

# Conservation and Sustainable Management of Below-Ground Biodiversity

## México



### POLICY BRIEF

Environmental policy in Mexico and the challenges to measure and manage the biota's soil in the biosphere reservation of The Tuxtlas, Veracruz, México.

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### **Brief description**

64% of the Mexican territory presents some kind of soil degradation. The most affected States are those with the highest biodiversity and/or industrial development. Actions concerned with soil conservation and restoration are of a secondary matter to other activities such as: reforestation, mechanical soil contention or a better biodiversity use.

The legal framework –although it is supposed to be integral- does not include soils as a subecosystem and it does not define actions for their improvement. Official definitions are contradictory from different perspectives, generating incoherent policies and programs. Here, we propose to restate the current Environment Services Program (Programa de Servicios Ambientales, PSA) and to use in a more efficient way the local processes of the society as the means of managing and publicizing the actions taken.

### **Introduction**

In this report we address the challenges and opportunities that current environmental policies present; it addresses the use of soil and the variety of species that form an ecosystem with living components known from the biota's soil. To talk about soil biodiversity is to talk about a topic that is being currently explored worldwide. Recently, a great amount of research is being done on how some species have become plagues for agricultural purposes. And how little has been explored about benefits and ties to the ecosystems above the soil such as forests and crops. Current research suggests that the biota's soil is an important resource not limited only to the microfauna but also includes microorganisms (bacteria and fungus) which allow agricultural sustainability.

The objective of this report is to point out how the current environmental regulation does not clearly consider environmental soil functions and its related organisms, and their ties to agrosystems and forest. It concerns us to point out how it is –or it is not- managed soil conservation according to the current legal framework. Furthermore, it is a brief and updated description of the current knowledge on this subject in four agricultural communities that belong to The Tuxtlas Biosphere Reserve.

#### **1.- Objective of the Policy Brief.**

To analyze the contradictions, limitations and problems under the current environmental legal framework with respect to the little importance paid to the soil subecosystems. To show examples along with results from research generated by the team working in The Tuxtlas Biosphere Reservation.

#### **2.- The soil degradation in Mexico: An acute and growing problem.**

The soils constitute a key subecosystem for the function and maintenance of the rest of subecosystems as well as for food supplies. Soils lend to the human society a great amount of environmental services. They help other subecosystems to do it as well.

#### **Box 1: Environmental and/or ecosystem services in which the biota intervenes or is the main contributor**

Environmental and/or ecosystem services associated with soil ecosystems
<ul style="list-style-type: none"><li>• <i>Nutrients recycle</i></li><li>• <i>Nitrogen fixation</i></li><li>• <i>Regulation of the organic material dynamics</i></li><li>• <i>Carbon encapsulated and fumes emission reduction type (CO<sub>2</sub>, NO<sub>3</sub>, CH<sub>4</sub>)</i></li><li>• <i>Soil structure elaboration</i></li><li>• <i>Maintenance of the water supply</i></li><li>– <i>Plague control</i></li><li>– <i>Contribution of plant production (for fiber and food purposes)</i></li><li>– <i>Contribution to biodiversity and landscape stability</i></li></ul>

The Nation territory presenting some degree of deterioration (SEMARNAT:2002) affects those States rich in biodiversity and forestry (tropical and temperate forests). It also affects those States with a high industrial or agroindustrial activity. 78% of the States face soil deterioration problems in 40% or more of their territories. 28% of the 32 Mexican States have more than 60% of their territory with some degree of soil deterioration. 25% present soil problems in more than 50% of their territory. Other 25% shows some kind of soil degradation in more than 40% of their extension. Only 15.6% of the 32 Mexican States has less than 30% of soil problems. Less than 10% of the States show minimal soil deterioration being these States in the north desertic areas.

**Box2.- Soil degradation  
(SEMARNAT: 2002)**

Soil degradation is estimated at 64% of the Mexican territory					
%National territory.	No degradation	Low	Moderated	Severe	Extreme
	36%	19.6%	30.9%	12.6%	0.9%

The agricultural activities are the main causes of degradation. Classified as follows:

**Box 3.- Types of soil degradation**

Type of degradation	No apparent degradation	Physical degradation	Biological degradation	Chemical degradation	Eolic erosion	Water erosion
National	36%	1.8%	3.6%	6.8%	14.1%	37%
Mountains	31%	0.5%	1.5%	1%	8%	58%

Nevertheless, they have not been considerate according to its importance.

