Land reclamation by agave forestry with native species (Mexico)

Recoveración de tierras degradadas por agaveforestería con especies locales de agaves, árboles y hierbas (Spanish)

DESCRIPTION

Agave forestry land reclamation system with native agaves, trees, shrubs and grasses planted through participatory action for a sustainable production of mezcal and other products in order to generate high incomes for farmers. Rehabilitation of degraded land is achieved using native agave (Agave inaequidens), trees and/or fruit trees, shrubs and grasses to create, over the medium-term (7-10 years), sustainable production of a traditional alcoholic drink (mezcal) made from agave and/or cosmetic and medicinal products, and/or fibres and/or fodder for cattle and/or wood. Between the agave plants, native vegetation is managed or planted for use as food, fodder and/or medicinal products. Depending on the slope and the level of land degradation, continuous planted rows of agave provide a 'green' barrier that controls soil erosion and runoff.

Purpose of the Technology: The main purpose is to achieve sustainable land rehabilitation while generating a high income for the farmer. This allows reducing the amount of livestock and overgrazing, which is the main cause of soil erosion in this region. The production of mezcal gives local farmers high incomes. Trees, shrubs and grasses for medicinal uses, food, and fodder are complements of agave production and are processed mainly by women, while agave harvesting is a male activity. As it is very attractive financially, farmers stay in the communities instead of emigrating to cities or abroad. Biodiversity is preserved and increased using native plants (agaves, trees, shrubs, grasses). These plant associations are effective at controlling plant pests and diseases. Turning eroded into productive soil sequesters carbon and increases water availability as a result of the new soil cover.

Establishment / maintenance activities and inputs: Unlike most agave, Agave inaequidens reproduces from seed, which requires harvesting the seeds from native plants in the fields. One plant generates 80,000 seeds with a 90% success rate of germination, which is enough to cover 25 ha of agave forestry plantations set up to control soil erosion. After harvesting seeds from native agaves, trees and shrubs, seedlings and small plants are raised in a greenhouse and nursery managed by the owners and tenants of the land in the first year. At the beginning of the rainy season, these are planted in plots protected from cattle grazing for at least the first two years after planting. The harvesting activity for trees, shrubs and grasses is done annually, but for the agaves only once every 7 to 12 years depending on the degree of soil degradation. Some months before harvesting, the flower from the stem has to be cut. The leaves are then cut and left in the plot while the 50 kg heart of the agave (‘piña’) is removed. Mezcal is produced from the heart and requires an average of three weeks and at least two men to process 25 agave plants (1.5 tonnes), which produces about 300 litres of mezcal.

Natural / human environment: Poverty levels in the area are medium to high and the income from agriculture accounts for only 10 to 20% of the total family budget. People, therefore, do not have time to install soil erosion protection systems in the fields. Cattle graze freely everywhere and the number of animals is increasing annually, which also increases soil erosion. Locals know how to produce mezcal, but they prefer to buy it from other people who take wild plants from their lands to process them. The proximity of the site to the Michoacán of Ocampo state capital and the recognition of the

LOCATION

Location: Morelia municipality, Mexico/Michoacán state, Mexico

No. of Technology sites analysed:

Geo-reference of selected sites

Spread of the Technology: evenly spread over an area (approx. 0.1-1 km2)

In a permanently protected area:

Date of implementation:

Type of introduction

- through land users’ innovation
- as part of a traditional system (> 50 years)
- during experiments/ research
- through projects/ external interventions
designation of origin for mezcal by the authorities will enhance its value for future production.

Example of plantation of Agave: case of Titzio project with Agave cupreata (since 2002). With or without tree cover (Alejandro Martinez (apalacios56@gmail.com))

Example of plantation of Agave (since 2002): Titzio project with Agave cupreata ("Agave papalote"). With and without tree cover (A. Martinez)

CLASSIFICATION OF THE TECHNOLOGY

**Main purpose**
- improve production
- ✓ reduce, prevent, restore land degradation
- conserve ecosystem
- protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- reduce risk of disasters
- adapt to climate change/ extremes and its impacts
- mitigate climate change and its impacts
- ✓ create beneficial economic impact
- ✓ create beneficial social impact

**Land use**
- Land use mixed within the same land unit: Yes - Agro-silvopastoralism
- Cropland
  - Perennial (non-woody) cropping: agave / sisal
  - Number of growing seasons per year: 1
- Grazing land
  - Semi-nomadic pastoralism
- Forest/ woodlands
  - Products and services: Timber, Fuelwood, Fruits and nuts, Other forest products, Grazing/ browsing, Nature conservation/ protection

