

# BIOFUEL CROPS AND THE USE OF NON-NATIVE SPECIES: MITIGATING THE RISKS OF INVASION

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## **CONTEXT**

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Many countries are currently looking at growing high-yielding crops for the production of biofuels as alternatives to traditional fuels (petrol and diesel) to address imminent energy shortages and reduce impacts of climate change. This usually involves the importation of foreign (i.e., alien) species of plants that are known for their fast and productive growth. If these initiatives are not carefully assessed, however, promoting the cultivation of some popular species for biofuel production will increase two of the major causes of biodiversity loss on the planet: clearing and conversion of yet more natural areas for monocultures, and invasion by non-native species.<sup>1</sup>

Habitat conversion is already the leading cause of biodiversity loss worldwide, and limiting the enthusiastic cultivation of new crops to areas already converted is not an easy task. The issue addressed here, though, is that some of the most commonly recommended species for biofuel production, particularly for biodiesel, are also major invasive alien species in many parts of the world. Thus, their likelihood of becoming invasive needs to be assessed before being cultivated on a large-scale for biofuel production in new areas. Some of these species are spread by birds, small mammals and other animals, making their control difficult or impossible, with impacts increasing over time and long-term production prone to greater financial losses than gains.

This note provides basic information and recommendations for proposals on biofuel developments using species that may have a history of invasion and so require careful management if they are to be used on a large scale and not contribute to natural habitat and biodiversity loss.

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<sup>1</sup> Chapin III, F.S., E. S. Zavaleta, V. T. Eviner, R. L. Naylor, P. M. Vitousek, H. L. Reynolds, D. U. Hooper, S. Lavorel, O. E. Sala, S. E. Hobbie, M. V. Mack & S. Díaz. 2000. Consequences of changing biodiversity. *Nature* 405: 234-242.

## **RECOMMENDED ACTIONS**

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The Global Invasive Species Programme has identified actions to avoid impacts on biodiversity from the use of inappropriate species for biofuels and is ready to provide further support to countries on this issue. Specifically, the development of biodiesel production projects should consider:

- **Information gathering:** check national noxious weed lists, databases and websites for references relevant to the countries where biofuel developments are proposed;
- **Risk assessment:** use formal risk assessment protocols to evaluate the risk of invasion by species in biofuel proposals, with particular attention and support to countries with less experience in addressing biological invasions or screening for impacts on biodiversity;
- **Benefit/cost analysis:** conduct market studies and presenting business plans that can show real benefits for the proposed activities before funds are made available, as there are many known cases of introduced species that have never achieved commercial value (but still remained as actual or potential problems);
- **Selection of native or low risk species:** create incentives for the development and use of native and/or non-native species that pose the lowest risks to biodiversity;
- **Risk management:** include monitoring and contingency planning (e.g., control in cases of escape) in proposals for biofuels (particularly biodiesel). Control procedures have to be viable and well-tested, so invading species that are normally dispersed by animals and other active means must not be used without tested contingency plan for escapes; and
- **Certification/accreditation processes:** evaluate project proposals according to criteria and/or certification schemes for sustainable biofuels development (a number of such processes are underway at the national and international levels).



The Global Invasive Species Programme recommends that countries do not develop activities that are based on the use of known potentially invasive alien species for biofuels production programmes. The risks to biodiversity are just too great. Recognising the reliance on biodiversity by many millions of people, especially in developing countries, GISP feels that risk assessment, monitoring and contingency planning are justified and should be mandatory for the support of projects to grow biofuels *en masse*. These actions are because the inadvertent introduction of alien species that could become invasive may result in diminished livelihoods, reduced development and more inroads into biological diversity.

## **GLOSSARY**

Native species: species or genotype that is indigenous to a country or area.

Non-native or alien species: species, subspecies or lower taxon, introduced outside its natural past or present distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce (CBD Decision VI/23).

Invasive alien species: alien species whose introduction and/or spread threaten biological diversity (CBD Decision VI/23).

Introduction: the movement by human agency, indirect or direct, of an alien species outside of its natural range (past or present). This movement can be either within a country or between countries or areas beyond national jurisdiction (CBD Decision VI/23).

## **SOURCES OF FURTHER INFORMATION ON INVASIVE ALIEN SPECIES**

Global Invasive Species Database (<http://www.issg.org/database>)

Global Invasive Species Programme (<http://www.gisp.org>)

IABIN Invasive Species Information Network (<http://i3n.iabin.net>)

## **CONTACT INFORMATION**

Dr. Sarah Simons, Executive Director, Global Invasive Species Programme  
tel: +254 (20) 722 4461; eml: [s.simons@gisp.org](mailto:s.simons@gisp.org)

Dr. Stas Burgiel, Policy Director, Global Invasive Species Programme  
tel: +1 703 841 2047; eml: [s.burgiel@gisp.org](mailto:s.burgiel@gisp.org)

## SPECIES USED OR CONSIDERED FOR BIOFUEL PRODUCTION AND THEIR POTENTIAL RISK

The following species are listed in different countries as species recommended for biofuel production, and pose risks at different levels. As all species are native to some ecosystem, the choice of using native species or non-invasive species is the best alternative.

