Making smart use of woody alien plants

Emilio Badalamenti & Tommaso La Mantia

Department of Agricultural, Food and Forest Sciences (SAAF) - University of Palermo - Viale delle Scienze Ed. 4, 90128, Palermo, Italy; e-mail: emilio.badalamenti@unipa.it, tommaso.lamantia@unipa.it

ABSTRACT

It is unquestionable that some alien woody plant species are a major issue for biodiversity conservation. However, being alien species generally adapted to warmer conditions than natives, they could be particularly suited to cope with the new environmental and climatic conditions that are also forecasted in the coming decades in Sicily. This poses an issue that is not easy to deal with, whether trying to use these species for the advantages they could bring, for instance in the new reforestation activities, while avoiding them becoming a serious problem for biodiversity conservation in natural and seminatural areas. Here, we present some study cases of non-native tree species which represent emblematic examples in that regard: Acacia saligna and A. cyclops, Eucalyptus spp., Leucaena leucocephala, Opuntia ficus-indica and Ailanthus altissima. These tree species are very invasive in some ecological contexts, while being useful to meet ecological services in others. A sound planning activity could help distinguish where planting these species could be not only possible but also desirable, from areas where their presence should be totally avoided.

INTRODUCTION

The spread of alien plants has assumed increasingly greater proportions in recent decades, thanks to the increase in global trade and human population, but also to the alterations and therefore the fragility of the habitats that host them (Grittì et al., 2006; Gallardo et al., 2024; Peller & Altermatt, 2024).

The spread of alien plants occurs to the detriment of native plants and therefore translates into a loss of biodiversity and not, as it is sometimes trivially written, into an overall advantage for species and ecosystems (La Mantia, 2020). However, just because of climate change effects and the large-scale alteration of soils, non-native trees, which have evolved in different environmental contexts, can also represent a resource for various purposes not only productive, including the recovery of degraded environments (Quatrini et al., 2003). It is necessary to develop adequate methods for the management of these species to avoid making mistakes which will then be difficult to remedy. In this research, we performed a historical analysis of the main alien woody species present in Sicily in forest or agroforestry systems. Species used in agriculture were therefore excluded (Citrus spp. for example), with the exception of the prickly pear (Opuntia ficus-indica (L.) Mill.) which is not a woody species. Herbaceous species were excluded because their control is absolutely aleatory, and, although they have a great potential, their management or, better, their confinement, appears impossible (for example: Cenchrus setaceus (Forssk.) Morrone, Pasta et al., 2010).
markedly thermoxerophilous environments also be -cause of its higher resistance to aridity compared to *A. saligna* (Pasta et al., 2012). The observations made in Lampedusa, certainly an ideal experimental site for the study of desertification processes in the Mediterranean (see LIFE DesertAdapt project: http://www.desert-adapt.it/index.php/it/), confirm the role of improving soil fertility, while posing risks to biodiversity (Badalamenti et al., 2014).

**Eucalyptus spp.**

*Eucalyptus* spp. were introduced to Sicily and to other parts of Italy and the world initially for their extraordinary ability to use water by drying up swamps and therefore making them less hospitable to malaria vector mosquitoes (La Mantia, 2013). The “discovery” of a forestry potential came later and, as it has now been established, was also the result of overestimations if not mystifications (La Mantia, 2013; Badalamenti et al., 2020b). Over the decades, some species have shown an ability to adapt which has led to evident naturalization phenomena; this especially affected *Eucalyptus camaldulensis* Dehnh., commonly known as the river red gum, that showed strong invasive characteristics especially in rivers (Badalamenti et al., 2018b). Nonetheless, the species is one of those most suitable for producing wood in Sicily (Badalamenti et al., 2020b); some caution is therefore necessary in choosing the places where to plant it which must be sufficiently far from rivers. It is also necessary that the planting systems preserve soil fertility, therefore favoring mixed plantings with the presence of legumes.

