



THE ECONOMICS OF  
LAND DEGRADATION



# Executive Summary for Public Policy

## The Economics of Mezcal Production in Oaxaca, Mexico

### Introduction

Mezcal, a traditional alcoholic drink from Mexico, has experienced significant growth in national and international markets. Between 2005 and 2010, mezcal exports increased by 140 %<sup>1</sup> and from 2013 to 2016, their cumulative growth was estimated to be 266 %<sup>2</sup>. The momentum behind mezcal and its positioning within the craft spirits segment are the result of a strategy focused on adding value to products through the Mezcal Designation of Origin (*Denominación de Origen Mezcal, DOM*), which covers products manufactured in eight Mexican states. In Oaxaca, specifically, the “**Mezcal Region**” is made up of the municipalities of Tlacolula, Yautepec, Mia-

huatlán, Sola de Vega, Ocotlán, Ejutla, Zimatlán and Santiago Matatlán, although the Designation of Origin status can also be used in other municipalities in the state.<sup>3</sup> Oaxaca’s cultural riches, combined with the wealth of agave species on its land, create a very complex value chain: agave producers engage in a diverse range of activities, which can vary according to the ethnic origin of the community and physical-geographical conditions. Both wild and cultivated species may be used and mezcal production systems range from traditional, with hand-milling and distillation in clay pots, to completely industrialized operations.



The recent boom in global mezcal consumption has led to an increase in agave farming, which is changing the landscape of Oaxaca. The effects are felt primarily in the districts with the highest agave production, where the landscape has been transformed by large monoculture plantations. The impact of this on biodiversity will be difficult to reverse in the short-term without functional restoration of the land. Oaxaca has high rates of deforestation, erosion, and soil fertility loss, and lacks adequate irrigation systems.<sup>4</sup> Over the last five years, the amount of land used to grow agave has increased

<sup>1</sup> *Plan Rector Sistema Nacional Maguey Mezcal [National Maguey System Master Plan], 2011.*

<sup>2</sup> *Planeación Agrícola Nacional 2017-2030 [National Agricultural Plan 2017-2030].*

<sup>3</sup> López Cruz, J. Y., Martínez Gutiérrez, G. A., & Caballero García, A. (2016). *Diagnóstico de la situación del agave-mezcal y opciones de desarrollo local en comunidades indígenas de Oaxaca [Conclusions regarding the agave-mezcal situation and options for local development in Oaxaca indigenous communities]. 21st National Meeting on Regional Development in Mexico.*

<sup>4</sup> *Estrategia para la Conservación y el Uso Sustentable de la Biodiversidad del Estado de Oaxaca [Oaxaca State Strategy for Conservation and Sustainable Use of Biodiversity] (ECUSBEO).*

in the mezcal-producing region encompassing the **Tla-colula, Yautepec and Miahuatlán** districts. This has resulted in the loss of forest cover and changes in land use that are visible in the region. This is a high-priority issue for the state government, which is why the study focuses on these three districts.

Using the methodology developed by the Economics of Land Degradation (ELD) Initiative, as part of this study we conducted an **economic valuation of the ecosystem services related to agave production for mezcal**, evaluating the economic potential of applying a sustainability strategy to agave-mezcal production. The objective was to enable decision makers to create the conditions for translating this economic potential into real wealth, so as to benefit the producers and actors in the value chain, achieve food security and mitigate the effects of climate change. The German Agency for International Development (GIZ) and the ELD Initiative worked together on the study, in coordination with the Oaxaca State Government, specifically the Secretariat for the Environment, Energy and Sustainable Development (SEMAEDESOC), the Secretariat for Agriculture, Livestock, Fishing and Aquaculture (SEDAPA) and the other members of the Inter-institutional Roundtable for Productive Restoration of the Landscape (MIRPP). Actors from several research institutions and civil society organizations, as well as leading experts on the state's agave-mezcal production system, also supported the study. They provided and validated the information and recommendations presented, feeding back into the methodological process.

### Methodological approach of the study

The information available in publications and grey literature was compiled to produce a description of the characteristics of the value chain and the factors that affect it. This information can be found in the Scoping Study and in the full study report. Field data were also collected: 423 questionnaires were conducted with producers and *palenqueros* (mezcal distillery owners) in the districts of Miahuatlán, Tla-colula and Yautepec.

