

*Invasion note*

## **Increasing the understanding of plant invasions in southern South America: first symposium on Alien Plant Invasions in Chile**

A. Pauchard<sup>1,\*</sup>, L. Cavierres<sup>2</sup>, R. Bustamante<sup>3</sup>, P. Becerra<sup>3</sup> & E. Rapoport<sup>4</sup>

<sup>1</sup>*Facultad de Ciencias Forestales, Universidad de Concepción, Chile;* <sup>2</sup>*Departamento de Botánica, Universidad de Concepción, Chile;* <sup>3</sup>*Departamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, Santiago, Chile;* <sup>4</sup>*Universidad Nacional del Comahue, CRUB, Bariloche-CONICET, Argentina;* \*Author for correspondence (e-mail: pauchard@udec.cl)

Received 1 June 2003; accepted in revised form 18 August 2003

*Key words:* Argentina, control, developing countries, exotic species

### **Abstract**

The first symposium on Alien Plant Invasions in Chile was held in southern Chile in November of 2002. Chile represents an interesting setting to study biological invasions because of its long history of introductions, and its high rate of endemisms that makes it more prone to invasions. However, little is known about plant invasions in Chile and the country lacks a clear policy on alien species. The speakers at the symposium discussed their research on several aspects of alien plant invasions in southern Chile and Argentina. They also elaborated a list of future challenges of plant invasion ecology for the area. The package of recommendations may be useful for other developing countries with similar state of knowledge of their flora and similar environmental and economic issues. We expect that this type of meeting will help to stimulate the scientific debate about invasion ecology and the development of coordinated research to answer local questions, while contributing to find generalities in plant invasion patterns and processes.

The first symposium on Alien Plant Invasions in Chile was held in Puyehue, southern Chile on 14 November 2002, as part of the 45th Annual Meeting of the Biological Society. The symposium was sponsored by the Interdisciplinary Program for Biodiversity Studies of the Universidad de Chile and the Botanical Society of Chile. The symposium discussed alien plant invasions and their status in Chile and Argentina. It was the first initiative to bring together specialists to discuss the global phenomena of alien plant species from a southern South American perspective and we expect it to be the starting point of a continuous discussion on the topic.

Chile represents an interesting setting to study biological invasions (Arroyo et al. 2000). This country has a long history of introduction with ca. 723 alien plant species (Concepción Herbarium, unpubl.

data 2002). The country also has a high rate of endemisms, due to its biogeographic isolation, which makes it susceptible to invasion processes (Arroyo et al. 2000). Furthermore, Chile is one of the few countries with temperate ecosystems in the southern hemisphere, allowing for interesting comparisons with Australia, New Zealand and South Africa as well as with climatic parallels in the northern hemisphere.

On the other hand, even though invasions are recognized as a major threat to biodiversity worldwide, little is known in developing countries about these processes. Currently, Chile lacks a clear policy on alien species. Research has been done sporadically, without a unified conceptual framework and with little coordination among institutions. This symposium offered a first opportunity to review the existing evidence about

plant invasions in Chile and to discuss future challenges for research and management.

Ramiro Bustamante, the chair of the symposium, illustrated the importance of studying plant invasions in Chile, highlighting some of the major questions of invasion ecology that not only applied to Chilean ecosystems but also have a global significance.

Eduardo Rapoport (Universidad Nacional del Comahue) discussed the role of human developments or population centers as sources of propagules for plant invasions. He presented data from the cities of London, Mexico City and Bariloche. Most alien species tend to concentrate around urban developments and decrease in their abundance in natural areas. He emphasized the use of multiple scale methods to study plant invasions, looking at processes such as propagule dispersal at a global, regional and local scale.

Aníbal Pauchard and Paul Alaback (University of Montana) emphasized the importance of the landscape context and corridors in the introduction of alien species into protected areas (Pauchard & Alaback 2004). They studied two Chilean national parks, where abundance and richness of alien species in roadsides are negatively related to elevation, while positively correlated to land uses associated with grazing and logging. Alien species were less abundant in parks compared to their adjacent matrices. They concluded that alien species should be monitored and controlled both inside natural areas but also in their matrices.

Pablo Becerra and Ramiro Bustamante (Universidad de Chile), using data from several published studies, searched for relationships between native communities and invasibility in forests and grasslands of central and southern Chile. They studied the effects of vegetation cover, native species' richness, tree canopy cover and the pool of alien species on alien species' richness. They found that overall vegetation and canopy cover is negatively correlated with alien species' richness. However, they found no clear trend in alien *versus* native species' richness. These results may be useful for restoration activities directed to avoid plant invasions in disturbed plant communities.