**Water supply**
- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

**Purpose related to land degradation**
- prevent land degradation
- reduce land degradation
- ✓ restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

**Degradation addressed**
- soil erosion by water - Wt: loss of topsoil/ surface erosion, Wg: gully erosion/ gullyng
- physical soil deterioration - Pu: loss of bio-productive function due to other activities
- biological degradation - Bc: reduction of vegetation cover, Bq: quantity/ biomass decline, Bs: quality and species composition/ diversity decline
- water degradation - Hs: change in quantity of surface water

**SLM group**
- ✓ improved ground/ vegetation cover
- ✓ cross-slope measure
- ✓ improved plant varieties/ animal breeds

**SLM measures**
- agronomic measures - A1: Vegetation/ soil cover
- vegetative measures - V1: Tree and shrub cover
- structural measures - S11: Others
Technical specifications

Agave production is based on planting them with trees along the contour. Herbs are maintained/planted or sown between the plants. Depending on the slope, one or more dense lines of agaves (1 plant every 25 cm) is planted for control of soil erosion and runoff, including a lateral gradient to the gully which will evacuate the excessive runoff. Footpaths are planned for the maintenance of the plantation.

Location: Michoacán, Mexico

Date: 2010

Technical knowledge required for field staff/advisors: low (low for reproduction, plantation and cultivation and middle for alcohol production)

Technical knowledge required for land users: low (low for reproduction, plantation and cultivation and middle for alcohol production)

Main technical functions: control of dispersed runoff: retain / trap, control of concentrated runoff: retain / trap, improvement of ground cover, improvement of surface structure (crusting, sealing), improvement of topsoil structure (compaction), improvement of subsoil structure (hardpan), increase of infiltration, sediment retention/trapping, sediment harvesting, increase of biomass (quantity), promotion of vegetation species and varieties (quality, eg palatable fodder)

Secondary technical functions: control of raindrop splash, control of dispersed runoff: impede / retard, control of concentrated runoff: impede / retard, control of concentrated runoff: drain / divert, reduction of slope angle, reduction of slope length, increase of surface roughness, stabilisation of soil (eg by tree roots against land slides), increase in organic matter, increase in nutrient availability (supply, recycling,...), increase / maintain water stored in soil, increase of groundwater level / recharge of groundwater, water harvesting / increase water supply, water spreading, improvement of water quality, buffering / filtering water, spatial arrangement and diversification of land use

Better crop cover
Material/species: Agave inaequidens + native trees + herbaceous
Quantity/density: 830/270
Remarks: Agaves/Trees per ha

Mixed cropping / intercropping
Material/species: Agave inaequidens + native trees + herbaceous
Quantity/density: 830/270
Remarks: Agaves/Trees per ha

Contour planting / strip cropping
Material/species: Agave inaequidens + native trees + herbaceous
Quantity/density: 830/270
Remarks: Agaves/Trees per ha

Cover cropping
Material/species: Native trees + herbaceous

Agronomic measure: Herbaceous
Material/species: Native herbaceous

Agronomic measure: Leafs from trees
Material/species: Native trees
Quantity/density: 270
Remarks: Trees per ha

Breaking compacted topsoil
Material/species: Agave inaequidens + native trees + herbaceous
Quantity/density: 830/270
Remarks: Agaves/Trees per ha

Contour ridging
Material/species: Agave inaequidens + native trees + herbaceous
Quantity/density: 830/270
Remarks: Agaves/Trees per ha

Breaking compacted subsoil
Material/species: Agave inaequidens + native trees + herbaceous
Quantity/density: 830/270
Remarks: Agaves/Trees per ha

Alignment: -contour
Vegetative material: C : perennial crops
Number of plants per (ha): 1200
Spacing between rows / strips / blocks (m): 30
Vertical interval within rows / strips / blocks (m): 0,25
Width within rows / strips / blocks (m): 1

Alignment: -along boundary
Vegetative material: O : other

Vegetative measure: Vegetative material: F : fruit trees / shrubs

Perennial crops species: Agave inaequidens (mature between 7 to 14 years)

Slope (which determines the spacing indicated above): 30%

Gradient along the rows / strips: 30%

Vegetation is used for stabilisation of structures.