The ecosystem services related to the agave-mezcal value chain were identified, along with the main threats to them and the current state of the ecosys-

tem services provided to agave and mezcal production. Scenarios were then developed to estimate the impacts of continuing the current trend in production activities and of implementing sustainability measures and better farming practices. These scenarios are:

- **“Business-as-usual” scenario** (baseline or cost of inaction – BAU): this scenario evaluates how ecosystem services will be degraded if production activities continue to follow current trends and the effects on the economy of the region under study. A 20-year projection was made, using data obtained from the federal government's Agrifood and Fishing Information Service (SIAP).
- **Maximum sustainability scenario** (SUSMAX): this model allows us to evaluate how ecosystem services would be positively impacted by restoration activities and sustainable management of production (transformation of production and intensification with the use of good agricultural practices, ecological restoration, and conservation). This is considered an optimal scenario, in which the cost of environmental service degradation is close to zero.

The sustainability criteria considered in this study were:

- 20 % of agave plants are not harvested and are left to reach maturity
- no agrochemicals are used
- crops are diversified (polyculture systems with milpa or forest products)
- efforts are made to protect the soil
- plants are harvested after maturing for seven years
- sustainable land management takes into account the intended use of the land

Using these scenarios, a cost-benefit analysis was performed, and recommendations were proposed.

It is important to note that there is a wide range of management strategies between the BAU and the SUSMAX scenarios, drawing on a variety of sustainable practices. This study evaluated the extremes of this range; nevertheless, implementing just some of the sustainability criteria considered could have a positive impact on the condition of the ecosystem services.

<sup>5</sup> <https://www.eld-initiative.org/>

## Problems identified in the agave-mezcal sector

Based on the literature review and the field questionnaire results, we identified the following problems, which have a negative impact on the agave-mezcal production system:

- **A lack of planning in agave farming**, which has led to periods of shortages of the raw material for mezcal production, in a context of increased demand. Poor agricultural planning of agave planting and harvesting can disrupt the supply of agave for mezcal.
- **Low yields in the agave-mezcal industry**, due to a lack of investment in the management of the production system. This penalizes both agave producers, who receive scant compensation for the raw materials, and *palenqueros*, who are unable to scale production to maintain or increase their profit margins.
- **A lack of organization in the industry throughout the value chain**. We observed that operational and support functions are dispersed along the value chain, while the lines have become blurred between the different links in the chain, where agave producers have positioned themselves to provide distinct functions according to the opportunities that arise and their economic needs.
- **A lack of technical information and knowledge** about production processes. This applies particularly to the management of agave production, crop planning, agronomic innovations, and market conditions (volumes and prices).

- **A lack of knowledge about the regulatory system**. Small agave and mezcal producers have little to no interest in becoming certified, due primarily to the substantial costs involved in obtaining certification. Moreover, there is no support structure to help them assess the advantages of obtaining certification and to make the administrative process easier. There is also a belief that, even with certification, their products (agave or mezcal) could not easily compete with the large producers on the market, that their profits would not increase significantly and their investment would not be easily recouped.

## Environmental impacts of the sector

When it comes to the sustainability of the agave-mezcal sector, **environmental factors pose the biggest risks**. Recent economic growth has come at the expense of environmental conservation. The impacts identified by this study are:

- **Monoculture** has become the primary means of maintaining profitability, despite the risk of exacerbating the problems of deforestation and loss of food security for farming households.
- In the long-term, **failing to use traditional farming practices for soil conservation** leads to processes such as desertification and soil erosion, reducing productivity in the region.
- **Loss of the genetic heritage** of wild agave, due to the overexploitation and fragmentation of natural wooded ecosystems, as well as the lack of strategies for conserving or reproducing the numerous agave species.

FIGURE 1

A) Business-as-usual scenario for agave production projected to 2030, based on 2003–2019 data from SIAP.  
B) Simulation of production value using Yautepec as an example, in three degradation scenarios: low (3.49%), moderate (8.8%) and high (12.8%). Full details can be found in the final report (ELD, 2022).

