and planning.

Figure 16. **Average annual expenditure in environmental protection** (2013–2014) **and Environmental Performance Index**



Prepared by the authors with data from the World Bank (2016), *World Development Indicators* and from Hsu, A., *et al.* (2016), *Environmental Performance Index.* New Haven, CT: Yale University.

Recommendations for IMPROVEMENT

- Increase the federal budget significantly to finance conservation and remediation of the natural environment, focusing on field staff, the adequacy of infrastructure and equipment, and its maintenance.
- Develop solid mechanisms and methodologies to determine the real, cumulative cost of the environmental impacts of development projects (both public and private works), in order to minimize, mitigate, and offset them in priority areas with compensation models (National Environmental Compensation Fund).
- Modify the national fiscal framework–with appropriate safeguards in place to avoid tax evasion–to incentivize individuals and companies to make tax-deductible donations to the conservation and management of our irreplaceable natural capital.
- Charge separate access fees for PAs for domestic and international visitors. Secure the reinvestment of these fees into the operations of the corresponding PAs, as is done in Costa Rica and Ecuador, among other places. This model would allow protected areas that receive more visitors (for example, Contoy Island, Monarch Butterfly Biosphere Reserve, and Cuatro Ciénegas) to effectively cover costs of tourism in their region, such as surveillance and monitoring, management, and maintenance.

- Encourage the design and implementation of participatory mechanisms to generate financial resources directly from citizens, by means of public–private models of value exchange (for example, payment of ecosystem services). One way this could be done is through water utilities operating in Mexico's biggest cities.
- Organize and publish transparent information related to the costs of environmental degradation in the country, and officially quantify the value provided to society by ecosystems across all the different ecosystem services.
- Develop hybrid business models between non–profit organizations and companies that direct a portion of their profits towards strategic support of PAs.

Santiago Gibert Isern

Santiago Gibert Isern

CONCLUSIONS

In this report, we discussed the most critical issues affecting biodiversity in Mexico today, including their current progress and challenges. We also outlined specific recommendations that will enhance the application of environmental policy tools for biodiversity conservation and ensure the well–being and stability of society.

Even though the recommendations throughout this document focus on specific fields, important conclusions can be drawn from the overall analysis.

Substantial progress has been made over the last 21 years in terms of national environmental policy in Mexico. In every field that we've discussed, innovative policies are emerging that are informed by multilateral collaboration, but their development and effectiveness are hindered by limited funding and insufficient human resources.

The field brings together people that are deeply committed to the environment, who, despite low wages, long hours, restrained budgets, and other increasing responsibilities and problems, carry out conservation efforts in an exemplary fashion. However, these factors are taking a heavy toll, and budget cuts this year (and those announced for next year) strike at the very heart of those who have been unconditional and tireless allies in this fight against environmental degradation. One of the biggest assets of environmental institutions is their human capital. Discouragement and the loss of perseverance in this field could be the biggest threats to surmounting the challenges ahead. It is important and urgent to build capacity within institutions, and properly gauge what is being done and what comes next.

CSOs have attempted to fill the gaps left by the authorities in many regions and fields. However, budget constraints and increasing fiscal and bureaucratic requirements place them in a very troubling situation. The same is happening with rural production enter-

prises and cooperatives that produce sustainable goods and services, which indigenous and *ejido* farmers are organizing to generate employment and income. New administrative requirements set by the SHCP hinder the development, strengthening, and promotion of these productive initiatives and organizations. In order to properly motivate communities to take part in sustainable activities, we must reevaluate the many burdensome legal provisions that have multiplied over the years, and help them overcome the obstacles already inherent to community–based businesses.

Other general challenges include the lack of land use planning and zoning, and the poor alignment of policies within the planning sector with those of other productive sectors and services (Map 8). The creation of a territory–wide planning policy that cuts across sectors can no longer be postponed. The Mexican State must make this a priority for the conservation and sustainable use of our natural capital, and it must integrate it as a part of the underlying strategy of the National Development Plan.

In order to measure progress, it is necessary to set specific, short–term, quantitative goals for the regulatory and economic instruments that value biodiversity. Additionally, it is necessary to review sectoral policies and programs to identify and do away with perverse incentives and subsidies, which result in the loss of biodiversity.

The Sustainable Development Goals (2015) are the foundation for the construction of a true national development agenda focused on environmental, economic, and social sustainability.

