

INTRODUCTION

Forest's around the world face unsuitable pressure to deliver economic, social, and environmental services. Conventional agriculture threatens biodiversity, however the world demand for food is increasing and the livelihoods of many families depend on it. An immense challenge is to come up with viable solutions to meet these two objectives (eat and maintain). An alternative to conventional agriculture are integrated landscapes with patches of native vegetation persisting along sustainable farming systems. With this project, we aim to test how to maintain countryside diversity and landscape connectivity in human-dominated landscapes.

The **overall goal** is to create an integrated landscape by regaining connectivity between forest fragments and transforming conventional pastures into more permeable and productive matrices that can sustain food production in the long-term. This will decrease the pressure on deforestation and reduce the effects of fragmentation, thereby maintain biodiversity and many ecosystem services.

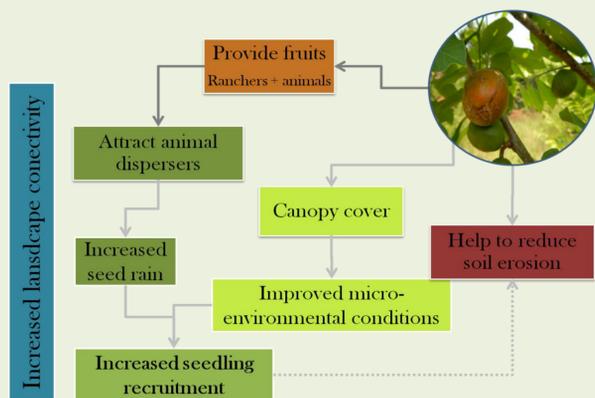
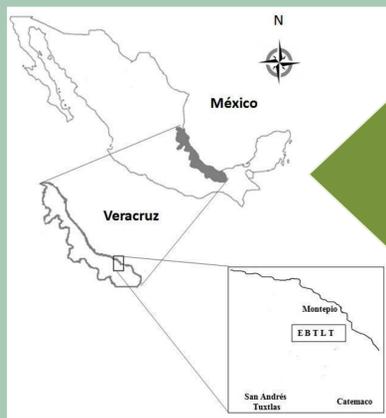
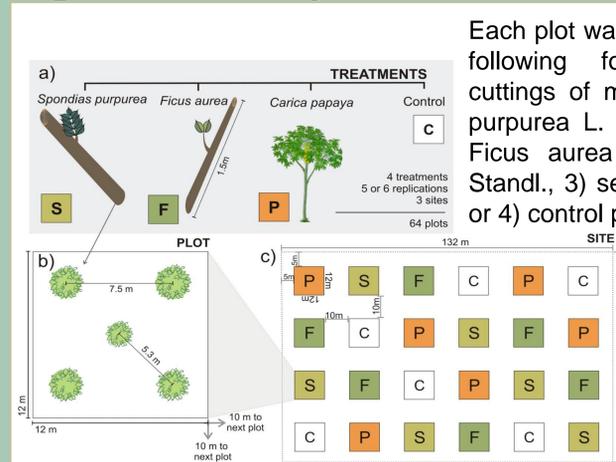


Diagram of the succession process and its effects on ecosystem services



METHODS

Experimental design



Each plot was established with one of the following four plantings treatments: cuttings of mature trees of 1) *Spondias purpurea* L. or *Spondias mombin* L., 2) *Ficus aurea* Nutt. or *Ficus colubrinae* Standl., 3) seedlings of *Carica papaya* L. or 4) control plots without plantings.

Study site

Los Tuxtlas, Veracruz, Mexico

- Los Tuxtlas Biological Station (EBTLT).
- Tropical rain forest.
- Biodiversity hotspot.
- 200 msnm, average temperature 27 °C, precip 4900 mm
- Fragmented mosaics of farms, forest remnants, and small habitat patches.