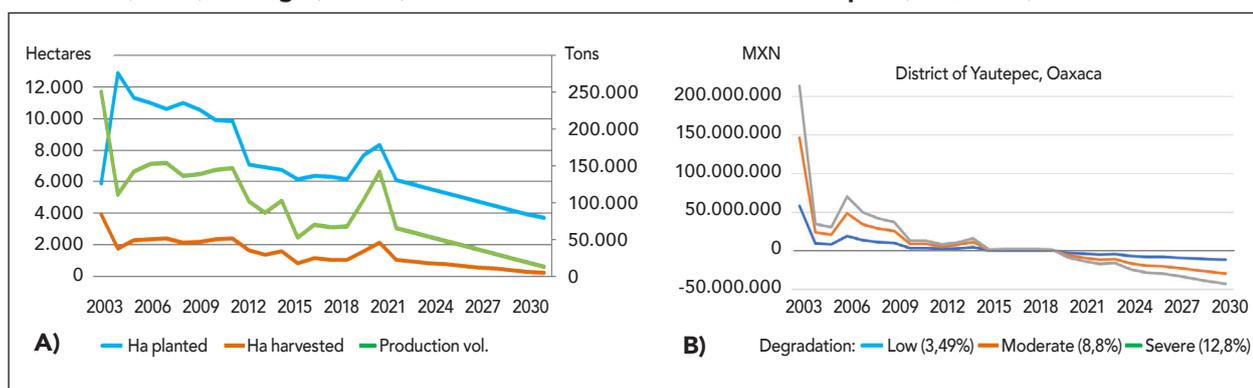
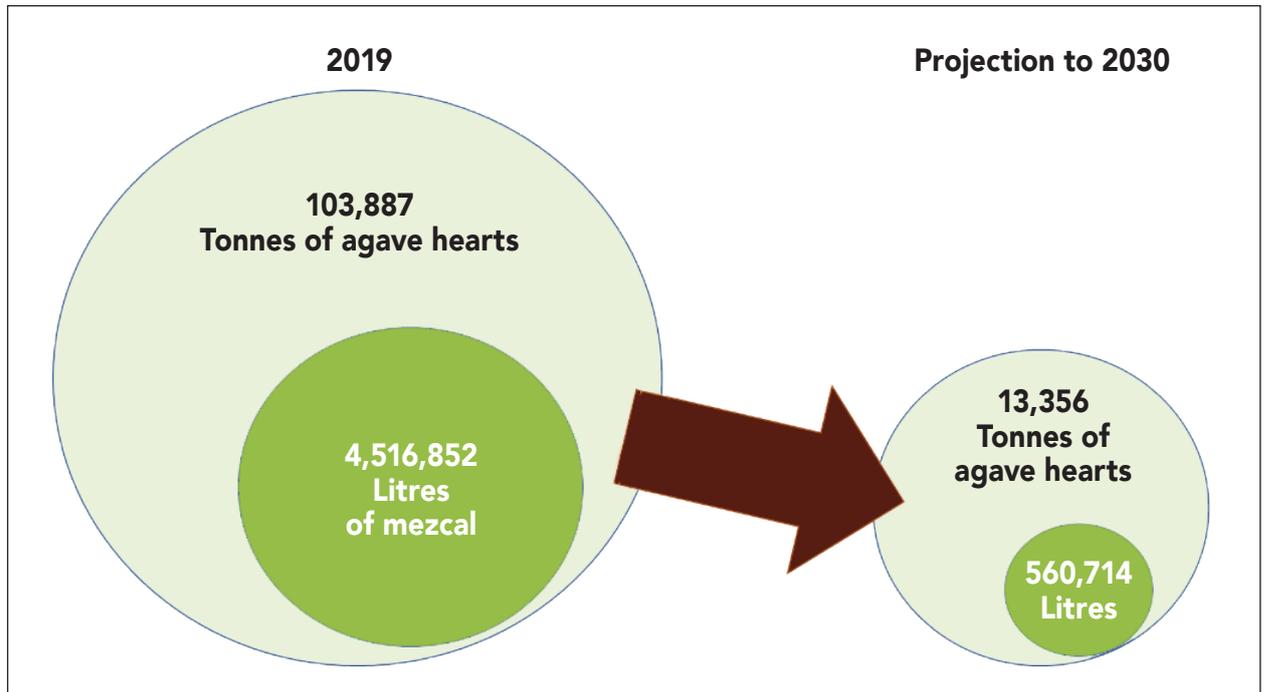


FIGURE 2

Projected production of agave hearts and litres of mezcal to 2030, in the BAU scenario.



