

ANNOUNCEMENT

2010 Biotropica Award for Excellence in Tropical Biology and Conservation

The Association for Tropical Biology and Conservation and the Editors of *Biotropica* proudly announce the winner of the 2010 *Biotropica* Award for Excellence in Tropical Biology and Conservation, presented to the author of a paper published in *Biotropica* during 2009. We recognize an outstanding contribution based on original research conducted in tropical regions. Criteria includes clarity of presentation, strong basis in natural history, well-planned experimental and/or sampling design, and novel insights gained into critical processes that influence the structure and functioning of tropical biological systems.

The 2010 Award is presented to Ezekiel Edward, Pantaleo K. T. Munishi, and Philip E. Hulme for their paper entitled “*Relative roles of disturbance and propagule pressure on the invasion of humid tropical forest by Cordia alliodora (Boraginaceae) in Tanzania*” published in *Biotropica* 41(2): 171–178.

Invasive exotic species are widely regarded as one of the most serious threats to biodiversity worldwide and have been the subject of research for decades. While invasive species have wreaked havoc on many tropical dry forests and grasslands, few exotic species appear to have become naturalized in tropical wet forests. Indeed, many studies have concluded that these forests appear more resistant to invasion than other biomes, perhaps due to some combination of structural complexity and high biodiversity. However, the conventional wisdom is that this resistance to invasion will be weakened by natural or anthropogenic disturbance, which is a key factor facilitating the establishment and spread of invasive species in other regions. If so, the key to invasion in tropical wet forests is the synergistic effects of disturbance and the arrival of propagules. And that is the crux of the problem: rarely do we know when or how many individuals arrive in a site, making it difficult to account for propagule pressure when assessing the relative importance of the multiple factors promoting invasion and establishment.

In 2000, the Tropical Biology Association (TBA) invited me to teach tropical plant ecology on their month-long International Summer School in the East Usambara Mountains of Tanzania, Africa. Having never been to Africa and without any knowledge of East African tropical forests, I rather foolishly agreed. Having failed to make the transition from novice to expert in the intervening period, it was with some trepidation that I arrived in the East Usambaras late one night with twenty eager students from across Africa and Europe. In the morning my fears of appearing a complete imposter were somewhat allayed as amidst the unfamiliar forest were many recognisable tree and shrub species. These were alien species, including several of the worst invaders in the tropics. The source was the Amani Botanical Garden, a century old colonial experimental station with a strong emphasis on economic botany. It

Edward, Munishi, and Hulme have circumvented this problem in a most creative way, by studying a deliberate introduction. In the early 1900s, a 50-hectare plantation of 210 *Cordia alliodora* trees was established in the Amani Botanical Garden in Tanzania. *Cordia alliodora* is a fast-growing hardwood tree native to the Americas and valued for its timber; it produces prodigious numbers of wind-dispersed seeds and is now the dominant species in the forest mosaic surrounding the Amani Garden. Using transects that radiated from the plantation into the surrounding landscape, Edward *et al.* were able to disentangle the effects of propagule pressure (measured as distance from the invasion), local diversity, forest structure, and disturbance on *C. alliodora* density and population structure. The results were clear. Distance from source populations were the most important variable correlated with density, suggesting propagule pressure plays the fundamental role in promoting the invasion of *Cordia*. Disturbance undoubtedly plays a role as well, as *Cordia* abundance, especially that of seedlings, was positively associated with disturbance. However, they correctly point out that disturbance and other habitat attributes are often confounded with propagule pressure, since degraded areas tend to be close to the site of invasion. By creatively taking advantage of a unique natural experiment, and with careful and detailed fieldwork coupled with robust statistical analyses, the authors were able to disentangle these confounded factors and reveal the clear and dominant signal of propagule pressure. Though it remains to be seen to what extent their conclusions can be generalized to other species and locations, their excellent study is a template other researchers can use to evaluate their conclusions. Congratulations to Edward *et al.* for simultaneously advancing the field of invasion biology and refocusing our attention on an emerging and overlooked issue in tropical biology and conservation.

Emilio Bruna

would have been obvious to anyone with an interest in biological invasions that this juxtaposition of a historically well-documented source of alien species introductions within a matrix of both lowland and montane tropical forest could prove an outstanding study system. With this in mind and in collaboration with the TBA, I was successful in obtaining funds from the UK Darwin Initiative for a research and capacity building project based in Amani. While the thrust of the training was built around hands-on workshops for local NGOs that provided background and practical experience in mapping, monitoring and management of alien plant species, proposal planning, project management and scientific writing, we also funded a number of two-year Masters projects. These projects were run through the neighbouring Sokoine University of Agriculture to ensure staff as well as students from this institution had the



The authors study invasive plants threats in rain forests across the globe: Philip Hulme in the temperate rain forests of New Zealand and Ezekiel Edward (pictured left) and Pantaleo Munishi (pictured right) in the tropical rainforests of the East Usambara Mountains.

opportunity to be involved in research. It was therefore immensely gratifying that we were able to publish some of this MSc research in *Biotropica*. The subsequent nomination for the Award for Excellence in Tropical Biology and Conservation is a considerable honour for all the authors but more importantly reflects the considerable potential of young African scientists to deliver outstanding research when given the opportunity. The particular issue Ezekiel Edward addressed in his MSc research was the processes that governed the spread of the alien tree *Cordia alliodora* into neighbouring forest following the introduction of around 200 trees in the early part of the 20th century. Transects radiating out from the initial introduction site were the basis for painstaking surveys of native and alien flora as well detailed measures of the occurrence and size of different life-stages of the focal tree species. To date, attempts to understand why tropical forests appear fairly resistant to plant invasions, have been frustrated by a lack of information on the propagule pressure such forests might be exposed to, or how this might interact with forest disturbance. With this experimental design we were able to disentangle these two effects for the first time. What we found was that propagule pressure and disturbance interact to determine the vulnerability of tropical forest to invasion. Relatively undisturbed forest can be colonised by *C. alliodora* if the propagule pressure (*e.g.* proximity to the source of introduction) is high but as disturbance increases the level of propagule pressure required for successful colonisation is lower. The data also showed

long-distance wind dispersal led to the rapid spread of this species and at least two pulses of expansion were indentified from the data. Such information suggests tropical forests may be no more resistant to invasion than temperate forest but that the current patterns largely reflect the lower levels of disturbance and low propagule pressure from introduced species. The future for tropical forests under this scenario thus looks rather bleak, with increasing levels of disturbance being recorded and rising pressure to introduce further alien species through agroforestry. Our work, combined with comparative studies in Amani by my PhD student, Wayne Dawson, form the basis for recommendations for assessing invasion risks for botanic gardens (Dawson *et al.* *Biodiversity & Conservation*, 2008, 17: 1979–1995), identifying key traits in the steps of plant spread (Dawson *et al.*, 2009, *Journal of Ecology* 97: 657–665) and the development of weed risk assessment tools (Dawson *et al.*, 2009, *Biological Conservation* 142: 1018–1024). These comparative studies encompassing a wide range of species also confirm the importance of propagule pressure and time since introduction as important determinants of invasion success. As a consequence, today the East Usambara Mountains probably represent the best studied forests in Africa, as far as biological invasions are concerned, that reflects a successful legacy of collaboration between local and international researchers.

Philip Hulme