**The soil ecosystems are being affected by the changes in the rest of the ecosystems.** It happens mainly because of the change of soil use; repeated crop burning (mainly corn crops) and by pollution. The actions for soil improvement or high impact reduction on soils are mainly taken under mechanic criteria for erosion control but it does not consider biodiversity.

**Policies and budgets are insufficient.** Only 5.7% of the budget is applied in environmental policies. From this, only 12% (0.68% out of total budget) goes to reforestation. Likewise, only 0.16% out of the budget was designated to soil conservation without publicizing agroecological strategies.

**There are neither policies nor specific programs toward conservation or restoration of soil biodiversity.** The key role of soils as nutrients for vegetation and animal life of macro-systems has been compromised, and with it the results from restoration actions, which opens up a way to desertification.

**3.- The Tuxtlas and the meaning of the problem: poverty and policy orientation.**

Origin of the problem in The Tuxtlas.

- a) Policies from the Public sector have privileged production without considering environment care. The growing of the agricultural frontier (since the sixties) has generated the disappearance of ecosystems and erosion (the loss of forest coverage and reduction of organic material falling on the soil). Agrochemical introduction has provoked soil and water contamination.
- b) Rural population growing poverty puts pressure on productive and natural resources. The tendency in The Tuxtlas is the increase use of soil for livestock than for agriculture. Extensive livestock is the safest way for having savings in poor communities located in the mountain range. The municipalities of Meyacapan, Soteapan and Tatahuicapan rank among the highest in poverty levels nationwide,

according to the National Population Committee; this becomes evident by the way rural support is oriented to the country-side.

<b>Box 4.- SIGNIFICANT RURAL SUPPORTS IN THE TUXTLAS</b>		
Environment action pattern	→ Environmental services payment	300 pesos /hectare/year
Agriculture and livestock action pattern	→ PROCAMPO (Pro-Countryside)	900 pesos/hectare/year
Social action pattern	→ OPORTUNIDADES (Opportunities Program)	125 a 790 pesos per son/daughter between 3° elementary & high school
The Biosphere Management Plan does not have specific actions toward soil restoration and conservation		

Current tools of State and Federal management in The Tuxtlas.- The public policies and government programs have been designed under the principle of production. These policies have limited environmental and ecologic criteria: a) Mechanical measures (to control or avoid erosion); and b) Biological measures such as reforestation. Only academic research, non-government organizations and the civil community have impelled alternative pathways for soil conservation.

The federal government rules actions according to the National Development Plan (Plan Nacional de Desarrollo). This Plan leans on three institutions: SEMARNAT (Secretary of Environment and Natural Resources), CONAFOR (Nacional Forest Committee), SAGARPA (Agricultural, Livestock, Rural Development, Fishery and Food Supply Committee) and the Nacional Protected Resources (CONANP). These institutions carry on non-forest soil restoration, forests and soils, wildlife, impact and environmental risk. These government institutions also take care of payments for environmental services (PSA), forest development and protection against forest fires (PRODEFOR), community forestry development (PROCYMAF). Soil conservation is attached to forest action, conservation and sustainable use of soil and water. The recommended actions are: to establish terraces, ditch drains, contention walls, live barriers and air breaking curtains; to practice conservation for sustainable development and the integrated handling of the ecosystems.

The State government does not devote many economic resources to conservation. Only two institutions accomplish the task about this topic. SEDARPA (through the Forest Development Office) Secretary of Social Development and Environment (SEDESMA). Their actions are oriented to promote citizen participation for the river basin supply improvement, with main focus to the river basin. Restoring forests and hilly areas. The change of soil use from livestock and agricultural to forestry. The sustainable commercial crops and the creation of community plant nurseries.

The academic research centers such as the Ecology Institute AC (INECOL); The Autonomous University of Chapingo (UACH); The Nacional Autonomous University of Mexico (UNAM) and the Veracruzana University (UV) work on basic research as well as training workshops. Finally, the local and civil organizations such as Community Development of The Tuxtlas (DECOTUX), the 14 farmer's cooperatives and the Santa Marta Project work on different activities: They designed the river basin's restoration strategy; handling of the productivity of the *acahual* (coffe and others); sustainable livestock; landslide restoration; village organization for restoration of: shadow crops, corn diversification, solar system maneuver and domestic ecotechniques (dry toilet and wood-saving ovens).