**Leucaena leucocephala**

The condition of Sicilian pastures is generally highly degraded and there is a lack of active management policies for degraded pastures, which, due to the spread of non-pabular species and fires, are becoming increasingly degraded. Research is identifying management techniques for silvopastoral systems suitable for guaranteeing the productivity of pastures but also the conservation of the environmental and ecosystem values that they preserve (Bianchetto et al., 2015; Bueno et al., 2023). However, this research concerns the pastures affected by secondary successions while it is the degraded pastures, especially *Ampelodesmos mauritanicus*
Making smart use of woody alien plants

(Poir.) T. Durand & Schinz grasslands, which, for the reasons mentioned above (overgrazing and wildfires), need immediate interventions, including the use of improving species such as legumes. In this context, woody exotics such as the acacias seen above, but also *Leucaena leucocephala*, a highly invasive species but of great interest (Badalamenti et al., 2020a, 2022) for use as a forage species, can play an important role. The management of the species to reduce its invasive potential appears easy where the species is prevented from distributing the seeds, and this can be obtained considering that the animals are fond of green legumes. The observations made (Badalamenti and La Mantia, personal data) show that, at the moment, the species has only spread in marginal areas not subject to grazing such as roadsides and abandoned places, while no spread phenomena are known in grazed areas.

*Opuntia ficus-indica*

*Opuntia ficus-indica* is an alien species which, due to its wide diffusion and importance in Sicily, is part of the iconography of the island. However, the widespread diffusion in cultivation makes the inclusion among alien species almost a stretch. The species spreads spontaneously because the seeds are spread by birds, but it is overwhelmed by native vegetation (shrubs and trees) when this is not subject to disturbance and can evolve. Only in some peculiar contexts it is invasive and actually harmful to the spontaneous flora, such as in the south-facing cliffs of various areas of Sicily. The fact of being a cactus, however, makes it suitable for growing in conditions of strong environmental aridity where it also manages to play a facilitating role in secondary succession processes, favouring the establishment of native woody species, both shrubs and trees (Fig. 1) (Bueno et al., 2024).

*Ailanthus altissima*

A controversial case is that of tree of heaven (*Ailanthus altissima*), the species that more than any other is linked to the concept of invasive alien species. In fact, for these reasons, it has been in-
cluded among the invasive species of Union concern pursuant to the Invasive Species Regulation 1143 of 2014 and, as such, it is effectively a prohibited species throughout the territory of the European Union. Therefore, it has been excluded from this list because it cannot be used. However, given its widespread diffusion and high productivity (unpublished data), we provide a brief description. It is the non-native tree species that has undergone the most rapid spread in Sicily (Badalamenti et al., 2012) and is the most dangerous for native habitats, including forests (Campagnaro et al., 2022) (Fig. 2). The reason for this success also depends on the biological strategies adopted by the species (Badalamenti et al., 2015b; Ciolfi et al., 2023). Some control techniques have been developed and tested (Badalamenti & La Mantia, 2013; Badalamenti et al., 2015a); however, the species that has now invaded also natural environments sees the city and its suburbs as the original source of diffusion. The species should therefore be totally eradicated, only then we could think about the possibility of developing techniques for the sustainable use, but exclusively of male plants (unpublished data).

CONCLUSIONS

The conservation of biodiversity is a global priority and, certainly, the spread of alien species is one of the major threats to this goal (Stohlgren et al., 1999; Badalamenti et al., 2018b; La Mantia, 2020; Castro-Diez et al., 2021), also affecting forest habitats (Campagnaro et al., 2022; Sitzia et al., 2019). However, climate change itself forces a scientific and non-dogmatic approach to evaluating the risks and opportunities of alien woody plants. The recent ban on the use of prickly pear in a project to combat desertification on an island where the prickly pear is widely cultivated is an example of a non-scientific approach to the problem. It is certainly necessary to avoid introducing new alien species that can potentially escape control even if they have apparent positive potential, for instance herbs and shrubs.

REFERENCES

Badalamenti E. & La Mantia T., 2013. Stem-injection of herbicide for control of Ailanthus altissima (Mill.)


Badalamenti E., Sferlazza S., La Mela Veca D.S., Maetzke F., Sala G. & La Mantia T., 2020b. Which are Southern Italy’s fastest growing tree species? Lessons from the past for future perspectives, with a special focus on Sicily. Annals of Silvicultural Research, 45: 31–43.


Gallardo, B., Bacher, S., Barbosa, A. M., Gallien, L., González-Moreno, P., Martínez-Bolea, V., Sorte, C.,


