

Chile and California: What can we learn from comparing plant invasions across regions and hemispheres?

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This talk

- 1. Framework for socioecological comparisons
- 2. Interhemispheric comparisons: Chile-California
- 3. Invasive pines in South America
- 4. International networks and collaborations



Scientists' warning on invasive alien species

Petr Pyšek^{1,2,3*}, Philip E. Hulme⁴, Dan Simberloff⁵, Sven Bacher⁶, Tim M. Blackburn^{7,8,3}, James T. Carlton⁹, Wayne Dawson¹⁰, Franz Essl^{11,3}, Llewellyn C. Foxcroft^{3,12}, Piero Genovesi^{13,3}, Jonathan M. Jeschke^{14,15,16}, Ingolf Kühn^{17,18,19}, Andrew M. Liebhold^{20,21}, Nicholas E. Mandrak²², Laura A. Meyerson²³, Aníbal Pauchard^{24,25}, Jan Pergl¹, Helen E. Roy²⁶, Hanno Seebens²⁷, Mark van Kleunen^{28,29}, Montserrat Vilà^{30,31}, Michael J. Wingfield³² and David M. Richardson³



Fig 2. Increase in cumulative established alien species richness across six taxonomic groups in four regions of the world. Time series are based on the year of first record of those alien species that later became established in the given region (based on Seebens *et al.*, 2017).

All regions equally invaded?



Multiple socio-ecological factors behing these patterns

Unveiling the factors behind plant invasions

Reducing redundancy in invasion ecology by integrating hypotheses into a single theoretical framework

Propagule pressure

A

Jane A. Catford1*, Roland Jansson2 and Christer Nilsson2

Р

В

Biotic

factors

Global scale "natural experiments"

Cross continental comparisons

Diversity and Distributions, (Diversity Distrib.) (2004) 10, 371–375



Abiotic factors

Comparing alien plant invasions among regions with similar climates: where to from here?

Aníbal Pauchard^{1*}, Lohengrin A. Cavieres² and Ramiro O. Bustamante³

California-Chile

Interhemispheric comparisons



• Chile and California coincide geographically between latitudes 30° and 40° in their respective hemispheres.

• Both regions have extensive coasts along the Pacific that strongly influence their economies and cultures.

• Their central coastal areas constitute 2 of the 5 ecosystems in the world that have Mediterranean climates, which means that their energy and agricultural potentials are quite similar.

• Both territories are located where tectonic plates meet, which means that earthquakes are frequent.



Cactuario del Valle is at Valle de Colchagua. October 25 at 3:40 PM · Santa Cruz · 🕥

FLOR DEDAL DE ORO 🥮 🚂

En la antigua Empresa de Ferrocarriles del Estado trabajó en algún momento un oscuro funcionario de nacionalidad francesa. Él sabía que en Francia se empleaba una pequeña flor para afirmar los numerosos terraplenes sobre los que se tendían las líneas del tren. Aparte de ser muy bonita, esa flor tenía la característica de echar largas y fuertes raíces que resultaban ser muy beneficiosas para afirmar los nuevos y aún no afiatados terraplenes. Por propia iniciativa, ese francés logró traer desde su país semillas de esa flor. En sus frecuentes viajes en tren recorriendo todo Chile y también en nuestro querido valle de colchagua en las líneas del recordado tren del vino **46** o desde San Fernando a pichilemu , el ingeniero solía sentarse al final del último vagón y, con santa paciencia, iba dejando caer semillas de Dedal de Oro o por todas las líneas de ferrocarril del país. Fue así como esa flor se aclimató en Chile y pasó a ser parte del alegre paisaje de nuestros campos. Ese fue uno de los silenciosos servidores públicos que otrora hicieron grande a Chile. Sin hacer ruido, él buscaba agradecer a nuestro país la hospitalidad con que él y su familia fueron acogidos en su ahora segunda patria, ademas está hermosa flor se da en tiempos de primavera.

Es bueno que esta pequeña historia sea conocida. De paso.

Hoy recorrimos parte de donde se encontraba esta hermosa flor por el valle de colchagua 💋

(San Fernando - Placilla - Nancagua y Santa Cruz)

#dedaldeoro #flor #flores #floressilvestresdelcampo #chile





Cortaderia selloana

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Common names: pampasgrass; white pampasgrass

Cortaderia selloana (pampasgrass) is a large perennial grass (family Poaceae) found along the coast of California, and in the Coast Ranges, Central Valley, Western Transverse Ranges, and Mojave Desert. Pampasgrass favors dunes, bluffs, coastal shrublands and marshes, inland riparian areas, and disturbed areas. It was introduced as an ornamental plant and for erosion control. Each plume produces up to 100,000 seeds that are widely dispersed by wind and develop without fertilization. Pampasgrass quickly colonizes bare ground, but establishment is generally poor where the seedlings must compete with other grasses or sedges.