Layout change according to natural and human environment: Natives plants are used, planted according to the slopes and the rest of vegetation still existing

### ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

<table>
<thead>
<tr>
<th>Calculation of inputs and costs</th>
<th>Most important factors affecting the costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs are calculated: per Technology area (size and area unit: 100 ha)</td>
<td>The most important factors determining the costs are: 1) the materials to build a greenhouse and the personal to take care of young plants; 2) the difficulties to make holes in the indurated soils, which takes time and efforts; and 3) the distance between the nursery and the field requires time and efforts (truck carrying the plants).</td>
</tr>
<tr>
<td>Currency used for cost calculation: mexican pesos</td>
<td></td>
</tr>
<tr>
<td>Exchange rate (to USD): 1 USD = 13.0 mexican pesos</td>
<td></td>
</tr>
<tr>
<td>Average wage cost of hired labour per day: 160</td>
<td></td>
</tr>
</tbody>
</table>

#### Establishment activities

1. Selection and collect Agave and tree seeds (Timing/ frequency: 1 week)
2. Building of greenhouses incl. soil and organic matter (Timing/ frequency: 1 month)
3. Fencing of greenhouses with barbed wire, poles and nails (0.5 ha (Timing/ frequency: None))
4. Seeding & maintaining in greenhouses (Timing/ frequency: 3 months)
5. Installation of a nursery for agaves and trees and transplantation of seedlings in plastic bags (Timing/ frequency: 2 weeks)
6. Plant care and maintaining in nursery (9 months) (Timing/ frequency: 9 months)
7. Transportation of plants in plastic bags (Timing/ frequency: None)
8. Plantation of plants (agaves and trees) (Timing/ frequency: None)

#### Establishment inputs and costs (per 100 ha)

<table>
<thead>
<tr>
<th>Specify input</th>
<th>Unit</th>
<th>Quantity</th>
<th>Costs per Unit (mexican pesos)</th>
<th>Total costs per input (mexican pesos)</th>
<th>% of costs borne by land users</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Labour</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building of greenhouses</td>
<td>persons/day</td>
<td>21.0</td>
<td>523,809.5</td>
<td>11,000.0</td>
<td></td>
</tr>
<tr>
<td>Seeding &amp; maintaining in greenhouses</td>
<td>persons/3 months</td>
<td>2.0</td>
<td>500.0</td>
<td>10,000.0</td>
<td></td>
</tr>
<tr>
<td>Installation of a nursery for agaves and trees</td>
<td>persons/day</td>
<td>14.0</td>
<td>10,714.285</td>
<td>15,000.0</td>
<td></td>
</tr>
<tr>
<td>Plant care and maintaining in nursery</td>
<td>persons/9months</td>
<td>2.0</td>
<td>15,000.0</td>
<td>30,000.0</td>
<td></td>
</tr>
<tr>
<td><strong>Plant material</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selection and collect Agave and tree seeds</td>
<td>plants</td>
<td>5.0</td>
<td>100.0</td>
<td>500.0</td>
<td></td>
</tr>
<tr>
<td><strong>Fertilizers and biocides</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Materials for plant care</td>
<td>months</td>
<td>9.0</td>
<td>2,777,777.777</td>
<td>25,000.0</td>
<td></td>
</tr>
<tr>
<td><strong>Construction material</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Materials for greenhouse</td>
<td>trees</td>
<td>60,000.0</td>
<td>0.0566666666</td>
<td>3,400.0</td>
<td></td>
</tr>
<tr>
<td>Materials for greenhouse</td>
<td>agave</td>
<td>200,000.0</td>
<td>0.035</td>
<td>7,000.0</td>
<td></td>
</tr>
<tr>
<td>Materials for fences</td>
<td>m</td>
<td>1500.0</td>
<td>2.4</td>
<td>3,600.0</td>
<td></td>
</tr>
<tr>
<td>Materials for nurseries</td>
<td>trees</td>
<td>60,000.0</td>
<td>1.5</td>
<td>9,000.0</td>
<td></td>
</tr>
<tr>
<td>Materials for nurseries</td>
<td>agaves</td>
<td>200,000.0</td>
<td>0.2</td>
<td>4,000.0</td>
<td></td>
</tr>
</tbody>
</table>

**Total costs for establishment of the Technology**

| Total costs for establishment of the Technology | 235'500.0 |
| Total costs for establishment of the Technology in USD | 18'115.38 |

