Non-Native Ornamental Palms Invade a Secondary Tropical Forest in Panama

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Palms are often introduced outside their natural range as beautiful and spectacular ornamentals. Some species may however invade natural vegetation and could become a threat to local native species.

Invasive alien organisms are a serious threat to native species and even ecosystems in many parts of the world. While invasive plants cause serious conservation problems in tropical forests on many oceanic islands, continental tropical forests seem to have been much less affected. However, with increasing fragmentation and disturbance of tropical forests this situation may well change (cf. Phillips 1997; Laurance 2000). A few published accounts of such invasions of continental forests already exist (e.g., Laurance 2000). Notably, in an isolated 4-ha forest fragment in the Singapore Botanic Gardens some alien plant species have become common and as many as five non-native palms species now occurs there (Turner et al. 1996). In North America the far majority of invasive woody plants are escaped ornamental species (Reichard & White 2001). As palms are among the most preferred ornamental plants in tropical areas, problems with invasive palms species are to be expected. In fact, palms have invaded forests from botanical gardens and urban areas in many parts of the tropics (e.g., Lorence & Sussman 1986; Jones 1995; Turner et al. 1996; Horvitz et al. 1998; Maunder et al. 2001). While little is known about the effects of invasive non-native palm species on the natural tropical plant communities, some appear to be crowding out native plants (even other palms); e.g., *Heterospathe elata* on Guam (Jones 1995) and *Livistona chinensis* on Mauritius (Maunder et al. 2001). Here I will describe an example where non-native ornamental palms massively invade a tropical secondary forest in Panama and seem likely to become an abundant, if not dominant, long-term part of the vegetation.

Study site

Gamboa (09° 07′ N, 79° 41′ W) is a town of c. 150 houses located at the Panama Canal and surrounded by the 22,104 ha Parque Nacional Soberania. The climate in the area is tropical monsoon climate and the natural vegetation is semi-deciduous tropical forest. The study site is a

1. Numerous *Roystonea* cf. *regia* seedlings, the Gamboa forest.

2. *Ptychosperma macarthurii*, the Gamboa forest.

c. 16 ha secondary (probably 40-60 years old) forest that divides Gamboa in two parts. The forest canopy is generally 15-20 m in height, but with taller emergent trees, and is mainly composed of tree species such as *Anacardium excelsum*, *Apeiba tibourbou*, *Bursera simarouba*, *Cecropia* spp., *Cordia alliodora*, *Ficus* sp., *Guazuma ulmifolia*, *Gustavia superba*, *Luehea semannii*, *Miconia argentea*, *Ochroma pyramidale*, *Schefflera morotoni*, *Spondias mombin*, *Triplaris americana*, *Virola sebifera*, and *Xylopia* spp. Lianas such as *Gouania lupuloides* are abundant, and the understory is often dense. Some typical understory plants are the coarse herbs *Aechmea magdalenae*, *Carludovica palmata*, *Costus* spp., *Cyclanthus bipartitus*, *Heliconia* spp, and *Renealmia cernua*, the slender bamboos *Chusquea simpliciflora*

3. *Areca triandra*-dominated understory, the Gamboa forest.

4. Well-established juvenile of *Livistona saribus*, the Gamboa forest.

and *Rhipidocladum racemiflorum*, the grasses *Pharus latifolius* and *Olyra latifolia*, the ferns *Adiantum* spp., *Cyclopodium semicordatum*, and *Tectaria incisa*, and various shrubs and treelets, e.g. *Cupania* spp., *Lacistema aggregatum*, *Piper* spp., *Psychotria pubescens*, and *P. poeppigiana*. Palms are among the most abundant plants throughout the forest, in particular in the understory and midstory.

