

Biodiversity Restoration of dry forest in the Sierra of Huautla

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File: Restoration ecology

Protection of natural areas essential aims are conservation of plants, animals and all ecosystems containing them, however when an area is declared protected it already has a history of exploitation and several degradation levels. Sometimes is enough to stop disturbance source in order to the natural process of recovery, called succession, begins. The main objective of ecological restoration is to reestablish lost biodiversity through manipulation of succession processes.

Sierra de Huautla Biosphere Reserve, located south of Morelos, was enacted in 1999, a fact that has contributed effectively to the conservation of dry forest. This ecosystem possesses a great diversity and it is constantly changed because of the close relationship between humans and this particular type of vegetation. Within the reserve there are 31 communities whose main productive activities are agriculture, livestock and selective extraction of natural resources. In order to find ways to productive activities and biodiversity co-exist, in 2006 a project of restoration ecology, science behind the actual ecological restoration, was installed in a forest nearby the community El Limón de Cuauchichinola, Tepalcingo Municipality, Morelos.

With funding from the Teacher Improvement Program of the SEP and the National Council of Science and Technology (CONACyT) we were able to exclude 2 hectares divided into 8 plots of secondary forest from all anthropogenic disturbances. Additionally we marked 1.5 hectares in areas without exclusion (control sites) in conserved forest and in low-diversity forest heavily disturbed for over 30 years, adding a total of 3.5 hectares under heavy monitoring.

Finally we increased diversity in over half of the parcels by introducing 20 species of typical trees of the preserved forest, intending to manipulate the speed of succession. Our aim to this 5 years first stage was to get an answer to 2 main questions: are biodiversity and its functioning recovered when disturbance is excluded? And, by planting trees from the preserved forest itself, is the natural process of recovery accelerated?

Colleagues at the Center for Research in Biodiversity and Conservation, the Center for Biological Research (UAEM) and the Ecosystems Research Center CIECO (UNAM), we have registered for 5 years:

1. The arrival of seeds to the plots (Biol. intern Alondra Nicholas),
2. Seed germination and seedling success (Biol. Leslie Alba),
3. The identity and density of birds (PhD. Marcela Osorio), rodents (PhD. David Valenzuela), bats (M.Sc. Lorena Orozco), ants (Biol. Amantina Lavalle), reptiles and amphibians (Biol. Jaime Orea and PhD. Ruben Castro), and Lepidoptera (Biol. Intern Iris Jaime and PhD. Ek del Val) eating and / or living in the plots,
4. Herbs wealthiest and biomass (Biol. Jessica de la O), trees (my office), cacti (M.Sc. Luis Arias) and ,
5. Herbivores in woody plants established and introduced trees (PhD. Raul Alcalá and PhD. Nestor Mariano). Besides, we registered which species were successful among the ones we planted in such degraded environments (Biol. Intern Miriam Montes de Oca).

After 5 years in this unique and ambitious project, now we can make specific suggestions for other ecological restoration efforts in the dry forest of Mexico and the world:

1. There is an evident increase in richness and density of seeds after exclusion time, potentiating biodiversity increase. Restoration plantations favored the increase in the richness of seeds dispersed by animals, even before producing fruit (Biol. Intern Lidia Gamboa),
2. Many seeds germinate during the rainy season, even though most of them die at the start of drought, and the surviving seedlings belong to *cochliacantha* Acacia, *Ipomoea pauciflora* and *benthamii* Mimosa, the same trees dominating disturbed secondary forest,
3. The density and richness of animals increase with time of exclusion and its composition and proportion of different functional groups is changing according to the natural succession process that will take this forest to maturity. Additionally, during the dry season, restoration plantings favor a higher density of amphibians and reptiles,
4. The entry of livestock favors ruderal herbaceous (cropping) over natives. The cacti in open areas (nopales) increase with disturbance, perhaps at the expense of arborescent cactus (organ). The thorny bush (*Acacia cochliacantha*) known to dominate large areas called disturbed cubatales shows high mortality rates within areas under restoration. This shrub favored by extensive livestock will disappear naturally once natural succession advances; it contrasts with past opinions supporting the elimination of cubatales as a first step for restoration. To increase diversity, it is necessary to plant as many tree species as possible, we recommend planting brazilwood (*Haematoxylon brasiletto*) and tlauhuitol (*Lysiloma divaricata*) trees which were successful in our plantations. Thanks to the participation of social service students and postgraduate students, as well as the irreplaceable help of hundreds of biologists from the School of Biological Sciences (UAEM) we have monitored the plants, animals and their interactions in this jungle. After 5 years into this project, we can answer yes to both questions we previously asked: It is possible that biodiversity and ecosystem function recovers after excluding the disturbance, and planting trees of the preserved forest accelerates natural succession processes

compared to those sites that were only excluded from the disturbance. For the next 5 years, our goal is to unravel the ecology of trophic cascades of plants, herbivores, insectivores and carnivores that are controlling and maintaining the biodiversity of these forests for our benefit.

Semblanza

Cristina Martinez-Garza is a graduate degree in Biology at the National Autonomous University of Mexico (UNAM). He completed his graduate studies at the University of Illinois at Chicago, under the direction of PhD. Henry F. Howe. He later received a repatriation scholarship from CONACyT in 2004 becoming part of the Universidad Autónoma del Estado de Morelos, specifically the Research Center for Biodiversity and Conservation (CIByC). He has taught the subject of Population Ecology at the Faculty of Biological Sciences. He conducted Ecological Restoration and Community Ecology seminars, field and laboratory sessions. Between semesters he also taught the subject of frugivory and dispersal. He coordinated the acquisition of material for the Library of CIByC, the UNAM postgraduate located the facilities of CIByC and participated in the development of the DES postgraduate of Natural Sciences at the UAEM.