#### Maintenance activities

1. Cleaning around plants to give them space the first 3 years (For 1 person 10 days) (Timing/ frequency: 1 time/year)
2. Cutting the scape before the harvest (For 1 person 15 days) (Timing/ frequency: 1 time in agave life (between 7-14 years))
3. Weeding around plants to give them space during the first 3 years (10 person days) (Timing/ frequency: 1 time/year)
4. Cutting the stalk before the harvest (15 person days) (Timing/ frequency: 1 Agavelife time (7 to 14 years old))
5. Replanting of agaves after 7 to 14 years (restarting of a new cycle of production, see establishment activities) (Timing/ frequency: None)

#### Maintenance inputs and costs (per 100 ha)
### NATURAL ENVIRONMENT

#### Average annual rainfall
- < 250 mm
- 251-500 mm
- 501-750 mm
- 751-1,000 mm
- 1,001-1,500 mm
- 1,501-2,000 mm
- 2,001-3,000 mm
- 3,001-4,000 mm
- > 4,000 mm

#### Agro-climatic zone
- humid
- sub-humid
- semi-arid
- arid

#### Specifications on climate
- Rainy season from June to October
- Thermal climate class: sub-tropics

### CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

#### Market orientation
- subsistence (self-supply)
- mixed (subsistence/commercial)
- commercial/market

#### Off-farm income
- less than 10% of all income
- 10-50% of all income
- > 50% of all income

#### Relative level of wealth
- very poor
- poor
- average
- rich
- very rich

#### Level of mechanization
- manual work
- animal traction
- mechanized/motorized

#### Sedentary or nomadic
- Sedentary
- Semi-nomadic
- Nomadic

#### Individuals or groups
- individual/household
- groups/community
- cooperative
- employee (company, government)

#### Gender
- women
- men

#### Age
- children
- youth
- middle-aged
- elderly

#### Area used per household
- < 0.5 ha
- 0.5-1 ha
- 1-2 ha
- 2-5 ha
- 5-15 ha
- 15-50 ha

#### Scale
- small-scale
- medium-scale
- large-scale

#### Land ownership
- state
- company
- communal/village
- group
- individual, not titled
- individual, titled

#### Land use rights
- open access (unorganized)
- communal (organized)
- leased
- individual
- ejido

#### Total costs for maintenance of the Technology in USD
- 3'850.0

#### Total costs for maintenance of the Technology
- 296.15

#### Labour
- Weeding around plants: persons/day 10.0, Unit (mexican pesos) 160.0, Total costs per input (mexican pesos) 1600.0, % of costs borne by land users 10.0
- Cutting the stalk before the harvest: persons/day 15.0, Unit (mexican pesos) 150.0, Total costs per input (mexican pesos) 2250.0, % of costs borne by land users 10.0

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5/8
### Access to services and infrastructure

<table>
<thead>
<tr>
<th>Service</th>
<th>Poor</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Education</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Technical assistance</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Employment (e.g. off-farm)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Markets</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Energy</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Roads and transport</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Drinking water and sanitation</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Financial services</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

### Socio-economic impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Decreased</th>
<th>Increased</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop production</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Fodder production</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Fodder quality</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Animal production</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Wood production</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Product diversity</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Production area (new land under cultivation)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Farm income</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Diversity of income sources</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

#### Reduction number of animals but improvement of meat production

#### Directly by plants, indirectly with the money earned, it is possible to buy medicinal products.

#### If producers sell their alcohol production abroad, no problems, if not problems!

#### Huge benefits can create great conflicts!

#### It can be positive as well as negative (may induce corruption, violence)

#### The production of alcohol beverage (certified Mescal) from agaves, and/or in medicinal products, will generate very high incomes for stakeholders. Life will change drastically. This allows the farmer's sons to stay in the community and work in the fields.