#### **4.- Contradictions in the legal frame of the Mexican soil biodiversity. A variety of concepts about soil.**

There is an ambiguous perspective about what *soil* means. The legal frame limitations begin with its blurry definition. It considers soil only as a natural resource. Not as a complex ecosystem where a wide variety of species –proper to certain soil- can live together. Among the soil definitions in the Mexican normative frame, stands out:

INEGI SEMARNAT (cited by Cotler et al 2007): "...specific area of land surface which characteristics embraces all the stable and predictable attributes of the biosphere...atmosphere...soil...subjacent geology...hydrology...plant and animal populations...human activity output from past and present...interactions from all of the above. Such attributes and interactions exert a great influence over the present and future uses performed by mankind."

CONAFOR: ".....nonrenewable natural resource. Its recovering process takes hundreds of years ...dynamic system that plays a biologic function support in the terrestrial ecosystem equilibrium. It functions as a filter and cushioning, retaining substances. Soil is protecting the subterranean and superficial water against penetration of noxious agents. Transforms organic components disassembling or modifying its structure. It obtains mineralization and provides renewable and nonrenewable raw material useful for the human being.

Source:

[http://www.conafor.gob.mx/index.php?option=com\\_content&task=blogcategory&id=21&Itemid=38](http://www.conafor.gob.mx/index.php?option=com_content&task=blogcategory&id=21&Itemid=38))

SAGARPA: The soil has a productive capacity. Its restoration cost is estimated in terms of necessary input to recuperate the lost productivity or even improving it (Robles 2009, annex report MIE-GEF DECOTUX).

Initiative of the restoration and conservation law for lands in Michoacán State, México: Soil: (Artículo 3°) frac. "XXX...systemic and dynamic body of physical, chemical and biotic elements capable of supporting plants and plant production..."

In general, definitions satisfy the political-theoretical requirements from signed agreements at international conventions (compromises that will not satisfy future generations), but these definitions do not offer concrete ways for sustainable handling and production. There are void definitions and conceptions related to the importance of the soil, the ecosystem conservation and the perspectives of sustainable development for the country. In this context, there are initiatives from the Legislature legally –or not- approved; these initiatives are impossible to apply when they are faced by contradictions in the national legal framework, which makes it difficult to regulate the present production and management practices.

### **5.- Actions and contradictions in the legal frame and the management of the Mexican soil biodiversity. Aspects of the current legal frame.**

The problem is confronted with a legal frame and public policies. These do not regulate the use of the soil as a natural resource but rather as a productive asset. There is neither specific law nor references in the existent ones about, for example, how to handle soil microorganisms. The environmental norms of the legal frame are not coordinated with those of agriculture and livestock. They do not contemplate soils as part of the ecosystem. The juridical framework is made up of constitutional norms and a body of laws, from which stands out:

#### Constitutional frame:

- Article 23: Analyzes the productive use and the care of the natural resources in the environment context.
- Article 27: Defines natural resources property. Establishes the basis to define the obligations to keep them well preserved.
- Article 73: Establishes norms for environmental protection. It defines the criteria to decentralize (not only Federal power is entitled to take care of the environment. It is also obligation of Municipalities and States governments)

### Legal frame:

Ecologic Balance and Environmental Protection General Law (LGEEPA); Rural Sustainable Development Law (LDRS); Internal Waste Management and Prevention Practices General Law; Wildlife General Law; Sustainable Forestry Development General Law; Law for the Biosecurity of Organisms, and regulations for the genetically modified ones.

Actions promoted by the laws: There are no actions assigned to soil conservation, neither as a resource nor as an ecosystem. There is not reorientation of soil use when it presents erosion. Government responsibilities -at the three levels- are not enforced to avoid soil degradation. There is not restructuring in the soil use. It does not have a view on handling the river basins in the high areas. There is not a soils and forests inventory that helps to prevent erosion and restore soils.

### **6.- Actions and contradictions in the legal frame and the management of the Mexican soil biodiversity. Initiatives for improvement.**

Due to the National problem due to soil degradation, there have been efforts to legislate on this matter to face the problem. The following are legislative initiatives for soil protection:

**Case A:** Initiative for Soil Conservation and Restoration Law: It is a Federal Deputy Chamber initiative. It proposes to regulate, to handle, to conserve and to restore soils. It includes coordinated actions around the fight against desertification. It provides the inclusion of soil in plans and programs of wider reach. But this initiative does not provide a strategic route and ends up being only a regulatory law from LDRS y LGEEPA.

**Case B:** Land Conservation and Restoration Law of the Michoacán State, México. It uses the concept of land and not soil. This law was elaborated with the main objective to comply with a United Nations agreement in the fight against desertification and soil degradation. It conceptualizes the term land restoration as the recovery of the productive capacity..."Defines soil as the dynamic system of elements capable of sustaining plants..." It does not define the origin of institutional support, neither a course of action about what is permitted and what is prohibited. Contribution: A redefinition of *soil* in a more integral way, and state sanctions.