An increasingly prevalent view among the key sectors involved suggests that certain regions, based on their biodiversity and ecosystem services, should be prioritized. This would help to focus efforts in the coordination of public policies, the conservation of biodiversity, and the improvement of social welfare. This could be done in some of the PAs and their surrounding areas. They, in turn, would become models for regional sustainable development. CONANP should take the lead in the coordination of these processes.

Lorenzo J. de Rosenzweig Pasquel

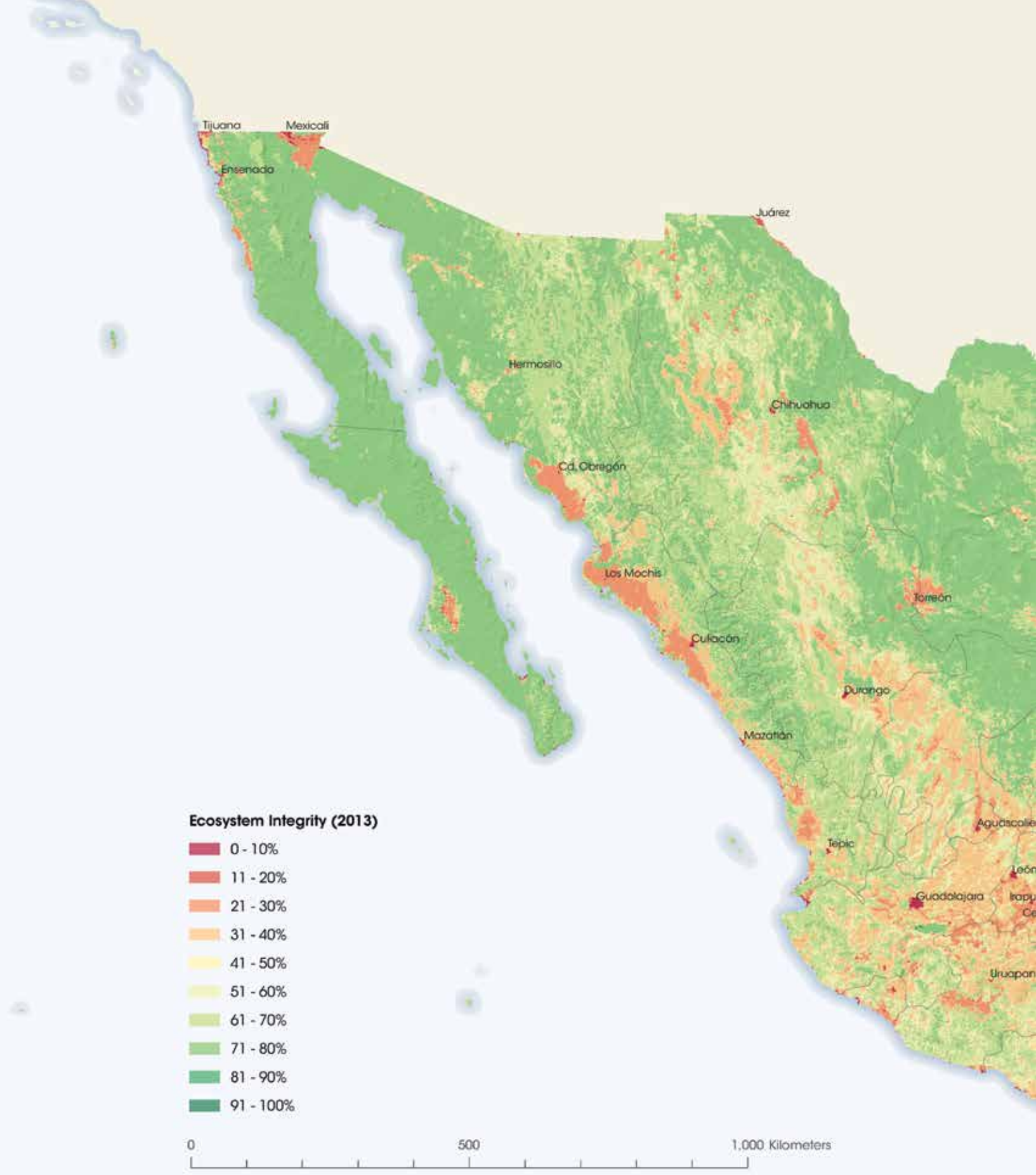
Such a model is feasible because the legal framework, institutions, and policies are already in place. What is missing is a landscape–level plan, a shared vision, and well–coordinated policies, as well as an adequate budget that will make sustainable development in these regions possible. It is worth mentioning that progress has been made in this respect, and that several cases, if they succeed, may offer good examples for the future. One such initiative is the Lacandon Jungle Region, where institutions at all three levels of government are coordinating with local communities, academics, and CSOs. Another is in the Ayuquila watershed, in Jalisco, where an initiative is being led across several municipalities, and also receives support from academia and CSOs.

