

AGAVEFORESTRY IN MICHOACÁN, MEXICO: A SUSTAINABLE REMEDIATION OF DEGRADED LAND WITH BENEFITS FOR SMALL FARMERS



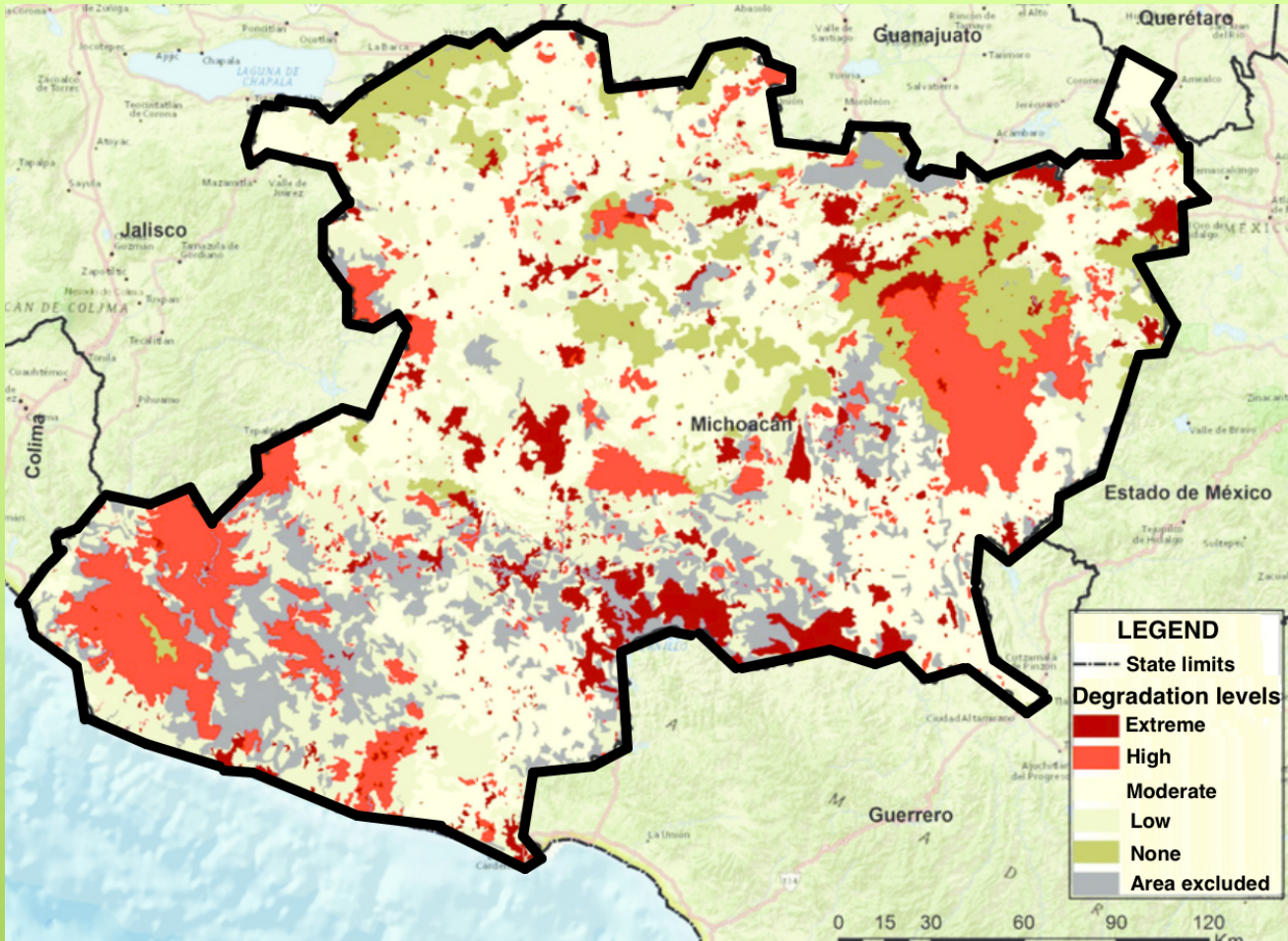
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Integrated indicator of degradation of the edaphic resource of Mexico (Comisión Nacional Forestal, Universidad Autónoma de Chapingo. 2013)