The use of one definition or another to design a course of action, plans or programs can lead to different interpretations and take different pathways. Lack of juridical clarity to define responsibilities and sanctions (as usually happens with the majority of the resources) and the multiplicity of defined concepts, as well as methodological and theoretical differences, open-up possibilities for interpretations which can lead to settlements in the political and economical areas. In this context, there is a complexity of government supports which faces powerful limitations because of contradictions in politics. Limitations due to low budgets designated to conservation, in general, and in particular for soil-preservation.

The efficiency of management tools becomes difficult for the political rivalry in the design and tooling of programs in Mexico. (between Political Parties disputing votes and Institutions disputing budgets. These Institutions also fight for presence in the design of Nacional policies for this matter). In summary, accomplished efforts have been little and contradictory. There is not a legislation that contemplates neither the soils nor its biodiversity. Its protection is a secondary element beneath other activities. Therefore, it has not been registered specific actions or concrete budgets for its protection.

### **7.- Recommendations in a complex local context.**

The context for action is complex: On one hand it involves the growth of consciousness on farmers, and on the other hand taking into account the decision makers.

The general recommendations for The Tuxtlas. In the reserve cushioning zone two aspects can be established. One is a local one, which suggests elaborating a regional participative plan for territory management that incorporates agroecological alternatives, which is a forestry

component in every productive activity. The National financial alternatives (which would include payment mechanisms for environment services -PSA- with several government and civil sources) and also would include international entities, as well as a scientific monitoring in the operative and financial areas. The recommendation contemplates the direct funding administration by the communities involved (under permanent financial and operative auditory) designated to disasters relief, environmental context and social politics, taking into consideration their internal organizational culture, as a way of securing efficiency in its application. There are local organization processes (supported by GEF-MIE-PNUD and FAO fundings) which have moved forward in this direction and make the proposition viable.

The second recommendation would try to give to the soil ecosystems the social importance they have in the ecosystem's maintenance and stability, and in the food production for the society. It implies to elaborate a document based on results from agricultural-scientific research. This document should also be based on political analysis. It should consider modifications in the respective laws in a way that soil is considered as a subecosystem, and to generate specific actions for its handling, restoration and conservation. (see box 5.)

## **8.- General recommendations.**

### Objectives:

\* To finance agroecological activities and resource management (conservation/restoration) through a PSA agreement system, that contemplates integral actions (not focused ones) on environmental improvement.

\* To benefit from the civil society organization efforts and the "built-up bridges" by different government levels for attending the environmental problems, having in mind the importance of soils in the agenda in all these efforts.

Line of work: Subcommittees formed in The Tuxtlas and Xalapa which have open-up spaces for plural and horizontal level discussions; confluence of different government levels to attend concrete matters; communities in process of experimentation on sustainable production; concrete restoration and conservation actions under the management of a logical planned program.

It is necessary to modify the soil uses as much as the ways to handle resources and production. It is required to promote, facilitate and finance agroecological activities, as well as the manage resources that conserves/restores and/or uses soil biodiversity.

#### Box 5.- Precise recommendations for soil conservation

- No crops on river basins. If it is done, it should be in transversal form or -even better- using terraces.
- Do not let land be naked. Use green fertilizers (*Mucuna*) or trees for nitrogen fixation(*Gliricidia*).
- Use biofertilizers, but the regional ones.
- To develop local inoculums.
- To have local mycorrhizal' banks .
- To regulate and control the use of herbicides, pesticides and fungicides.
- To apply liquid chemical fertilizers at the appropriate moment for the plant to take 100% advantage of it, so the phreatic mantles and rivers do not get contaminated.
- To promote organic waste recycling. Use of compost or worm-compost instead of burning. The compost output taken back to the lands: Soils have to be fed.
- To promote varied crops (corn crops) and the Creole varieties.
- To know biodiversity *in situ*, above and below the soil.

#### Legislation and environment services of the biota's soil.

As we have seen in points 4, 5, and 6, the Mexican legal frame is confusing due to different interpretations that every law provides for soil definition, as well as for environmental services. There is a neglected view to define specific environmental services, the biota's soil contributions and its links with the agricultural and forestry systems. The Sustainable Forestry Development General Law (DOF. Jan.25, 2003), in its Art. 7 fraction XXXVII, defines the Environmental Services as "those services offered by the forestry ecosystems in a natural way, or by means of sustainable management of forestry resources such as: water supply in quality and quantity, carbon, pollution and natural components capture, oxygen generation, impact cushioning of natural phenomena, weather modulation or regulation, biodiversity protection, ecosystems and wildlife protection, soil protection and recuperation, landscape and recreation among others." This is the only law that refers to environmental services as a service provided by the ecosystem, including natural and anthropogenic systems as well as the soil. However, it is not clear in the incorporation of biota's environmental functions.

