Local ecological knowledge and forest resilience in a conservation landscape

Berta Holgado Vargas
Arthur Bondoux
Matías Guerrero Gattica
Francisco Zorondo
Margarita Huerta
Rafael Valenzuela
Ángel Videla Bello
Meredith Root-Bernstein
How to valorize and manage the woodlands?

• The landscape of the central zone of Chile has long been seen as a potential wasteland, and has little state conservation

• Silvopastoral *espinal* has recently been shown not be a degradation of sclerophyllous forest, but rather part of the successional cycle of woodland regeneration

• Long but little understood anthropogenic woodland histories

*Acacia caven* nurses endemic sclerophyllous trees along a successional pathway from silvopastoral savanna to forest

MIRIANI ROOT-SHOMETER,†‡† KARINA VALZANELLA,§ MARGARITA HUERTA,* JUAN ARMESTO,* and FURMAN JACOB†

†Department of Anatomy, Aarhus University, Aarhus, Denmark
‡School of Environment and Business, University of Chile, Santiago, Chile
§Instituto de Ecología y Biodiversidad, Santiago, Chile
*University of Chile, Santiago, Chile
†Instituto de Ecología y Biodiversidad, Santiago, Chile
‡CIES, Pontificia Universidad Católica de Chile, Santiago, Chile

*Acacia caven* nurses endemic sclerophyllous trees along a successional pathway from silvopastoral savanna to forest. *Ecosphere* 8(2):e025467.

10.1002/2e025467
Various research models: interdisciplinarity and including ILK in research and conservation

- Research team members were involved in creating, or interested in evaluating, the first phases of the Conservation Landscape initiative.
- Further research has been requested by various stakeholders.
- Local (mestizo) people contributed knowledge as guides and interlocutors.
- We come from several disciplines.
- Here, we combine results from independent studies using various interdisciplinary and disciplinary approaches.
Ethnobiology methods
(B.H.)

• Participants all from Pichi n = 31
• Snowballing
• Questionnaire focused on socio-demographic questions
• Interview based on open questions to determine knowledge of sclerophyllous woodland plants and their uses
• Open questions about the problems affecting the woodlands in Pichi in the context of the Conservation Landscape initiative
• Participative mapping workshop focusing on changes over time in Pichi
Agricultural livelihoods, knowledge, values surveys (A.B., M.G.G., F.Z., & M.R.-B.)

• This was part of a larger project on design of conservation programmes for farmers
• Participants from Alhué, Pintué and Doñihue (n = 98)
• Stratified sampling (farm size)
• Questionnaire on farm production and livelihoods, environmental values, knowledge of forest regulations, and socio-demographic questions
• The questionnaire was read to participants
Ecological fieldwork methods
(M.R.-B., A.V.B., R.V., & M.H.)

• Transects of 15 trees each, recording position, species, height, canopy area, facilitation interactions, etc.
• 42 transects (one double-length)
• Transects were placed according to advice from local guides, along with «snowballing » to gain a representative sample of both typical and unique woodland formations and histories
• Zero-inflated regression and $\chi^2$ tests
Ecological fieldwork methods
(M.R.-B., A.V.B., R.V., & M.H.)
Ecological results 1: condition of the woodlands of Alhué

• 33 tree species recorded, of which 23 endemic to central Chile

• Includes natural and planted populations of the endangered Chilean palm (*Jubaea chilensis*), dispersed by free-range cattle

• History of anthropogenic impacts:
  
  – Wheat, beans, fallows/livestock rotation until up to 30 years ago

  – Charcoal production
Ecological results 2: Factors affecting woodland regeneration

- **regeneration index** = sum of seedlings < 0.4 cm and trees facilitated by a nurse tree in each transect
- Regeneration index increased with natural water presence (river, stream, or quebrada) and with signs of cattle presence
- none of the anthropogenic, current disturbance or historical disturbance variables affect regeneration

There were more seedlings in areas without spring-only cattle grazing ($\chi^2=14.119$, df = 7, p = 0.0491), and there was no difference in seedling number between sites with and without year-round cattle grazing ($\chi^2=6.4762$, df = 7, p = 0.4854).
Agricultural surveys results 1: Production systems

- we found ~70 crops being grown (none indigenous food crops) and ~16 animals being raised
- Alhué: mixed profile of industrial fruit production and smallholders
- Livestock (cattle, horses, sheep) are raised, on private land, communally managed land, or via land access rights in former fundos
Agricultural surveys results 2: Knowledge of forest regulations

Alhué

- Frequency
- Knowledge of forest regulations
Ethnobiology results 1: Locally recognised and used plants

128 names were given for 113 plant species, 80 of which were native. 73 uses were identified:

Distribution of uses of native flora in Alhué
Ethnobiology results 2: Perceptions and proposals for woodland conservation

• Species most important for woodland conservation: 3 species that form leaf litter (*quillay, boldo, litre*) and 1 that is associated with running water (*patagua*)

• List of threats:
  – Fire
  – Drought
  – Felling
  – Poor management and bad behaviours
  – Mining
  – Floods
  – Road construction
  – Invasives and plagues

• Historical reduction in rainfall and running water volume

• Propose zonification of the woodlands, education and outreach, and training in sustainable exploitation practices

In the future, do you think the forest...

- Disappears
- Grows
- Stays the same
- Diminishes
Conclusions

• Water is a key variable for woodland regeneration and conservation
• Mining and climate change are threats
• In the long term (100 yrs), farming and woodland exploitation have not negatively affected woodland composition
• Cattle have a surprising positive effect!
• High level of traditional and regulatory knowledge
• Training in management techniques that maintain a diversified livelihoods strategy, including NFTP and extensive cattle pasturing should be developed in the context of the Conservation Landscape
Conservation landscape  
Alhué, Chile

- New municipal land-use planning tool
- Aims to promote sustainable development and protect natural and cultural heritage

PLADECO Alhué 2014