Progress towards the recommendations made in this report would fulfill Mexico's commitments as part of the CBD, Aichi Targets, and other international biodiversity agreements. Initiatives that promote biocultural landscapes, conservation on private land (working with farmers and ranchers), and community forestry companies are particularly significant, as is the above-mentioned example in the Lacandon Jungle, where stakeholders all work in a strategic, collaborative manner. These new management mechanisms exemplify the central themes of the *Thirteenth Conference of the Parties to the Convention on Biological Diversity: Mainstreaming Biodiversity*, that is, incorporating biodiversity conservation into the development agenda.

The potential for generating, sharing, and accessing information is greater than ever in this age of social media and digital connectivity. These platforms make it possible to publicly communicate the multilateral commitments Mexico has made to conserve biodiversity, and to involve citizens in the efforts required to reach the goals and objectives of sustainable development. Likewise, government officials from every sector should know and understand these commitments, and develop and apply the tools at their disposal with these objectives in mind.

Lastly, throughout the report, we have pointed out that although Mexico has a solid legal framework for conservation, there are several issues that need to be reviewed and analyzed anew in terms of legislation. Our objective here is to strengthen legislation, avoid redundancies, and address lacunae. We want to emphatically point out that any modification to the environmental legislation must follow the procedures that have been successfully developed throughout our brief history with environmental policy. As explained in the document, the 1996 reform to LGEEPA and the General Wildlife Law issued in the year 2000 were each developed through a lengthy, 18–month process, in which CSOs, academia, the private sector, political parties, the executive branch, and legislative powers all took part. What they achieved–during politically challenging times, no less–was legislation that is universally endorsed and backed by judicious technical and scientific expertise. The upcoming reforms to the Wildlife Law, the General Water Law, the General Law for Sustainable Forest Development, and others, cannot aspire to be anything less than that–they cannot take effect without thorough discussion and national consensus.

In closing, we would like to mention that the environmental policy framework has been built through highly participatory processes, and is itself part of the collective Mexican heritage. Continuing on this path will allow us to formalize a much-needed National Environmental Policy, which will help our government and all its citizens construct a prosperous and competitive future for Mexico.



Source: National Commission for the Knowledge and Use of Biodiversity, National Commission of Natural Protected Areas, National Forestry Commission, and Mexican Fund for the Conservation of Nature (2016). *Integridad ecosistémica.*

Map 9. **Ecosystem integrity**

The map illustrates the health of Mexico's ecosystems in 2013. Green indicates healthy ecosystems while regions in yellow, orange and red exhibit varying degrees of degradation. The health, or integrity, of an ecosystem is determined by the combination of its structure, composition and functions.