Actual level of soil degradation, Michoacán, México. Bolaños González, et al. 2016. Terra Latinoamericana 34

45% of Mexico suffers land degradation, 12% of which (23 million hectares), are degraded due to water erosion. In Michoacán, a state in west-central Mexico, this number is over 27%. Our studies in central Michoacán, determined that overgrazing is the main cause of degradation. It is an emergency to find solutions to stop this processes.



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After participative actions with farmer communities and based on field experimentations as well as the stakeholders experiences, we define all together a new strategy: **the agaveforestry**.

Our agaveforestry proposal was established as a process where trees, shrubs and herbaceous plants, free of agrochemicals, are combined in the same crop, incorporating grazing animals too. There, we test and measures different parameters.



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While waiting for the agave to mature (>7 years), the farmers intercrop trees plants and grasses that produce marketable products and women earn income in greenhouses by selling small agaves from the seeds they have collected.



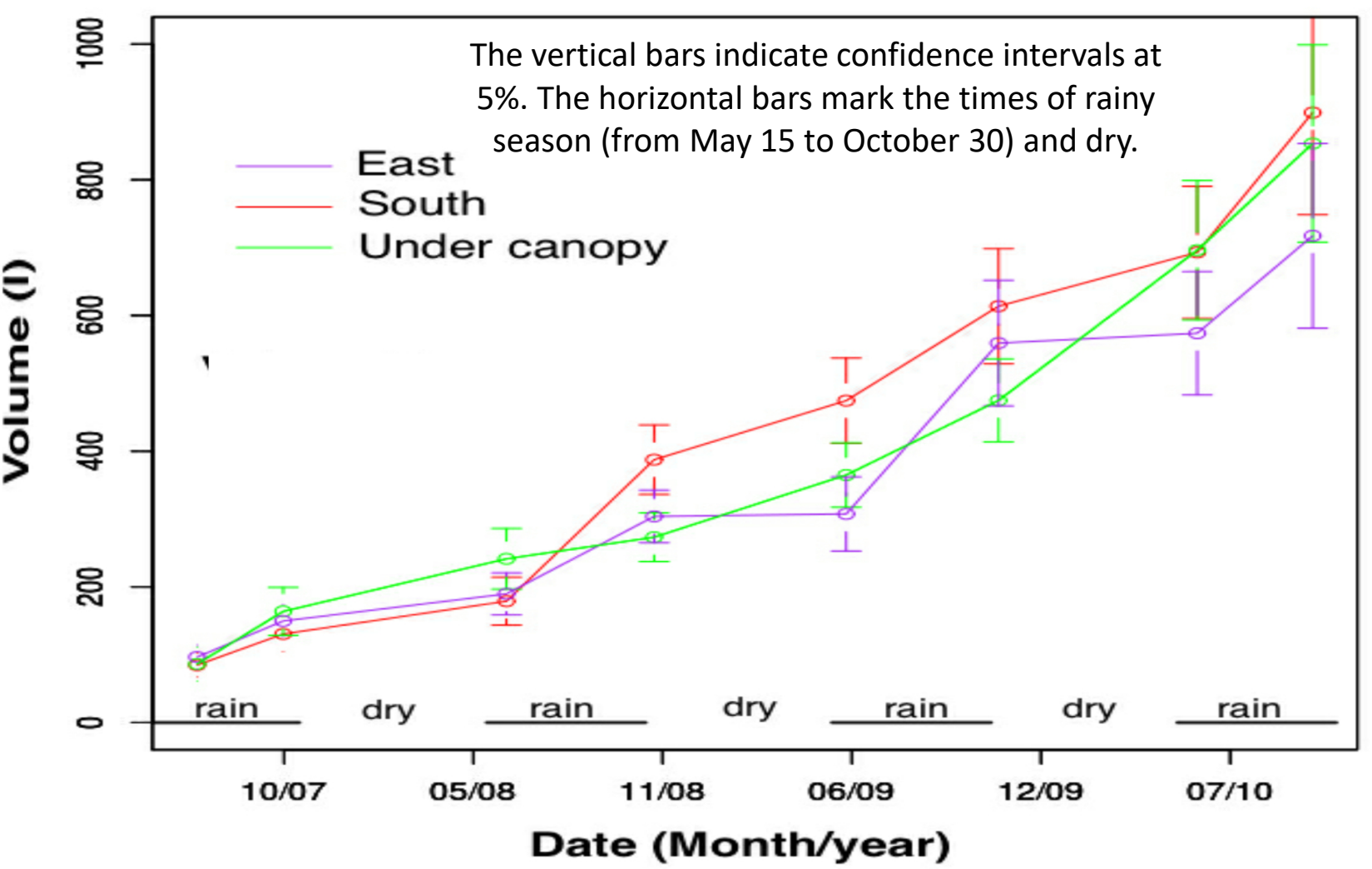
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Local agave (*Agave cupreata*) can be used to produce a high-valued alcohol drink (mescal) as well as medicines and cosmetics. So farmers will prefer to produce agaves and they will reduce their cattle and so, soil erosion.

