Conservation and reforestation of biodiversity in the biological corridor La Gamba, Costa Rica

Summary of field-work conducted in La Gamba, Costa Rica 2013 – 2023
Costa Rica: hosts 5% of global biodiversity

Total area: (CR/AUT)
51.100 km²/83.878 km²

Land use:
agricultural land: 37.1%
forest: 51.5%
other: 11.4% (2011 est.)

Biodiversity:
Costa Rica’s rainforests
5% of the world’s biodiversity and 25% of them are protected

Environment:
carbon-neutral by 2021

Costa Rica: Deforestation & ecosystem degradation

1940: 75 % of land protected area
Now: only about 25 %
<table>
<thead>
<tr>
<th>Numbers</th>
<th>Category</th>
<th>Hectare</th>
<th>Percent of Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>National Parks</td>
<td>623.771</td>
<td>12.23%</td>
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<tr>
<td>8</td>
<td>Biological Reserves</td>
<td>21.674</td>
<td>0.42%</td>
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<tr>
<td>32</td>
<td>Protected Zones</td>
<td>155.817</td>
<td>3.06%</td>
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<tr>
<td>11</td>
<td>Forest Reserves</td>
<td>227.834</td>
<td>4.47%</td>
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<td>58</td>
<td>Wildlife Refuges</td>
<td>180.035</td>
<td>3.53%</td>
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<tr>
<td>15</td>
<td>Wetlands/Mangroves</td>
<td>77.869</td>
<td>1.53%</td>
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<tr>
<td>12</td>
<td>Other Categories</td>
<td>17.306</td>
<td>0.34%</td>
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<tr>
<td>161</td>
<td>TOTALS</td>
<td>1,304,306</td>
<td>25.58%</td>
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</tbody>
</table>
Costa Rica: Biological corridors for species migration

Path of the Panther - “Paseo Pantera“
the Central American Corridor
Costa Rica: Biological corridor La Gamba
Wildlife: conduct a camera survey across corridors
**COBIGA: Biological Corridor La Gamba**

**2007:** Gifted by the Verein Regenwald der Österreicher

**2023:** 570 ha administrated by the Tropical Field Station La Gamba

**Land-use types:**
- Primary forest,
- secondary forest,
- riverine vegetation,
- abandoned cacao plantation,
- garden and buildings
**Reforestation: sucession from pasture to forest**

1996: forest law restricts the dramatic rate of deforestation in Costa Rica.

2013: more than 100 native tree species have been planted but regeneration of damaged areas is still a huge challenge for ecologists.

2015: re-growing forest highlights succession of different plant species.

2018: collection of data from 19 planted species (12 families, 3 individuals/species).

Gradient of landscape degradation to assisted forest restoration
Study: morphological & physiological plant traits

1) **Aim**: Characterize plant functional traits of tropical tree species
2) **Hypothesis**: Certain plant traits sustain faster growth?
3) **Experiment**: Collect intact **leaves** and **root** systems of different plants (i.e., 12 families, 3 individuals per species).

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**Aboveground traits**
- Stem diameter (DBH)
- Stem height
- Specific leaf area (SLA)
- Leaf N content (Nleaf)

**Root morphological traits**
- Specific root length (SRL)
- Specific root area (SRA)
- Root tissue density (RTD)
- Nodulation of N-fixing species

**Root nutrient concentrations**

**Physiological traits**
- Phosphatase enzyme rates

**Interaction with soil microbes**

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Fig. 1.: Aerial photograph of the reforested area (Anton Weissenhofer).
Methods: experimental planting with randomized design

- More than 10,000 native trees have been planted 2012–2013
- Randomized plot design (3 functional groups in replicates: high density / low density / legumes)

Fig. 1.: Aerial photograph of the reforested area (Anton Weissenhofer).
Results: performance related to plant growth strategy

- **Hypothesis:** Certain plant traits sustain faster tree growth
- **Results:** indicate some degree of habitat specialization:
  - SG (secondary-growth): fast
  - Generalist (G): in between
  - OG (old-growth) specialist: slow

→ Functional differences need to be considered in models (cf Plant-FATE)
Model: simulating vegetation response to the environment

Explore research questions:

**R1:** Does a more diverse system support more ecosystem functions?

**R2:** Is a functionally diverse system more resilient to climatic fluctuations?

**R3:** What are the mechanisms determining forest resilience to climatic extreme events?
Immerse yourself in a tropical rainforest...
Thank you for listening!

Happy to take your questions...

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