Santiago Gibert Isern

Acronyms

ASEA: Safety, Energy and Environment Agency
NPA, PA: Natural Protected Areas
BIOFIN: Biodiversity Finance Initiative
CBD: Convention on Biological Diversity
CONABIO: National Commission for the Knowledge and Use of Biodiversity
CONACYT: National Council for Science and Technology
CONADE: National Commission of Physical Culture and Sport
CONAFOR: National Forestry Commission
CONAGUA: National Water Commission
CONANP: National Commission for Natural Protected Areas
CONAPESCA: National Commission of Aquaculture and Fisheries
DGIRA: Environmental Impact and Risk Office
EIA: Environmental Impact Assessment
EPI: Environmental Performance Index
FAO: United Nations Food and Agriculture Organization
GEF: Global Environment Facility
FMCN: Mexican Fund for the Conservation of Nature
FONCER: Endangered Species Fund
GDP: Gross Domestic Product
GECI: Island Conservation and Ecology Group
GPS: Global Positioning System
INAPESCA: National Fisheries Institute
INE: National Institute of Ecology
INECC: National Institute of Ecology and Climate Change
INEGI: National Institute of Statistics and Geography
LGEEPA: General Law on Ecological Equilibrium and Environmental Protection
LGVS: General Wildlife Law
MAB: Man and the Biosphere Programme
MIA: Environmental Impact Statement
NMX: Mexican Standard
NOM: Official Mexican Standard
OECD: Organization for Economic Co-operation and Development
OEGT: General Ecological Zoning Plan
OEM: Marine Ecological Zoning Plan
OET: Ecological Zoning Plan
UN: United Nations
PACE: Species Conservation Action Program
PCVSDP: Wildlife Conservation and Production Diversification in the Rural Sector Program
PEF: Federal Expenditures Budget
PNRA: National Water Reserves Program
UNDP: United Nations Development Program
PREP: Conservation and Recovery of Priority Species Project
PROCER: Conservation Program for Endangered Species
PROCYMAF: Conservation and Sustainable Management of Forest Resources Program
PROFEPA: Federal Attorney of Environmental Protection
REIA: Regulations to the General Law for Ecological Equilibrium and Environment Protection in Matters of Environmental Impact Evaluation
ROE: Regulations to the General Law for Ecological Equilibrium and Environment Protection in Matters of Ecological Zoning Plans
RPA: Potential Water Reserves
SAGARPA: Secretariat of Agriculture, Livestock, Rural Development, Fisheries, and Food
SEA: Strategic Environmental Assessments
SEGOB: Ministry of the Interior
SEMAR: Naval Secretariat
SEMARNAP: Ministry of the Environment, Natural Resources, and Fisheries
SEMARNAT: Ministry of the Environment and Natural Resources
SHCP: Ministry of Finance and Public Credit
SUMA: System of Wildlife Conservation Management Units
UMA: Wildlife Conservation Management Units
UNESCO: United Nations Educational, Scientific and Cultural Organization
WWF: World Wildlife Fund
ZOFEMAT: Federal Maritime Land Zone

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Photography Captions

Page 0: A holistic understanding of the landscape and social engagement are essential to proper land use planning.

Page 4: The Chamela-Cuixmala Biosphere Reserve has some of the highest numbers of reptile and amphibian species recorded along Mexico's Pacific coast.

Page 7: Aerial view of the Devil's Canyon in the megadiverse region of the Chihuahuan desert in the northernmost part of Coahuila.

Pages 8 & 9: The recently established Mexican Caribbean Biosphere Reserve is characterized by its diversity of coastal and marine ecosystems and by the large numbers of resident and migratory marine bird species.

Page 10: Ecosystem-level conservation, as opposed to species-level, is based on protecting all of an ecosystem's components and guarantees their natural interconnections.

Page 19: The Baja California coastline is increasingly threatened by real estate development, creating an imbalance between the availability of natural resources and demand.

Page 22: Enough knowledge and experience exist today to allow the agricultural industry to replace harmful practices with others that have a smaller impact on natural resources.

Page 25: The effectiveness of EIAs should be measured over the lifetime of a project, and it should consider whether it avoided—or reduced to a minimum—negative impacts on the environment.

Page 30 & 31: The San Pedro-Mezquital River runs from its source in the mountains of Durango to the coast of Nayarit where it empties into the Pacific Ocean. Many sacred sites of the Cora and Huichol peoples, such as the Muxatena rock formation, are found along its course.

Page 32: Protecting the benefits provided by natural resources helps strengthen cultural identities, which, in turn, are closely tied to community well-being.

Page 34: Cloud forests are essential to the provision of freshwater; however, they are among the most threatened ecosystems in Mexico.

Page 36: Good management of forest ecosystems promotes economic productivity and encourages biodiversity conservation.

Pages 42 & 43: The Maya Forest tree cover in Campeche is in excellent condition in *ejido* lands with good management practices.

Page 49: Black bear populations have increased over the last two decades thanks to wildlife conservation strategies implemented by CONANP and private organizations.

Page 58: The Montes Azules Biosphere Reserve offers an array of opportunities for watching wildlife and other ecotourism activities.

Page 68: The civil society-led initiative to protect the waters of Cabo Pulmo National Park is without precedent in the history of biodiversity conservation in Mexico.

Page 84: Mangroves are characteristic of Mexico's coastlines and their conservation depends, in large part, on proper planning of the Federal Maritime Land Zone.

Page 97: The diversity of insects, and beetles in particular, is an indicator of ecosystem health, because they fill multiple ecological niches.

Page 98 & 99: La Encrucijada Biosphere Reserve in Chiapas helps to protect one of the most extensive mangrove forests in Mexico.

Page 100: Biological corridors, a vision that describes the connectivity between protected areas, guarantee the annual migration of the monarch butterfly across the country.

