

**Predicting the potential impacts of new pasture  
and amenity legumes on temperate natural  
ecosystems**

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## Abstract

There is a desire to source novel legume species to combat the threat of dryland salinity to agriculture and the environment. There are already many legume weeds in temperate Australia and the potential negative impact of new species has created a justifiable impasse. Weed risk assessment presents a potential solution, but deficiencies in the current Australian system have hampered progress thus far. A greater emphasis on the impact of the weed species may be a means of solving this conflict. Therefore, this project attempted to predict the level of impact that a legume species would have upon temperate natural ecosystems.

The weed impact of exotic legume species in natural ecosystems was determined by distributing a questionnaire to experts. Respondents reported that woody perennial legumes were more important than herbaceous legumes. Field measurements demonstrated that the abundance of legumes was correlated with their perceived impact in natural ecosystems. Thus, two test species lists were compiled, one of woody species and the other herbs. The woody species comprised three impact levels: major, moderate and no impact. The herbaceous species also comprised three lower impact levels: consequential, inconsequential and no impact. The identification of legume species with differing levels of impact subsequently allowed them to be compared with respect to a number of biological traits, with the aim of distinguishing impact groups based on these traits.

Seedling growth was examined in the glasshouse under both high and low soil moisture. With high soil moisture, major and moderate impact legumes were distinguished by having a higher specific root length than no impact legumes. Consequential impact herbaceous legumes had lower specific leaf area than the lower impact groups. Moisture stress did not alter the comparisons between impact groups.

Five reproductive traits were explored through a mixture of experimental, field sampling and literature research. Major and moderate impact legumes had a shorter juvenile period, higher seed dormancy, a smaller seed mass and higher seed production than no impact legumes. Major and moderate impact legumes could be differentiated by their seed mass and seed production. Consequential and inconsequential impact herbaceous species had higher seed production and seed dormancy than no impact species.

To allow for important interactions with the environment, the ability of the test legumes to establish in temperate natural ecosystems with and without physical disturbance was studied. This provided some test of the conclusions reached from individual trait studies. The highest impact legumes were the most successful at establishing in the natural ecosystems studied. Disturbance had a positive effect on establishment, except for the major impact group where disturbance was not important.

This study was able to highlight that for a legume to successfully naturalise in temperate Australia it must possess certain biological traits. Less success was achieved in distinguishing naturalised legumes of differing impact. However, growth form is important and seed mass appears a significant trait in regard to woody species. Both are easily measured traits and could be incorporated in weed risk assessment of legumes in the future.

## **Declaration**

I hereby declare that the work in this thesis has been carried out by myself and does not incorporate any material previously submitted for a degree or diploma in any university or other tertiary institution. To the best of my knowledge and belief it does not contain any material previously written or published by another person except where due reference is made in the text.

I give consent to this copy of my thesis, when deposited in the University library, being made available in all forms of media, now or hereafter known.

Jason Emms

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