

# Potential threat to Mediterranean forest ecosystem services by invasive species

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Logging for fuel and construction has taken place since ancient times around the Mediterranean Rim. *Cupressus* and *Juglans* were no doubt planted for timber production while *Quercus*, *Abies* and *Pinus* were the harvested native species.

For centuries, ancient forest stands were maintained by coppicing and good forestry management. Then from 1960 onwards, Short Rotation Forestry (SRF) was launched across Europe. Fast-growing trees are cultivated in dense stands (1,000-2,000 plants/hectare) and harvested every 3-4 years for their wood, generally utilised as fuel. Plantations are normally found on agricultural land or degraded areas outside traditional forests. Over the last 10 years, forestry for bioenergy has grown in the guise of SRF, in part due to greater energy demand in industrialised countries, geopolitical instability linked to the fossil fuel market, concerns about global warming and the need for 'carbon neutral' energy. Beyond national and regional support, the EU's Common Agricultural Policy (CAP) subsidises plant biomass production from agriculture and forestry to produce bioenergy.

However, questions remain. SRF needs to be more environmentally sustainable, for reasons including food security, loss of soil fertility and (in)direct land use change. Aggressive SRF genotypes, once they escape, impact strongly on ecosystem services and biodiversity, also harming (semi-)native and remnant forest stands, including alteration of their natural regeneration/dissemination.

## Tracking invasiveness

Many biofuel tree/shrub species proposed for bioenergy production are selected for precisely the same traits which make invasive species successful. Several species are, in fact, already considered invasive 'elsewhere'. In any case, a precautionary principle should be applied, even if there is no immediate evidence of escapes. It should also be considered that newly-introduced species, after planting, may take a long time to escape, spread and establish themselves. For these reasons, species/genotypes used for SRF should be subject to pre-entry weed risk assessments before cultivation and to a post-entry monitoring programme for those species that passed the initial risk assessment.

## European Policy

One of the EU's main energy policy targets is to increase sustainable energy sources. In 2009, the EU adopted a Directive (2009/28/EC) to promote the use of renewables. While the directive does not directly address the risks of introducing invasive species into Europe through the importation or cultivation of biofuels, it does call on member states to monitor the impact of biomass cultivation through such indicators as land use changes, including displacement and introduction of invasive alien species, and other effects on biodiversity. Furthermore, the Bern Convention recently adopted a recommendation (n. 141/2009) on 'Potentially invasive alien plants being used as biofuel crops'. Contracting Parties should avoid the use of species that are already considered

invasive in the region, screen for invasiveness of new species and genotypes, monitor the possible spread of biofuel crops into natural habitats and introduce appropriate mitigation measures to limit crop escapes. EU CAP (Common Agricultural Policy) subsidies are linked to the respect of the environment; however, not all the direct support schemes for farmers comply with the European legislative framework on invasive species (cf. Table).

## Assessment of invasiveness

Several countries have adopted formal risk assessments to identify high-risk species, facilitate decision-making on prevention and eradication and, ultimately, to avoid ecological and economic harm. In particular, the International Plant Protection Convention (IPPC) and European and Mediterranean Plant Protection Organization (EPPO) were involved in the development of a 'Pest Risk Analysis' to assess the potential spread of a pest or disease for member states under the ISPM (International Standard for Phytosanitary Measures). The Australian Weed Risk Assessment System -AWRAS- ([www.daff.com.au](http://www.daff.com.au)) has, however, been used for longer and more widely than any other predictive model for invasive plants and has recently been validated for Mediterranean Europe. The AWRAS worksheet application is based on 49 questions involving several life history traits and generates a numerical score correlative to the invasive potential of that species. The outcome can be used to accept/reject the species for importation, or as a management tool for identi-

fyng the traits that are most responsible for the invasiveness. Assessment should be used as a screening tool for preventing cultivation of new, or not widely planted, SRF species that could become invasive.

It is particularly recommended for regions that intend to introduce a new SRF cultivation system. In fact, simply changing the climate and soil parameters, and assessing the invasiveness capacity from cultivar selection, is enough to assess the potential invasiveness of an alien species in a specific region.

ISPRA (the Italian Institute for Environmental Protection and Research) has adapted the AWRAS (with a second screening procedure) for Central Mediterranean Italy and screened six phanerophyte species proposed for bioenergy (cf. Table); the results show that all of them have the potential to become invasive species: of these, some are already recognised as weeds, both in Italy and elsewhere in Mediterranean-type regions, while others, i.e. *Jatropha*, are not yet widely farmed. In particular, the latter species showed evidence of escape into and invasion of natural ecosystems in tropical regions (i.e. East Africa). However, with the aim of establishing a forest system for the production of oil field experiments are underway in regions with Mediterranean ecosystems such as Sicily and Spain on the agronomic res-

ponse of the *Jatropha* species/genotypes.

### Minimising establishment risk

To regenerate/disseminate, a species needs to be able to disperse and find a suitable site for germination and seedling establishment. Therefore potentially invasive SRF species should not be planted close to sites that can act as source systems, stepping stones, or ecological corridors. Such favourable sites include abandoned land, disturbed areas or river banks. SRF, in fact, is often developed near rivers, with water systems acting as pathways for propagules. Consequently, between the crop field and natural vegetation, or ecological corridors which act as pathways, a buffer zone should be established to act as a specific biological barrier to the invasive SRF crop. Within farmlands, the buffer zone can be maintained with other (non-invasive) plant cover or through periodic ploughing. Buffer zones need to be specific (to reduce only the dispersion of the undesired germoplasm<sup>1</sup>) and be calibrated according to the potential invasive capacity of the crop. The width of the buffer zone should be a function of the distance of dispersal of the species while the intervals between ploughing should be based on the invasive species' minimum regenerative time. In the case of *Ailanthus altissima* plantations, for example,

a wide buffer zone of 100 metres should be ploughed at least once every three years to reduce the likelihood of establishment of the species. The probability of an invasive crop species establishing itself in a natural habitat increases with the number of propagules and their dispersion capacity; it decreases according to the distance between the SRF and the natural habitat (cf. Figure).