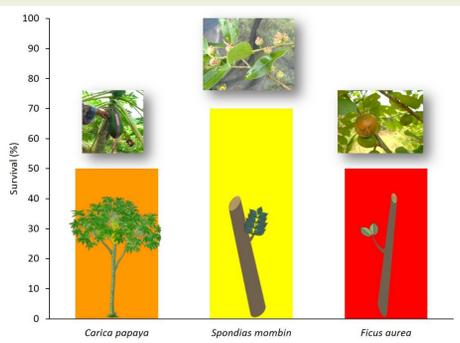
Censuses of biological variables:

- Planting success.
- Fruiting and flowering of the planted trees.
- Seed rain.
- Bat and bird activity and seedling recruitment

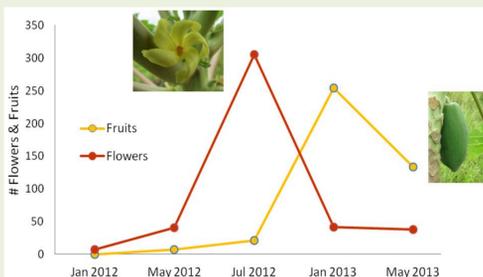


RESULTS

Planting success



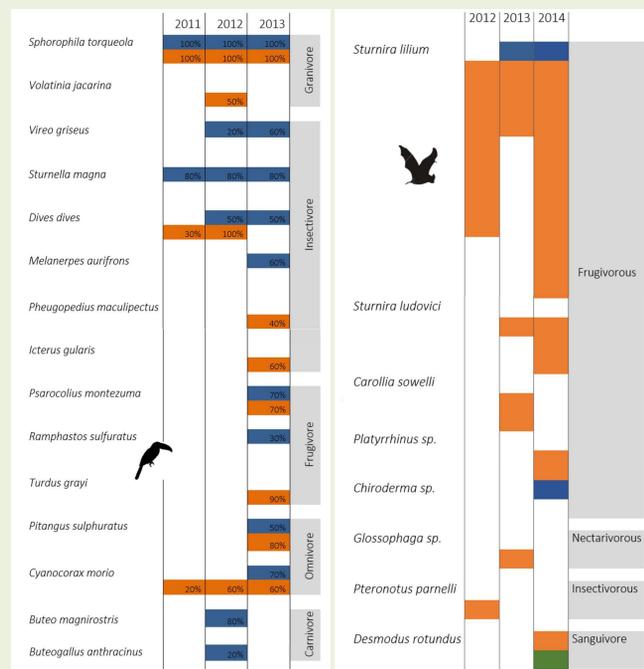
Percentage of establishment success by species



Papaya flowering and fruiting. Fruit set of 96% in one year

Bird and bat visitations

Birds- higher increase of insectivorous and frugivorous bird species and densities. *Pitangus sulphuratus* and toucans were observed eating papaya fruits. **Bats**- In 2014 the majority of bats were frugivores



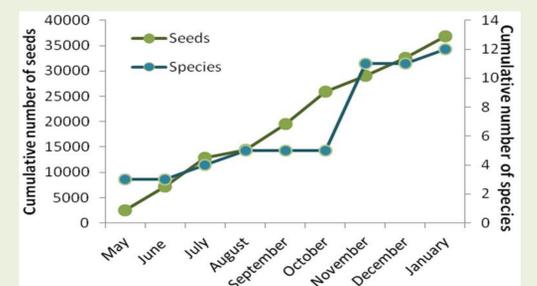
Bird species crossing or perching in planted plots. Different colors represent sites. Frequencies are percentage of times observed out of all censuses (A). Species and abundances of bats captured in mist nets inside the planted plots. Different colors represent sites and relative abundances are represented by the width of the cells (B).



Papaya fruit eaten by toucans (A) and small bat (C). *Sturnella magna* on *Ficus aurea* cutting (B). *Glossophaga sp.* (D)

Seeds

The majority of seeds were from exotic grasses and herbs. In the last year we observed an increase in seed arrival of forest species like *Poulsenia armata* (MORACEAE) and *Bursera simaruba* (BURSERACEAE).



Cumulative number of seeds and seed species from 2012 to 2013

Seedling recruitment

We recorded extremely low recruitment of woody species. Densities were as low as 3 to 0.5 individuals per hectare. Grass extent and height increased extremely fast forfeiting the ability of seedlings to grow and survive.



Two common pioneer trees recruiting in planted plots. *Cecropia obtusifolia* (left) and *Heliconia appendiculata* (right)

CONCLUSIONS

- Once *Spondias* cuttings and papayas produced fruits, bird and bat species and abundance increased, particularly the fruit-eating group. Consequently, seeds of forest species arrived, however the seeds were not able to overcome the grass barrier that limited seedling establishment.
- Integrating small-scale sustainable agriculture as part of the matrix in tropical landscapes has a better chance of preserving biodiversity and agricultural production in the long-term.

IN A NUT SHELL

The idea is to create vegetation patches of fruiting trees to allow for animal movement between forest fragments, increase connectivity within the landscape, and help to regain ecosystem services.

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