- **Loss of biodiversity** and forest ecosystems, impacting the prospects for agave reproduction.
- Crop vulnerability to **pests and drought**.
- **The production of waste and residues** that contribute to the degradation of water resources through leaching and run-off.
- Vulnerability where there is **severe soil erosion**.

### Results of the analysis

For the BAU scenario, the data obtained from SIAP show that there was a general downward trend in the value of agave-mezcal production between 2003 and 2019, which translated into a loss of profitability, associated in turn with a decrease in production (Figure 1A). **The cost of ecosystem service degradation over the 2003–2019 period was estimated at US\$ 19 million on average across the three districts.** This corresponds to the revenue that the districts in the study area lost over this period due to land degradation (Figure 1B).

Yautepec has the highest level of vulnerability, accounting for 44 % of this loss, in comparison to 29 % for Tlacolula and 27 % for Miahuatlán. The analysis

showed that the cumulative losses from 2019 projected to 2030 could reach up to US\$ 163 million, with an annual average of US\$ 14 million. This is the *cost of inaction* if production practices continue to follow the current trend.

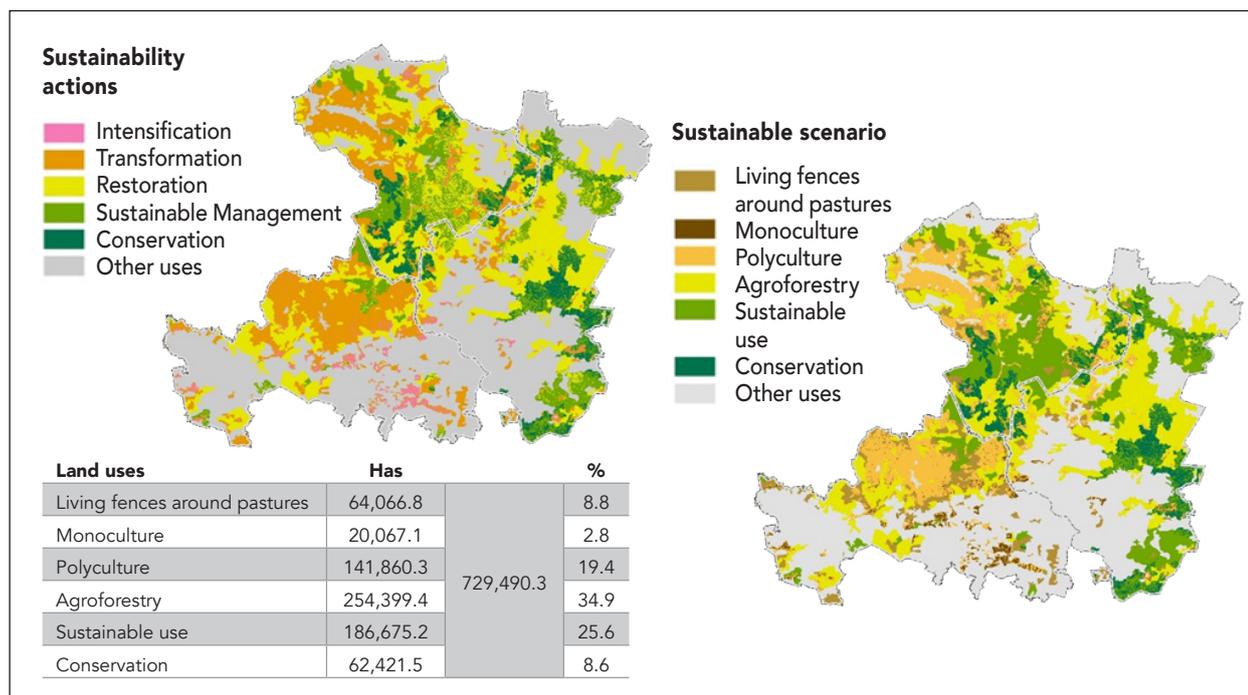
Our results suggest agave heart (called *piñas*) production could fall by 124 % and mezcal production by 114 % by 2030, if the current scenario continues (Figure 2). The costs of inaction are highest in Yautepec when compared to the other two districts.