Page 104: The return of the Mexican grey wolf to the wild, through the Conservation Program for Endangered Species, exemplifies successful collaboration between academia, government agencies and the private sector.

Page 111: Over 300 species of reptiles are endemic to Mexico, ranking it second worldwide. The photograph depicts a red-lipped arboreal alligator lizard, an example of micro-endemism in the Chiapas Highlands.

Inside back cover: A camera trap captures a jaguar near the conservation station Chajul in the Lacandon Jungle. Population surveys help determine the status of the species.

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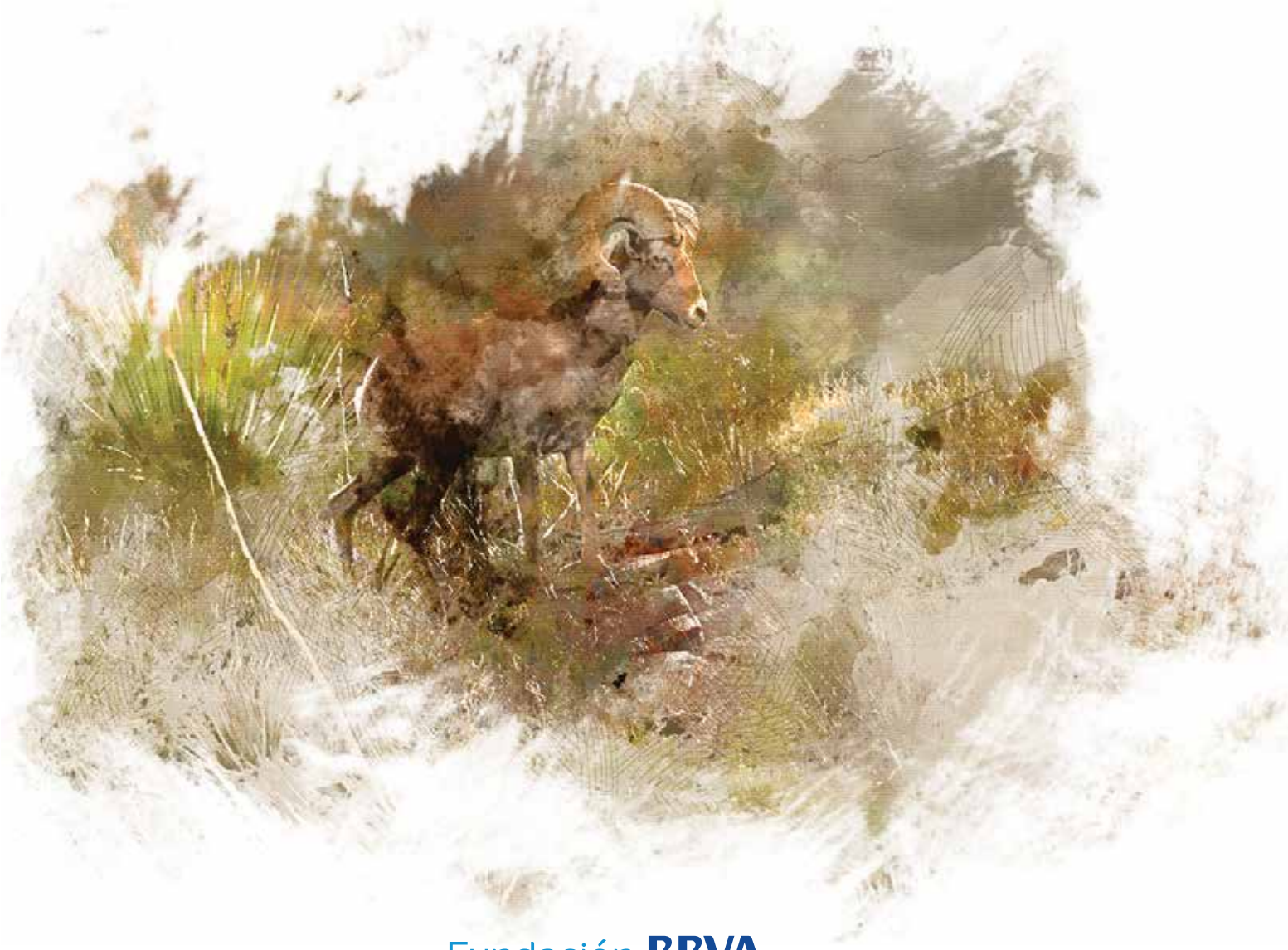

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