Ramiro Bustamante and Javier Simonetti (Universidad de Chile) presented results on the invasion of *Pinus radiata* (Monterrey pine) into *Nothofagus* forest fragments of central Chile, currently surrounded by industrial *P. radiata* plantations (Bustamante et al. 2003). They found that most *P. radiata* seedlings tend to grow in the edges of remaining fragments, reaching the

interiors only in highly disturbed and open forest fragments. Using an experimental approach, a similar pattern was observed for the germination and recruitment of *P. radiata* seeds. They suggested that these forests are still resistant to the invasion of *P. radiata*, but monitoring is needed to assess invasion processes in the long term.

Lohengrin Cavieres (Universidad de Concepción) concluded the symposium with general recommendations, previously elaborated by all guest speakers, about the future and challenges of plant invasion ecology in Chile. The package of recommendations may be useful for other developing countries with similar state of knowledge of their flora and similar environmental and economic issues.

The recommendations included:

- (1) *Develop an inventory of alien plant species, identifying those species that are or may become invasive.* In developing countries, the distribution of the flora is still poorly understood. Alien species have been neglected in collections and studies due to a historical bias that found no scientific value in studying alien component of plant communities. Thereby, major efforts are needed to complete herbarium records of alien species across the country. Additionally, an early detection system to identify aggressive invaders can be implemented using information from other regions of the world with similar climatic conditions.
- (2) *Study patterns and processes of alien plant invasions in native communities of Chile.* The few studies that have been conducted in alien plant species in Chile are mainly focused on describing patterns of distribution and abundance. However, few have tried to understand the mechanisms behind invasions, both in consideration of the invaded community and the invader. These studies will not only give answer to local questions, but they may also contribute to find global generalities in invasion ecology.
- (3) *Study the autoecology of those alien plant species known to be aggressive invaders.* Globally, the study of the characteristics of alien species that allow them to overcome ecological barriers and become invaders have been strongly emphasized. In Chile as in other developing countries, few studies have addressed invasions from the perspective of the invader. These studies, while only providing a partial vision of the complex invasion process,

are needed to understand and manage the most aggressive invaders.

- (4) *Study the economics and biological impacts of alien plant species.* Alien species not only affect ecological values, but also have a strong impact on economic activities. Currently, in Chile, there is no assessment of impacts of plant invasions in either of these elements, limiting the efficiency to manage them and our capacity to prioritize limited resources.

Chile, as many other developing countries, faces similar challenges in the study of alien plant invasions, but it also offers a unique opportunity to study biological invasions in the southern hemisphere because:

- (a) Due to its unique native flora with high levels of endemism and diverse climatic gradient, Chile can be used to test invasion ecology generalities and hypotheses that have been tested in other regions of the world.
- (b) Many invasions are recent, thereby we know the initial conditions and we can monitor the ongoing invasion process. In addition, there are good historical records in the main Chilean herbariums.
- (c) There is growing concern among managers and scientist to protect the biodiversity of Chile, which can only be done by early detection and control of alien plant species.

We expect that this symposium had helped to stimulate the scientific debate about invasion ecology, promoting the development of coordinated research on the topic that could help to answer local questions, while contributing to find generalities in patterns and processes associated with plant invasions.

We believe that there is an increasing awareness in the national scientific community to continue further studies and discussions dealing with plant invasion and its ecological and economic consequences. In fact, a second symposium on plant invasions in southern South America was organized in a conjoined effort by the Botanical Societies of Chile and Argentina. This was held during the Binational Meeting of both societies in San Luis, Argentina from 19 to 23 October 2003. The meeting included the presentations of Argentinians, Chileans and Americans. Aníbal Pauchard (Chile) and Enrique Chaneton (UBA, Argentina) coordinated this second symposium.

We expect to soon inform the international scientific community about the conclusions of such symposium and the future steps that will be taken to coordinate research efforts on biological invasions among neighboring countries of southern South America.

## References

- Arroyo MTK, Marticorena CM, Matthei O and Cavieres L (2000) Plant invasions in Chile: present patterns and future predictions. In: Mooney HA and Hobbs R (eds) *Impact of Global Change on Invasive Species*, pp 385–421. Island Press, Washington, DC
- Bustamante RO, Serey I and Pickett STA (2003) Forest fragmentation, plant regeneration and invasion processes across edges in Central Chile. In: Bradshaw GA and Marquet PA (eds) *How Landscape Changes. Human Disturbance and Ecosystem Fragmentation in the Americas*, pp 145–160. Springer-Verlag, New York
- Pauchard A and Alaback PB (2004) Influence of elevation, land use, and landscape context on patterns of alien plant invasions along roadsides in protected areas of south-central Chile. *Conservation Biology* 18(1) (in press).