

Biosecurity gains from assimilating lessons from history

Alien trees have caused problems as invasive species, but Professor Dave Richardson from South Africa's Centre for Invasion Biology believes that invasions are not random, impacts can be predicted, and the bioeconomy can avoid making the same mistakes in the future, including in the quest for biofuel feedstock



Professor Dave Richardson is the Deputy Director of the Centre for Invasion Biology at Stellenbosch University in South Africa. He has performed research and published more than 180 peer-reviewed papers on the ecology and management of biological invasions.

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While exotic trees and shrubs are the foundation of forestry and agroforestry activities across the world, hundreds of species have become invasive. Some now feature prominently on national lists of invasive alien plants, and some account for the most conspicuous and damaging invasions.

South Africa has had 300 years of dealing with the importation of forestry trees and now hosts the Centre for Invasion Biology where Professor Dave Richardson is a recognised world leader in understanding plant invasions.

He says benefits that woody species provide are not in dispute. They supply food, feed, timber, pulp and firewood resources and can control erosion, sandrift and dryland salinity. But problems arise when species become invasive – when they displace and disrupt ecosystems, biodiversity, water catchments or agricultural land.

“Invasive trees that are commercially important have invaded many habitats, creating conflicts of interest,” Professor Richardson said. “They pose special problems with implications for the bioeconomy. However, solutions are possible in the form of regulatory and management practices that are built from an understanding of what drives invasiveness.”

At the Centre for Invasion Biology, the ‘nuts and bolts’ of tree invasion are studied with the goal of building analytical tools that can predict how new species are likely to behave when moved around the world.

Professor Richardson said countries like South Africa, Australia and New Zealand are in an especially good position to learn from past experience with invasive foreign plants. “We have the opportunity to use our experience and apply it to other plants all over the world.”

To build on experience in ways that deliver predictive and proactive management principles, Professor Richardson outlined a basic R&D strategy whose key components include:

- charting which species have been introduced over time and where;
- identifying attributes that distinguish invasive from non-invasive species, including factors such as the size of the area planted;
- generating spatially explicit models and mapping the spread from both a single dense dispersal site or many smaller areas; and
- correlating plant traits with ‘invasiveness’ and features of the environment with ‘invasibility’.

Plant attributes that generally facilitate invasions include small seeds with large wings, short juvenile

periods, short intervals between large seed crops and the ability to survive moderate browsing. Large plantings over long periods are also considered facilitating factors, while sparsely vegetated grass and shrub land present the most accommodating environments. But the analysis runs deeper, including factors such as soil bacteria, disease-causing fungi, wind, flooding and climate.

“Enterprises using foreign species have options available to make them safer,” he said. These include selecting less invasive species, manipulating the plant’s seed production or dispersal, and manipulating the receiving environment. For example, tree plantations in New Zealand use less invasive species at the periphery to generate a barrier to dispersal.

“It is important that the response to weedy species be seen in its specific environmental context and that it interacts with land and water-management services, agricultural enterprises and national priorities,” he said.

With woody species under consideration as second-generation feedstock for biofuel production, there is a sense of urgency to Professor Richardson’s work. The potential of biofuel species to turn invasive is real and while they present the quintessential plant biosecurity issue facing the bioeconomy, they also present the opportunity to roll out improved national and international stewardship protocols.

There may not be a one-size-fits-all fix, Professor Richardson said, and preventing the introduction of a suspect species will always offer the most stringent form of control. But the opportunity exists to minimise from the outset the risks of a species turning invasive.

“We can learn from past mistakes,” he said. “If we apply mitigating strategies very early it becomes possible to minimise damaging impacts from invasive woody species and the clean up costs. We need to proceed with caution and use wisely the information from accumulated history of exotics in the bioeconomy.”