Specific cultivation measures should also be taken into account to reduce the chance of SRF crop species becoming invasive and harming Mediterranean forests; for example, use of sterile cultivars, planting cuttings only from purely male/female trees (in case of dioecious species), mechanical removal of inflorescences, harvesting before seed development, use of germoplasm lines that reduces seed viability and germination. It is also important to limit any escape of propagules during harvesting, storage and transportation. Following such simple precautions will help to preserve Mediterranean forests for our future generations.

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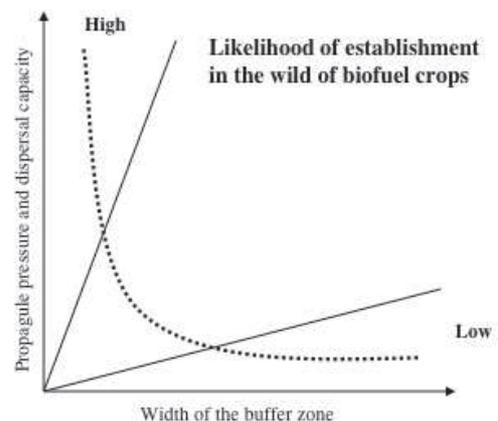
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<sup>1</sup> Germoplasm: collection of genetic resources for an organism. For plants, the germoplasm may be stored as a seed collection or, for trees, in a nursery.

Species	WRA score	WRA outcome	2 <sup>nd</sup> screening	Established cropping system in Italy	CAP direct support schemes for farmers (EC) N. 73/2009			Family
					Es	Fr	It	
<i>Jatropha curcus</i>	15	rejected		no				Euphorbiaceae
<i>Acacia saligna</i>	12	rejected		no		√		Leguminosae
<i>Ailanthus altissima</i>	17	rejected		yes				Simaroubaceae
<i>Melia azedarach</i>	12	rejected		no				Meliaceae
<i>Paulownia tomentosa</i>	4	evaluated	further evaluation	yes	√		√	Bignoniaceae
<i>Robinia pseudoacacia</i>	16	rejected		yes		√	√	Leguminosae

Table Weed Risk Assessment undertaken on some of the species proposed for SRF cultivation in the Mediterranean Basin. WRA scores and outcomes (source ISPRA 2009; Crosti R., Cascone C., Cipollaro 2009. Use of a weed risk assessment for the Mediterranean region of Central Italy to prevent loss of functionality and biodiversity in agro-ecosystems. Biological Invasion).

\* (EC) N. 1120/2009 entitles CAP decoupling payments also for areas used for SRF, allowing Member States to define suitable varieties. Es Spain; Fr France; It Italy.





# The Latest on Mediterranean Forests

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## Editorial



The *Groupe Inter-académique pour le développement* (GID) ([www.g-i-d.org](http://www.g-i-d.org)), set up in 2007 under the French law for associations, is an association working for development. It brings together academic institutions and learned societies, including the *Académies* (Societies) for Science of France, Morocco, Senegal and Turkey, the different French *Académies* for Medicine, Agriculture and Technology, the Arabic Academy for Water, along with other bodies such as the Alexandrian Library and the French National Development Agency. The GID's aim is 'to contribute to enhancing knowledge and competence in developing or emerging countries' through the 'reinforcement of the links between science, professional activities and public expectations... or, stated otherwise, to share knowledge and understanding in a perspective of excellence, impartiality and independence.'

The association's five main programmes involve, in whole or in part, all the countries of the Mediterranean Rim. This is notably so for the Parmenides series of Mediterranean scientific conferences (named after the Ancient Greek philosopher) of which the first, held in Paris in 2008, centred on agriculture, the marine environment and climate change, followed by the Rome conference in 2009 whose theme was human health.

The aim of the third conference, organised in Alexandria on June 22-24 2010, was to take a proactive look at the future concerning the interdependence of biological and cultural diversity, focusing on the three topics central to Mediterranean development: trees (and woodland and forest ecosystems), fish and books. The 'tree' conference was structured around four papers on, respectively: the assessment and monitoring of Mediterranean woody plant formations (FAO), the biodiversity of woody plants (a group of French scientists), woodland areas: economy and policies (Plan Bleu-EFIMED), institutions and governance (Moroccan Secretary of State for Water, Forests and the Fight against Desertification). The paper presentations were rounded out by workshop discussions on the themes of education, research, remote sensing, international cooperation and the role of NGOs (this last theme introduced by the president of the AIFM).

The substance of the conclusions and recommendations of the 'tree' conference, reproduced in this number of the magazine, will no doubt be familiar to AIFM members. But the aim of the conference was not to preach to the converted, as all of us here are. Rather, it was to bring to the attention of leading figures in the scientific and cultural communities of the Mediterranean countries, and through them to raise the awareness of political decision-makers, about the all-too-often underestimated gravity of the degradation of Mediterranean woodland areas and its impact on the Mediterranean peoples. And, hence, the research and development programmes needed to tackle the related problems. From this point of view, the conference made a useful contribution, and it will prove that much more useful if its recommendations benefit from a real follow-up, which was commented during the 2<sup>nd</sup> Mediterranean Forest Week in Avignon.

Jean-Paul Lanly  
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