The SUSMAX scenario generates net profits, with projected cumulative profits over the same period (2019–2030) of US\$ 85 million and net income of US\$ 7 million per year. This sustainability scenario offers a vision of the economic potential of agave, whose growth relies on the ability to regenerate natural capital – represented by the land’s ecosystem services – and the capacity to significantly improve the socioeconomic situation of the traditional, artisan producers of agave-mezcal.

Analysis of the benefit-cost ratio shows that, in the BAU scenario, every US\$ 1 invested would result in a loss of US\$ 10 in the projected period, whereas in the SUSMAX scenario, every US\$ 1 invested would generate a profit of US\$ 3.12.

FIGURE 3

## Areas of planned agro-ecological transition through agroforestry or restoration.



### Land management analysis

The study identified the areas with the most severe land degradation and the areas with strong potential for reducing deforestation and maintaining natural ecosystems (Figure 3). In these areas, we propose promoting agroforestry models using domestic or wild species for the productive and ecological restoration of the land, as well as restoration measures that incorporate secondary vegetation into agave management plans, and other forest resource management activities.

- In livestock zones (64,189.3 ha), we identified the potential for a productive transformation, by introducing living fencing made of agave plants, which would enable soil erosion to be reversed.
- In crop farming zones (162,271.4 ha), we identified two types of sustainable management. The first is intensification of agave monoculture in areas with severe erosion (given that agroforestry would be expensive and produce low yields). The agave would enable these areas to recover, reducing erosion. The second type of management recommended is transforming crop farming areas with moderate erosion into areas with very low erosion. This would involve introducing polyculture (agroforestry) and implementing good practices.

- In areas with secondary shrub vegetation (254,630.9 ha), we identified the potential for productive and ecological restoration, by introducing an agrisilvicultural system, with a view to recovering the natural vegetation and managing it sustainably.
- In wooded areas (132,419.942 ha) with moderate to very severe erosion, we suggest pursuing restoration (by reintroducing and managing native species of agave, applying community management plans, etc.) and sustainable management. In areas with low to very low erosion, sustainable management is recommended.
- In areas where primary vegetation still exists (114,760.1 ha), the objective should be conservation, avoiding the deforestation resulting from clearing farmland for agave crops.

### Recommendations

The results of the study demonstrate the advantages of moving towards a sustainability scenario for the agave-mezcal production system. This approach would seek to guarantee a positive benefit-cost ratio by maintaining the ecosystem services on which production depends. As part of this study, we pro-

pose a transitional phase. This phase would incorporate a *programme for the sustainable production of agave for mezcal* aimed at traditional or small-scale agave producers – those who own up to 6 hectares – which would ensure that production remains economically viable and environmentally responsible.

### Programme for the sustainable production of agave for mezcal, aimed at traditional or small-scale agave producers

The main objective of this programme would be to improve the environmental condition of the productive land, which would have a positive effect on both agave-mezcal production and farmers' well-being. The programme would have the following components:

1) **Certification.** Environmental conditions can only be improved by introducing agroecological innovations into agave-mezcal production systems, such that the land and production process can be certified by the Mexican Mezcal Quality Regulation

Council (COMERCAM). Another possible certification mechanism would be the “biolabel” or *Biodiversity Friendly Label* promoted by the Secretariat for Agriculture and Rural Development and the National Commission for Knowledge and Use of Biodiversity (CONABIO). This certification would guarantee that the agave production process meets certain sustainability standards, which would help improve conditions for obtaining high-quality raw material and secure improved market recognition of the environmental credentials of agave-mezcal production. A positive impact on mezcal quality can be expected as a result, along with better positioning in national and international markets.