Cal-IPC Rating: High @ CDFA Rating: None @



Comparison Chile-California

Do climatically similar regions contain similar alien floras? A comparison between the mediterranean areas of central Chile and California

Alejandra Jiménez^{1,4}, Aníbal Pauchard^{1,4*}, Lohengrin A. Cavieres^{2,4}, Alicia Marticorena² and Ramiro O. Bustamante^{3,4}

Taxa	Chile	California	Exclusive to Chile	Exclusive to California	Shared	Total
Families	69	128	2	27	65	132
Genera	301	571	26	235	275	610
Species	593	1212	139	746	491	1376

California has a higher number of non-native species from more diverse origins.



Comparison Chile-California



Figure 6 PCA ordination of latitudinal bands in Chile (circles) and California (triangles), based on the composition of their alien floras at the species level.



Non-native floras are different and there is segregation even when only considered shared species

Invasive Fabaceae in Chile and California







Impacts of invasive Fabaceae: *Genista monspessulana* and fire





Acacia dealbata (Hirsch et al. 2021)



Complex results – multiple mixtures – probably secondary introductions Cluster: Chile, California, Portugal, Magadascar





Pines in Chile

Natives to North America invasive in South America

Pinus contorta in the world.

- One of the most invasive commercial species.
- Invades temperate cold and dry environments, even at high elevations.



Pinus contorta invasion in the Chilean Patagonia: local patterns in a global context

Bárbara Langdon · Aníbal Pauchard · Mauricio Aguayo

Pinus contorta as a model species



NATIVE

INTRODUCED

(Gundale et al. 2014)

Pinus contorta: a model species for studying Invasion impacts





Local reduction in plant diversity



Fig. 3 Relationships between pine canopy area and (a) impact on richness, and (b) impact on cover for the Patagonian steppe (*white circles*) and the *Araucaria araucana* forest (*grey circles*) sites. Impact is expressed as the mean percentage reduction or increase in richness or cover in 'Under canopy' plots compared *Author's personal copy*

to 'Outside canopy' plots (100%). Negative values indicate a lower species number (or cover) in under canopy plots, and positive values indicate the opposite. The coefficient of determination (R^2) and the regression formula are reported

Biol Invasions DOI 10.1007/s10530-016-1344-6

ORIGINAL PAPER

Pine invasion impacts on plant diversity in Patagonia: invader size and invaded habitat matter

Jorgelina Franzese · Jonathan Urrutia · Rafael A. García · Kimberley Taylor · Aníbal Pauchard



Reduction in species richness* was steeper in the Patagonia Steppe compared to the Araucaria forest.

*Cover, very similar effect CONTEXT DEPENDANCY Reduction is stronger in sites where trees are naturally absent. Novel life form





Pinus contorta reduces plant diversity in the community (but more when is nonnative)

Diversity and Distributions, (Diversity Distrib.) (2016) 1-11

BIODIVERSITY

RESEARCH



Native versus non-native invasions: similarities and differences in the biodiversity impacts of *Pinus contorta* in introduced and native ranges

Kimberley T. Taylor^{1*}, Bruce D. Maxwell¹, Aníbal Pauchard², Martin A. Nuñez³ and Lisa J. Rew¹

Impacts on fire regimes?



HEMISPHERIC VIEW







INVADED





REMOVED



Pine impacts and legacies

Pine biomass changes **light and microclimate**, and reduces **species diversity** and more so in treeless environments.

Impacts are ecosystem dependent (steppe vs. Araucaria forest)

Legacies are strong and impacts do remain

The more advanced the invasion the lower the recovery (spp richness and abundance).

Monitoring needed to understand the trajectories, e.g. potential for re-invasion; fire regimes.



How similar is this for other tree invasions? What can we learn for management?

International Networks

To solve GLOBAL issues We need them!!



The Mountain Invasions Research Network



How consistent are elevational nonnative species richness patterns?



- Species richness decrease with elevation in all regions.
- Peak richness always in lower third of the elevational range.



Alexander 2016





Assessment of invasive alien species and their control

Aníbal Pauchard (Chile), Helen Roy (UK) and Peter Stoett (Canada)







Food and Agriculture Organization of the United Nations



www.ipbes.net





Science and Policy for People and Nature

The IPBES IAS global assessment: more than 80 authors

Invasive species are a global problema and required a global coordinated effort







¡Gracias!

<u>www.lib.udec.cl</u> <u>www.mountaininvasions.org</u> <u>www.ipbes.net</u> lib.udec.cl