The local palm flora

The palms comprise 14 species, only six of which are native to Panama. Of these, three are relatively common: the spiny, clonal understory palm *Bactris major* Jacq., the clonal midstory/canopy palm *Oenocarpus mapora* H. Karst. and the climbing *Desmoncus orthacanthos* Mart. The spiny midstory

palm *Astrocaryum standleyanum* L. H. Bailey, the massive canopy palm *Attalea butyracea* (Mutis ex L. f.) Wess. Boer, and the massive understory palm *Elaeis oleifera* (Kunth) Cortés have more scattered occurrences. Outnumbering the native palms, eight species of exotic palms have invaded the forest:

Aiphanes aculeata Willd. – Trinidad to Colombia, SW Brazil to Peru and Bolivia.

Areca triandra Roxb. ex Buch.-Ham.– India and Southeast Asia.

Bentinckia nicobarica (Kurz) Becc. – Nicobar Islands.

Dypsis madagascariensis (Becc.) H. Beentje & J. Dransf. – Madagascar.

Livistona saribus (Lour.) Merr. ex A. Chev. – South-East Asia

Ptychosperma macarthurii (H. Wendl. ex H.J. Veitch) H. Wendl. ex Hook. f. – Australia and New Guinea.

Roystonea oleracea (Jacq.) O. F. Cook – Lesser Antilles to Colombia

Roystonea regia (Kunth) O. F. Cook – Northern Caribbean.

Status of the non-native species

Of these eight species, at least four appear completely naturalized, all having many reproductive adults in the forest and lots of regeneration: *Roystonea regia* occurs in high abundance as both seedlings (Fig. 1) and juveniles throughout and appears to be more or less taking over a wet, central part of the forest. It is also quite frequent as large subadults and adults all over the forest, and is by far the most abundant palm reaching the upper canopy. *Ptychosperma macarthurii* (Fig. 2) and *Areca triandra* (Fig. 3) are abundant as seedlings, juveniles, and adults in the western half of the forest and sometimes completely dominate the understory. While *Aiphanes aculeata* is less abundant, it is nevertheless common both as immature and adult individuals in most of the forest.

Roystonea oleracea has a much more restricted occurrence in the forest, being concentrated in one creek, but here appears well naturalized with many adults and much regeneration (as I was unable to distinguish seedlings and juveniles of the two *Roystonea* spp., I am assuming that they belong to the species whose adults occur most close by). *Dypsis madagascariensis* occurs only in a small, peripheral area of the forest, but here has both juveniles and adults. The related *Dypsis lutescens* (H. Wendl.) Beentje & J. Dransf. is very frequently planted in gardens in Gamboa and produces lots of seedlings there, but apparently is unable to invade the forest. While *Livistona saribus* has no adults in the forest, it is abundant as well-established, small to massive (leaves reaching 3–5 m in height) juveniles in much of the forest (despite only a limited number of adults in Gamboa) (Fig. 4). It seems likely that at least some of these juveniles will be able to reach maturity and thus it may simply be a question of time before *Livistona saribus* becomes naturalized, too. *Bentinckia nicobarica* likewise has no adults in the forest, but has several well-established large juveniles in one sector of the forest (Fig. 5). As this species exhibits profuse spontaneous regeneration in unkempt parts of the Summit Botanical Garden, some 8 km away, I suspect its scarcity at the study site simply reflects is rarity in the gardens of Gamboa.

Invasions outside Gamboa?