**Categories are:**

- 1 - Species being cultivated and already known to be invasive
- 2 - Species being cultivated but not yet expressed as invasive
- 3 - Species that are not prone to invasion

Species	Common name	Native range	Habitat type	Invasive in	Vectors	Category	Reference
<i>Amelanchier canadensis</i>	Serviceberry	North America, Europe, Asia	temperate forests	United States	Animals	1	Biomass 9 (1986) 49-66
<i>Artocarpus communis</i> , <i>A. altilis</i>	Breadfruit	Pacific Islands, Southeast Asia		Fiji, Kiribati, Line Islands		1	<a href="http://www.hear.org/pier">www.hear.org/pier</a>
<i>Arundo donax</i>	Giant reed, Oboe reed, E-grass, bamboo, danubian reed, elephant grass, giant danube reed, spanish reed	Eurasia	Wetlands and riparian areas	United States, Mexico, the Caribbean, Southern Europe, South Africa, Thailand, Australia, New Zealand, Hawaii	Water (vegetative spread)	1	Global Compendium of Weeds, The weedy truth about biofuels (Invasive Species Council)
<i>Azadirachta indica</i>	Neem	India, Burma, Sri Lanka, Myanmar, Bangladesh	Arid lands	West Africa; Australia, Fiji, Mauritius	Birds, Bats	1	Global Compendium of Weeds
<i>Brassica napus</i>	Rapeseed/canola	Eurasia	Well-drained soils	Australia, Ecuador, Fiji, Hawaii, New Caledonia, Galapagos Islands		1	<a href="http://ww.hear.org/Galapagos">ww.hear.org/Galapagos</a>
<i>Camelina sativa</i>	False flax	Eastern Europe and Southwest Asia	Well-drained soils	North America, Western Europe, Australia, Central America, South America, Japan		1	Feb. 2007 Biodiesel Magazine
<i>Cocos nucifera</i>	Coconut	Unknown		Australia, United States, Micronesia, Japan		1	
<i>Crataegus</i> spp.	Hawthorn	North America, Europe, Asia		Australia, United States	Birds, mammals, insects	1	Biomass 9 (1986) 49-66

			Bottomland swamps, along stream banks, in upland forests, in fields, pine woods, and dry scrub lands				
<i>Diospyros virginiana</i>	Persimmon	Eastern United States			Animals	1	
<i>Diospyrus kaki</i>	Oriental persimmon	China, Japan			Insects	2	Biomass 9 (1986) 49-66
<i>Elaeis guineensis</i>	African oil palm	West Africa (Madagascar)	Tropical riparian forests	Brazil, Micronesia, Florida USA	Animals	1	
<i>Gleditsia triacanthos</i>	Honeylocust	Eastern North America	Forests	Central Argentina, South Africa, Australia, USA, New Zealand	Insects	1	
<i>Jatropha curcas</i>	Physic nut, Barbados nut, curcas bean, purge nut, purging nut, tuba	Tropical America	Arid and semi-arid lands	Australia, South Africa, United States, Pacific Islands, India, Brazil, Fiji, Honduras, Panama, El Salvador, Jamaica, Puerto Rico and other parts of the Caribbean, Florida, Hawaii Islands, the Galapagos Islands and Australia	Water and in mud on vehicles and machinery or animals	1	DWAF - South Africa, The weedy truth about biofuels (Invasive Species Council)
<i>Maclura pomifera</i>	Osage orange	Central United States	Well-drained soil	Europe, USA, Australia, South Africa	Animals	1	
<i>Miscanthus</i> spp. ( <i>Miscanthus x giganteus</i> , <i>M. sacchariflorus</i> , <i>M. sinensis</i> )	Chinese silvergrass, Amur silvergrass	East Asia	Well-drained soil	Australia, North and South America, Europe and Asia	Wind	1	The weedy truth about biofuels (Invasive Species Council)
<i>Moringa oleifera</i> / <i>Moringa pterygosperma</i>	<i>Moringa oleifera</i> , Ben-oil tree, horseradish tree, ben nut, drumstick tee, sprokiesboom	India	Dryer areas from sea level to 250 m	Tropical Africa, tropical America, Sri Lanka, India, Mexico, Malaysia, Philippines and Australia		1	The weedy truth about biofuels (Invasive Species Council)
<i>Morus alba</i>	Mulberry	Asia		Brazil, Ecuador, United States	Animals	1	Biomass 9 (1986) 49-66

