Restoration of native vegetation on the Temehani plateau, Raiatea island (French Polynesia)

The importance of post-control monitoring and the study of plant succession

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Introduction

- **Biological invasions** as one of the main causes of biodiversity erosion on islands (Elton 1958, Simberloff 2009)

- “**The global biotic homogenization**” (Olden 2006)

*Images of Miconia calvescens (Tahiti), Melinis minutiflora (Rapa Nui), and Pinus caribaea (New Caledonia)*
Ecological restoration

- “Process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed” (www.ser.org)

- Returning a system to a historical or reference state

- Removing anthropogenic disturbances (e.g. invasive alien species)

“The next century will, I believe, be the era of restoration in ecology” (E. Wilson)
POLYNESIE FRANCAISE

Tahiti
Maupiti
Reitoru
Raivavae
Ua Pou
Makatea
Rapa

Flora of French Polynesia

- **855 native plants (including 551 endemics)**

<table>
<thead>
<tr>
<th>Islands</th>
<th>Land area (km²)</th>
<th>Endemic flowering plants (%)</th>
<th>Endemic genera</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Caledonia</td>
<td>19,060</td>
<td>2,448 (80%)</td>
<td>100</td>
</tr>
<tr>
<td>Fiji</td>
<td>18,270</td>
<td>799 (61%)</td>
<td>12</td>
</tr>
<tr>
<td>Hawaii</td>
<td>16,880</td>
<td>859 (89%)</td>
<td>32</td>
</tr>
<tr>
<td>Galápagos</td>
<td>7,900</td>
<td>139 (32%)</td>
<td>7</td>
</tr>
<tr>
<td>French Polynesia</td>
<td>3,520</td>
<td>462 (71%)</td>
<td>11</td>
</tr>
</tbody>
</table>

- **> 1500 alien plants**
- **590+ naturalized (including 70+ invasives)**
The Temehani plateaus, Raiatea Is.

- 450-820 m asl
- Trachytic lava flow (2.5 Myr)
- Ferralitic soils
- Rainfall > 4,000 mm/yr
- Windy and cooler!
Conservation challenges

- “elfin” montane cloudforest & shrubland
- 29 Raiatean endemic plants (including 9 strictly endemic to the plateaus)
- Many endangered and legally protected species
- High ecological value in French Polynesia
The « flag-ship » endemic species

Tiare apetahi *Apetahia raiateensis* (Campanulaceae)
The two invasive alien plants

Rose myrtle *Rhodomyrtus tomentosa* (Myrtaceae)

Coco plum *Chrysobalanus icaco* (Chrysobalanaceae)
The current situation
Association TUIHANA (created in 2005)

The goals
The experimental protocol

- **16 permanent (24x24 m) plots**
  - 8 treated, 8 control (no herbicide)
  - alien seedlings removed in half of the plots
  - 833 tagged alien shrubs

- **Treatments**
  - Cut stump & herbicide
  - Stem injection & herbicide
  - 3 herbicides (sodium chlorate, glyphosate, trichlopyr)
  - 2 concentrations (60% and 100%)

- **Post-treatments monitoring**
  - 36 quadrats (2x2 m) per plot (total = 576)
  - 6 (yr 2011) and 12 months (yr 2012) after treatment

Main results

I. Efficiency of the control methods (after 1 yr)

- triclopyr > glyphosate > sodium chlorate
- cut-stump > stem injection
- no significant differences between herbicide concentrations
Main results

II. Study of plant succession (after 1 yr)

- No significant change of native species composition and abundance after control
- Massive recruitment of alien plants in “cut stump plots”
- Less reinvasion in “stem injection plots” with progressive defoliation of invasive trees
Increase of total plant abundance after control and alien seedling removal
Recolonization by new alien (pioneer) species vs limited recruitment of natives

Species richness in *Chrysobalanus icaco* plots (2012)
Conclusions

- Reinvasion by other alien plants after control
- Few recolonization by native species

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Low habitat resilience?

How much time is needed for the recovery of the native vegetation = “true” habitat restoration?
Future prospects

- Long-term monitoring is needed!
- Continual management?
- Alternative stable state = towards “novel ecosystems”…

Acknowledgements


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Rava

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