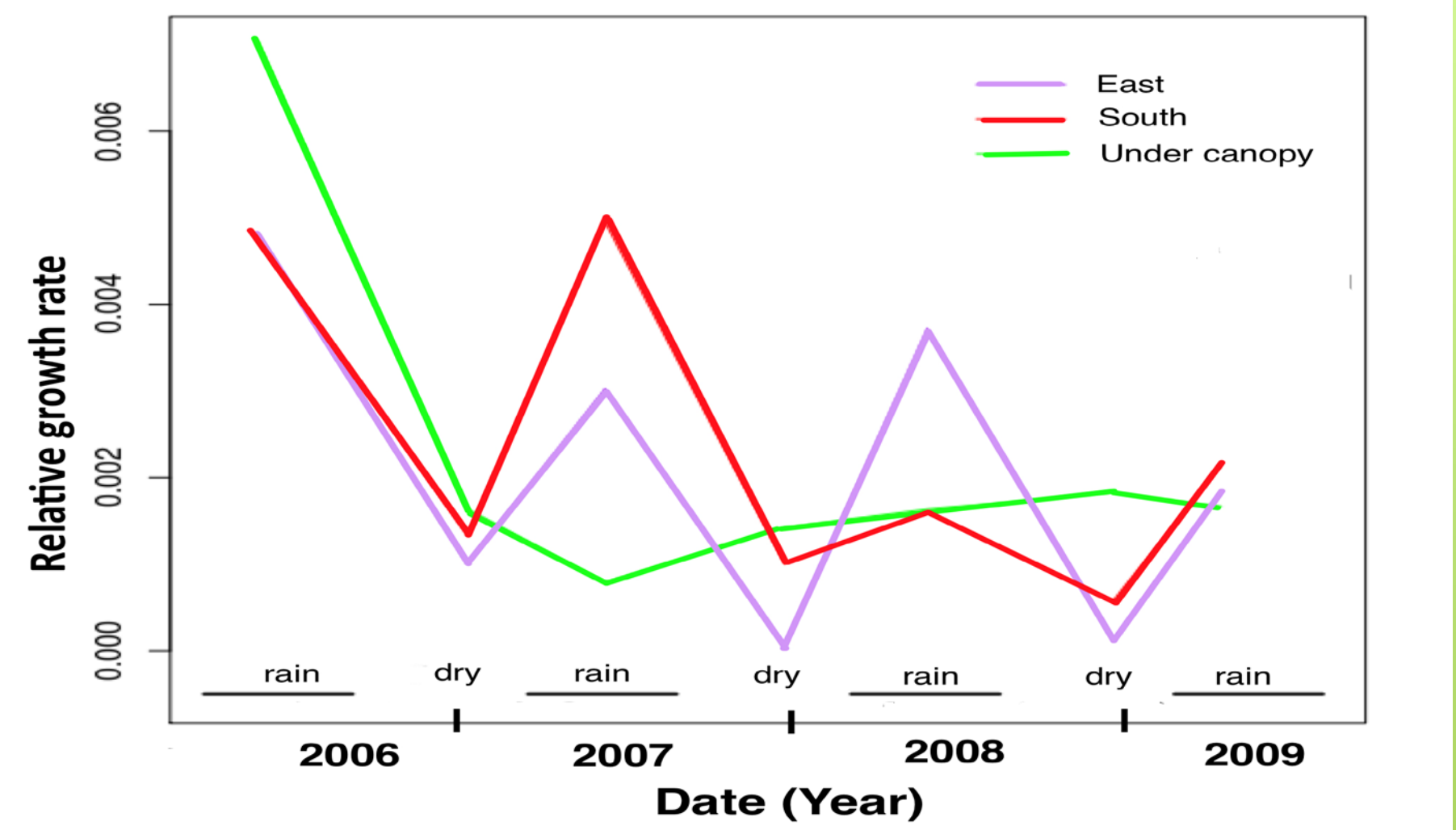


Impact of soil quality and solar radiation on *Agave cupreata* growth

Agave cupreata is characterized by its natural growth under the oak forest canopy, occasionally in low deciduous forest, between 1220 and 1890 meters of altitude. However, mezcal producers observe better growth and better quality of the plants when they grow in the sun. To answer this question, the *Agave cupreata* growth was evaluated under three agroecological conditions, which differ in terms of solar radiation and soil quality (Table 1).



Growth in volume of plantations between 3 and 6 years of *A. cupreata* under integral management depending on its orientation to the sun: east, south and under canopy.



Relative rate of growth of *A. cupreata* in plantations between 3 and 6 years under integral management according to their exposure: oriented east, south and under canopy.

	East	South	Under canopy
Solar radiation	High	High	Low
Soil	Superficial, compactated, low % O.M.	Deep, not compactated, high % O.M.	Deep, not compactated, high % O.M.