2) **A package of incentives to compensate for the costs associated with transforming agave production systems into agroecological production systems.** The package of incentives includes payment of a *premium price and a mechanism to compensate for the costs of agroecological transition*. The premium price would enable a progressive transition from an unsustainable situation to a sustainable one and would have to be paid by the downstream links in the value chain (*palenqueros*

T A B L E 1

#### Methodological proposal for landscape design on land suitable for agave production under a sustainability scenario.

\*Soil Condition - VS: Very severe erosion; S: Severe erosion; M: Moderate erosion; L: Low erosion; VL: Very low erosion

LAND USES	OPTIONS FOR SUSTAINABLE MANAGEMENT ACTIONS		
Livestock zones	Living fences (any soil condition)		
Rain-fed crop farming zones	Monoculture (VS, S)	Polyculture/ agroforestry systems (M, L, VL)	
Secondary vegetation: shrubs	Agroforestry systems (any soil condition)		
Secondary vegetation: trees	Sustainable use (M, S, VS)	Sustainable use (L, VL)	
Natural vegetation	Sustainable use (S, VS)	Sustainable use (M)	Conservation (L, VL)
INTENSIFICATION AND PRODUCTIVE TRANSFORMATION	PRODUCTIVE/ ECOLOGICAL RESTORATION	FOREST RESTORATION	
FOREST MANAGEMENT	CONSERVATION		

and mezcal producers, packagers, and merchants) given that ultimately this increase in the price of mezcal would be paid by the end consumer in national and international markets. Based on a simulation of the optimal change in prices by 2030, applied to the estimated increase in production volume resulting from good agricultural practices, it is estimated that the maximum economic potential of a premium price over an 8-year transition cycle would be US\$ 15,800,164. This sum takes into account all the externalities estimated in this study.

The mechanism to compensate for the costs of agroecological transition would enable production costs to be reduced while traditional and small-scale producers are transforming their agave-mezcal production systems. For this purpose, a base cost of 29 Mexican pesos (MXN) per agave heart was estimated. The cost above this threshold would then be compensated, up to MXN 49 per agave heart. Above MXN 49 per heart, production is considered unprofitable. This compensation mechanism — which could be likened to a subsidy — was estimated to cost US\$ 3,626,865 between 2022 and 2030 (a cycle of 7-8 years).

Both incentives are necessary and complement each other at two different points in the transition. The premium price only comes into play at the point of selling the agave hearts and is dependent on the market, whereas the compensation takes effect in the early years of cultivation, when most investment is needed. The benefit-cost ratio is 6.15, meaning that US\$ 6.15 of profit is expected for every US\$ 1 invested.

- 3) **A proposal for sustainable management of the agave-mezcal value chain.** The sustainable landscape scenario was created on the basis of a land management proposal addressing the current land uses and types of vegetation in the areas where agave and mezcal are produced (Table 1). The good practices considered were: zero tillage for soil conservation; diversification of production (annual, perennial, fruit, and timber crops) for pest control; incorporation of cover crops and management of weeding waste to control weeds and reduce herbicide use; living fences; crop feeding with broths and compost to reduce the use of chemical fertilizers and control diseases and pests; and planting appropriately for the topography.



4) **Strategy for building capacity in the state to implement the sustainable production programme.** To implement the recommendations made above, it will be necessary to build capacity along the length of the value chain and to establish a mechanism for monitoring the programme's progress. This strategy should include the following elements:

- a. **Strengthening the agave-mezcal producers' technical and agronomic skills in relation to sustainability criteria.** Technical assistance is a priority and an expectation of the agave-mezcal producers who participated in the study. The training must therefore focus on agroecology educators, to support the small-scale and traditional producers through the agroecological transition and to help them obtain the certification accompanying this general policy proposal for sustainable agave-mezcal production.
- b. **Establishing an information system and indicators for monitoring the agave-mezcal production system.** We propose building a consolidated information system with indicators and monitoring tools, to facilitate the periodic evaluation of programmes and actions targeting the value chain and its constituent ecosystems.
- c. **Strengthening communication and training on regulations.** We propose training producers on current regulations through a programme of trainer training, in which civil society associations, academic institutions and governmental bodies would participate.



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