Olea europaea	Olive tree, Olea europaea ssp. africana, Olea europaea ssp. cuspidata, Olea europaea ssp. Europaea, African olive, common olive, European olive, olive tree, small-fruited olive, wild olive	Mediterranean Europe	Dry areas	Australia, Hawaii, New Zealand	Animals (birds and foxes)	1	The weedy truth about biofuels (Invasive Species Council)
Panicum virgatum	Switch Grass	United States, Central America	Prairies and open ground	Hawaiian Islands	Wind	1	
Phalaris arundinacea	Reed canarygrass, swamp phalaris	Europe, Asia, North America	Wetland	United States, South Africa, Australia, New Zealand, Chile, most temperate countries	Wind, water	1	The weedy truth about biofuels (Invasive Species Council)
Populus spp. (P. alba, P. nigra)	Poplars	Eurasia, Africa	Riparian areas	Australia, New Zealand		1	The weedy truth about biofuels (Invasive Species Council)
Prosopis spp. (Prosopis juliflora)	Mesquite	America	Arid and semi-arid lands	Eastern Africa (Sudan, Eritrea, Ethiopia, Djibouti), Southern Africa, India, Australia	Animals, wind	1	
Quercus acutissima	Sawtooth oak	Eastern Asia, Korea, Japan, China		North America, Europe	Wind, squirrels	1	Biomass 9 (1986) 49-66
Ricinus communis	Castor bean, castor oil bush, palma-christi	East Africa and Asia	Riparian areas	Many countries - Brazil, Australia, Pacific islands, New Zealand, South Africa, Mexico, United States, Western Europe	Animals and water	1	The weedy truth about biofuels (Invasive Species Council)
Rubus cf. fruticosus	Blackberry	North America and Europe	Forests and prairies	One of Australia's 20 top weeds, New Zealand, South Africa, Western Europe, United States	Animals	1	Biomass 9 (1986) 49-66
Rubus idaeus	Raspberry	Eurasia	Forest clearings or fields	Western Europe, Australia, Eastern Europe, New Zealand		1	Biomass 9 (1986) 49-66

<i>Sambucus canadensis</i>	Elderberry	Central and North America	Riverbanks and forest edges, swamps	Australia	Birds	1	Biomass 9 (1986) 49-66
<i>Sapium sebiferum/Triadica sebifera</i>	Chinese tallow	China, Japan	Wetlands and riparian areas	United States, Australia, Puerto Rico	Birds	1	The weedy truth about biofuels (Invasive Species Council)
<i>Salix</i> spp.	Willow	Europe	Wetlands and riparian areas	Australia, United States		1	The weedy truth about biofuels (Invasive Species Council)
<i>Spartina</i> spp. ( <i>S. pectinata</i> , <i>S. anglica</i> )	spartina	North and South America, Europe and Africa	grow on mud in brackish wetlands and saline riverbanks in temperate regions	Australia	Water	1	The weedy truth about biofuels (Invasive Species Council)
<i>Sorghum halepense</i>	Johnson grass	Mediterranean to India	Fertile lowland areas	United States, Australia, Pacific Islands, Central and South America, Indonesia, Thailand	Birds, livestock, water, wind	1	
<i>Vaccinium</i> cf. <i>angustifolium</i>	Blueberry	North America		Germany		1	Biomass 9 (1986) 49-66
<i>Viburnum trilobum</i>	Highbush cranberry	North America				2	Biomass 9 (1986) 49-66
<i>Zizyphus mauritiana</i>	Chinee apple, jujube, Indian jujube, chonky apple	India, China	Arid lands, sandy, well-drained soils and do less well in heavy, poorly drained soils	Australia, Africa, Afghanistan, China, Malaysia, northern Australia, some Pacific archipelagoes and Caribbean region	Insects and wind	1	Biomass 9 (1986) 49-66; The weedy truth about biofuels (Invasive Species Council)
<b>Low risk species</b>							
<i>Helianthus annuus</i>	Sunflower	America				3	
<i>Glycine max</i>	Soy	Unknown				3	
<i>Saccharum officinarum</i>	Sugar cane	Unknown				3	
<i>Ipomoea batatas</i>	Sweet potato	South America				3	
<i>Arachis hypogaea</i>	Peanut	Brazil				3	
<i>Triticum</i>	Wheat	Unknown				3	
<i>Sorghum bicolor</i>	Sweet sorghum	Northern Africa				3	
<i>Manihot esculenta</i>	Cassava / yuca	Brazil				3	
<i>Gossypium</i> spp.	Cotton	Unknown				3	