### Socio-cultural impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Reduced</th>
<th>Improved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food security/ self-sufficiency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health situation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cultural opportunities (eg spiritual, aesthetic, others)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recreational opportunities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SLM/ land degradation knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conflict mitigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Situation of socially and economically disadvantaged groups (gender, age, status, ethnicity etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact on the community due to the huge benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livelihood and human well-being</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Ecological impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Reduced</th>
<th>Improved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvesting/ collection of water (runoff, dew, snow, etc)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface runoff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groundwater table/ aquifer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil moisture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil cover</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil loss</td>
<td></td>
<td></td>
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<tr>
<td>Soil crusting/ sealing</td>
<td></td>
<td></td>
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<tr>
<td>Soil compaction</td>
<td></td>
<td></td>
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<tr>
<td>Nutrient cycling/ recharge</td>
<td></td>
<td></td>
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<tr>
<td>Biomass/ above ground C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant diversity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animal diversity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Habitat diversity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire risk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
wind velocity
increased [ ] decreased [ ]

Off-site impacts
water availability
(groundwater, springs)
decreased [ ] increased [ ]
reliable and stable stream
flows in dry season (incl. low
flows)
reduced [ ] increased [ ]
downstream flooding
(undesired)
increased [ ] decreased [ ]
downstream siltation
groundwater/ river pollution
buffering/ filtering capacity (by
soil, vegetation, wetlands)
increased [ ] decreased [ ]
damage on neighbours’ fields
damage on public/ private
infrastructure
increased [ ] decreased [ ]
biodiversity
increased [ ] decreased [ ]

COST-BENEFIT ANALYSIS
Benefits compared with establishment costs
Short-term returns
very negative [ ] very positive [ ]
Long-term returns
very negative [ ] very positive [ ]

Benefits compared with maintenance costs
Short-term returns
very negative [ ] very positive [ ]
Long-term returns
very negative [ ] very positive [ ]

That is why, state institutions fund the installations of this system meanwhile the production did not start. After that, benefits generated will be enough to motivate people to increase by themselves, the surface to remediate, without economical helps.

CLIMATE CHANGE
Gradual climate change
annual temperature increase
not well at all [ ] very well [ ]
Climate-related extremes (disasters)
local rainstorm
not well at all [ ] very well [ ]
local windstorm
not well at all [ ] very well [ ]
drought
not well at all [ ] very well [ ]
general (river) flood
not well at all [ ] very well [ ]
Other climate-related consequences
reduced growing period
not well at all [ ] very well [ ]

ADOPTION AND ADAPTATION
Percentage of land users in the area who have adopted the Technology
single cases/ experimental
1-10% [ ]
11-50% [ ]
> 50% [ ]
Number of households and/ or area covered
50 households covering 10 percent of the stated area
Has the Technology been modified recently to adapt to changing conditions?
Yes [ ]
No [ ]
To which changing conditions?
climatic change/ extremes
changing markets
labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT
Strengths: land user’s view
Remediation of degraded land turning it to a sustainable production generating very high incomes in the medium term
How can they be sustained / enhanced? Life will change drastically and not necessarily for the better. Transparency and communication regarding benefits and land use are necessary.
Project done in a participative way where different kind of
Weaknesses/ disadvantages/ risks: land user’s view → how to overcome
Obligation to find external funds to pay the first steps of the system (greenhouse, planting, etc.) due to the lack of incomes amongst farmers. → Involve all stakeholders in the project
Be sure that alcohol production will not be consumed in excess in the community → Control of the volume of the production, and the sufficiently high selling price should avoid

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stakeholders are involved: administrations, politics, scientists and people.

How can they be sustained / enhanced? Maintain workshops dynamic between stakeholders, present results to other authorities and forum

- Low-cost project but need to be funded and supported with technical and institutional advice to initiate the first cycle of the project.

How can they be sustained / enhanced? Farmers can start to produce their mezcal from the wild agaves to sell them to wholesalers and use this money to pay for the project.

- As a result of the economical benefits, young people will stay in the communities.

How can they be sustained / enhanced? Involve the young to guarantee the future: develop the marketing, the diversification of the products, the quality of production, etc.

- It will hopefully reduce the number of cattle, which are the main cause of soil erosion, as farmers lose interest in cattle raising.

How can they be sustained / enhanced? Authorities need to monitor this and inform the farmers about the ecological impact of too much free cattle grazing.

REFERENCES

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Full description in the WOCAT database

Linked SLM data
Approaches: Land reclamation by agave forestry with native species
https://qcat.wocat.net/en/wocat/approaches/view/approaches_2454/
Approaches: Participative actions for economic benefits of agave forestry
https://qcat.wocat.net/en/wocat/approaches/view/approaches_2436/

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Project
- DESIRE (EU-DESIRE)

Key references

Links to relevant information which is available online
- DESIRE project Mexico partner (IRD 22): http://www.desire-project.eu/