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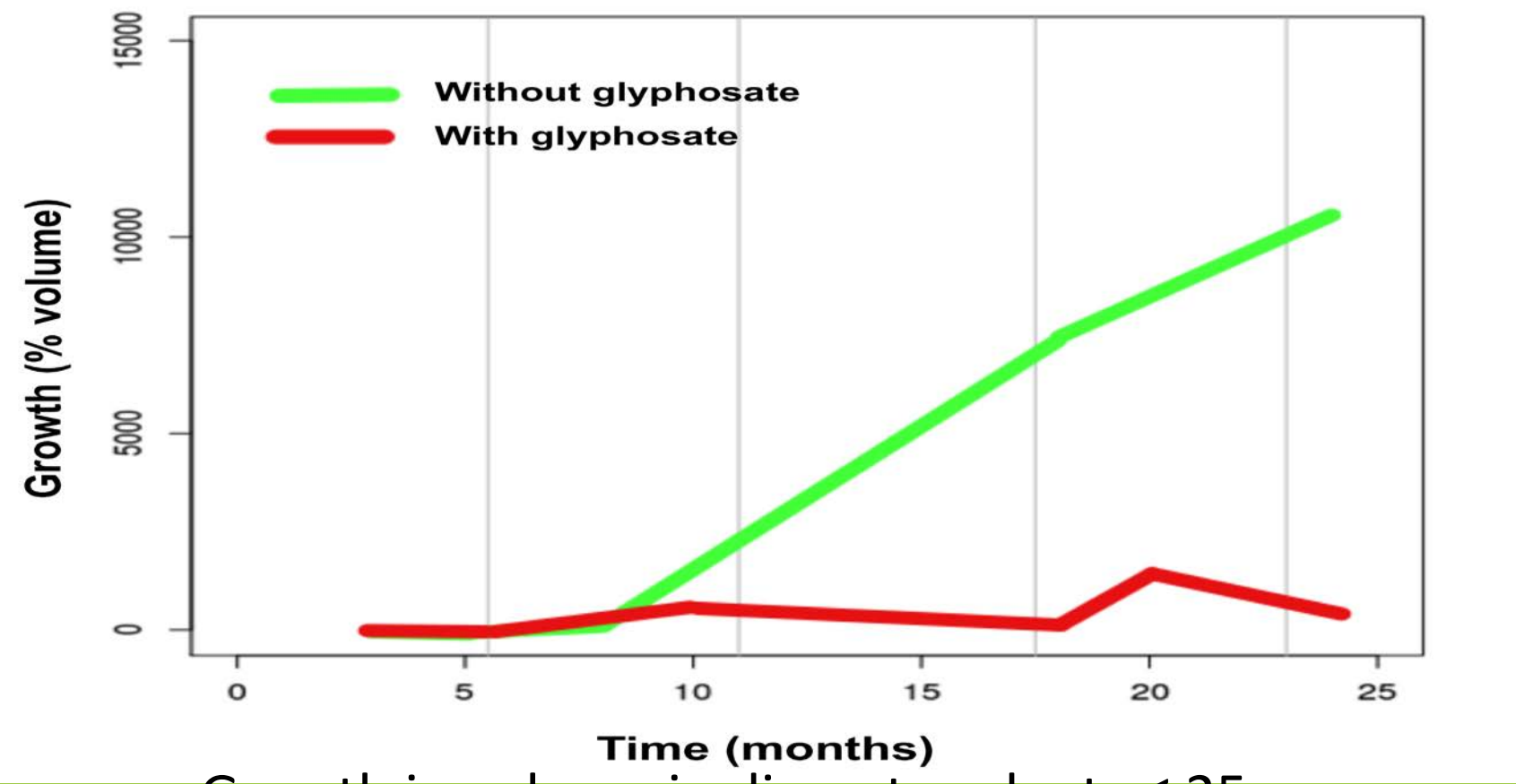
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Soil quality is the most important difference between them. The plot exposed to the East, closer to the lower part of the hill, probably has a thinner and leached soil, more exposed to compaction by cattle grazing than that exposed to the South, which receives runoff and erosion product.

Agave cupreata under the canopy tends to grow more in dry season while those of the open sky grow more in the rainy season. Leaves of this plants are more horizontal because of the lack of light, those of open sky are erect to avoid direct rays.

Impact of agrochemicals on *Agave cupreata* growth

The objective was to show differences between the development of *Agave cupreata* plants under an agaveforestry management and an conventional plantation management. The plants were established at a density of 2,500 agaves.ha⁻¹. In the agaveforestry system agrochemicals were not applied as well as burning or weeding, only pruning at the height of crops. The conventionnal management received in may a dry grass burning and continuous applications of agrochemicals.



Growth in volume in diameter plants ≤ 25 cm

After 6 years in both systems, the agaveforestry registered losses of agaves <5% for diseases and <1% for pests, meanwhile in the conventional system, there were losses of 30-60%, mainly due to attack of *Erwinia* (bacteria), *Fusarium* (fungus) and *Scyphophorus acupunctatus* (beetle). 80% of the agaves presented a physiognomy of twisting and lost of vigor and yellowish color of the leaves.

Conclusions

In the agaveforestry system, there was no difference between the sizes of plants growing under the canopy and in the open sky. In the first case, the greater development occurred during the dry season while in the second case, it was during the rainy season. A good quality of soil is a guarantee of a good plant grow. *Agave cupreata* grows perfectly well under an agroforestry system, meanwhile, the conventional one with the use of chemicals was closed to a disaster. Investigations are still going on to understand interactions between plants, as well with animals.



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