#### The experience on the environmental services payment in Mexico.

The first experiences on the environmental services payment (PSA)<sup>1</sup> in Mexico were implemented in the Biosphere Reservoir of the Sierra Gorda and Scolél Té in Chiapas and Oaxaca (Zambrano y Cordero: 2008:4). In 2003, it is established as a Federal government program through CONAFOR acquiring a federal status. Its operation and evaluation is regulated through the Congress Union. The PSA includes: payments for hydrologic services, biodiversity conservation, carbon confinement and agroforestry. All of these in order to protect the forestry ecosystems and offer alternatives to the farmers that preserve the forests.

In the definition of ecosystem functions considered by CONAFOR, it does not include specifically what provides the biota's soil. It is not recognized in the PSA, neither its role in water retention and regeneration of vegetal cover. Hence, the main contribution to the species inventories reported by the Subjacent Soil Biodiversity Conservation Project to Four common lands of The Tuxtlas Reserve constitutes the first approximation about its environmental functions, and its relationship with the forest.

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<sup>1</sup>For PSA we understand a monetary transaction in which the landowners are retributed by the environmental services users. It is an enforced payment, it means, this payment pretends to make possible a change in the resource usage, it might not happened without this payment. In other cases, it is an incentive for those landowners who already practice conservation.

Since 2003 the PSA program has been applied, initially with government funding and the World Bank, and since 2008 with government resources only. The objective was to finance 126.8 thousand hectares. An average of \$350 pesos was assigned per hectare during 5 years<sup>2</sup>, even though the program became permanent since 2008. The Mexican Forestry Funding (FFM) was also implemented and a Project was initiated in Coatepec, Veracruz. The budget amount was determined considering opportunity costs with respect to corn production. This method has been questioned because corn yields and production costs are different in different Mexican regions. It has also been debatable because of the amount of money received through programs such as PROCAMPO and OPORTUNIDADES.

Unfortunately, the PSA is a passive plan where the farmer receives money with no obligations to increase his/her forest territory green cover. It is also an excluding program because it supports only farmers with forestry lands in good shape. The plan does not incentivize farmers with deforested or in recovery lands.

In the next paragraph we outline how to generate incentive mechanisms that motivate farmers to attract funding for their reserve area; it is necessary to evaluate whether the specific destination can yield better results for conservation.

### **8a.- Updated recommendations for PSA**

Among the main recommendations derived from biological and agronomical research is the agroecologic production. We believe that a variety of interests play a powerful limitation. An awareness work can be insufficient if it is not taking into account the complexity of the corrupted political-economic network. This connects farmers and ranchers, political and social associations, city and country-side merchants, etc. A proposal that does not offer something to local players –in terms of interests- can hardly be instrumented under the current circumstances.

#### **We propose three courses of action**

Participative research in communities- Crop experimentation, promoters training, permanent information in assemblies, publishing material for public relations, training and advisory, participative feed back from the experiments and a link to other monitored variables, for example, water monitoring.

Permanent information- In the regional planning (Subcommittee for the river basin in Huazuntlan river) and Veracruzana University and others that gives proper importance to soil biodiversity for soil restoration linked to environmental services. It is admitted special importance to the subcommittee for its potential capacity to bring about consensus decisions from all players from different sectors of the society, and therefore its capacity to negotiate and manage funds devoted to conservation. Informing research and experimental results comparing indicators derived from conventional ways. Use of resources and technique associated with soil biodiversity restoration.

Lobbying at the different legislative and local governments (municipalities) to shape and to regulate the inclusion of soil biodiversity in the normative and legal frameworks. To define specific conservation and restoration actions, indicators for monitoring, and resources for its implementation.

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<sup>2</sup> \$300 pesos per hectare for specific soil uses such as jungles and forests. \$400 pesos per hectare for specific soil use in mountain forests.

<sup>9</sup> Robles, C., F. Robles, A. Martínez and I. Barois. 2010. Policy Brief Environmental policy in México and the challenges to measure and manage the biota's soil in the biosphere reservation of The Tuxtlas, Veracruz, México.



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