The distribution of most of the exotic palms suggests that they are currently dispersal limited within the Gamboa forest: With exception of *Roystonea regia* and *Aiphanes aculeata*, the other species are all highly concentrated in parts closest to the main garden source areas. Thus, given time at least the well-naturalized *Areca triandra* and *Ptychosperma macarthurii* must be expected to spread and become abundant in all of the forest. This raises the concern that with time the exotics may also spread to the neighbouring national park. Indeed, this has already occurred. I have observed both adults and juveniles of *Areca triandra* and *Roystonea regia* as well as a number of more or less massive, well-established juveniles of *Livistona saribus* in the edge of the forest of the national park bordering Gamboa. While I have not surveyed other Canal Area forests systematically, at least *Roystonea regia* occurs frequently in forest and scrub close to houses in the whole Canal Area. It seems particularly well naturalized in swamp or lakeside forests, i.e. in habitats similar to its natural habitats in the northern Caribbean (Henderson et al. 1995). A number of other non-native palm species, notably *Euterpe oleracea* Mart., *Livistona saribus*, *Ptychosperma macarthurii*, *Bentinckia nicobarica*, and *Areca triandra*, also exhibit vigorous spontaneous regeneration in or just outside Summit Botanical Garden (also see Hubbuch & Craft 1995). *Euterpe oleracea* and *Ptychosperma macarthurii* are also well naturalized in the adjacent forest, the first dominating large tracts of swamp forest.

Birds and ants may facilitate invasion

Birds seem to be an important seed dispersal vector for non-native palm species into the Gamboa forest and may be a key factor in the invasion of

natural vegetation by these species (as they probably are elsewhere, see Horvitz et al. 1998). The fruits of all of the non-native species seem to be quite popular with many local bird species. Of particular importance might be Gray-headed Trushes (*Turdus grayi*) which are abundant both in the urban parts of Gamboa and in the forest (Fig. 6). Close to a direct observation of bird-mediated dispersal from Gamboa into the forest, I once observed a Blue-crowned Motmot (*Momotus momota*) flying out from the forest and sitting for several minutes eating (swallowing, and not regurgitating) *Ptychosperma macarthurii* fruits and then flying back into the forest. Forest birds like Keel-billed Toucans (*Ramphastos sulfuratus*) and Gray-headed Chacalacas (*Ortalis cinereiceps*) are also frequently observed eating palm fruits in Gamboa gardens. While birds may provide the colonization opportunities for the exotic palm species, it is less clear why non-native palms are able to be successful once inside the relatively diverse Gamboa forest. One factor might be the abundance of leaf cutter ants (mainly *Atta colombica*) in this and other secondary forests. At leaf cutter ant nest sites in the Gamboa forest, exotic as well as native palms seem to be among the few plants able to regenerate successfully (Fig. 5). Perhaps the high fiber content of the palm leaves causes the ants to generally avoid them.

Risk assessment needed

My observations exemplifies that popular ornamental palms are able to invade natural, albeit secondary tropical forest vegetation and further suggests that at least *Roystonea regia*, *Ptychosperma macarthurii*, *Euterpe oleracea* and *Areca triandra* could become abundant, long-term components of Panamanian forests. As species or genera that are invasive in one region often also will be invasive in other regions, these popular ornamental species may invade tropical forests in other parts of the world, too. Their congenerics *Roystonea oleracea* and *Ptychosperma elegans* certainly do so in the Guianas and Florida, respectively (Henderson et al. 1995; Horvitz et al. 1998). While many naturalized non-native plants may not really cause nature conservation problems in their new home, others seem to do so (Jones 1995; Maunder et al. 2001). In North America the majority of the invasive non-native woody plants were introduced for horticultural purposes (Reichard & White 2001), and in general the most problematic non-native plants have been intercontinental introductions (White & Schwarz 1998). As palms are very popular ornamentals, many species often being planted outside their home continents, and clearly have the potential to become problematic invasive species, it would be wise to develop risk assessment protocols for the introduction of palm species to new areas (cf. White & Schwarz 1998). A starting point would be to compile a world-wide list of invasive non-native palm species. To this end I would greatly appreciate information about invasive palm species from throughout the world (email: svenning@biology.au.dk).

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LITERATURE CITED

HENDERSON, A., G. GALEANO AND R. BERNAL. 1995. Field guide to the palms of the Americas. Princeton University Press, Princeton, New Jersey. 420 p.

HORVITZ, C. C., J. B. PASCARELLA, S. MCMANN, A. FREEDMAN AND R. H. HOFSTETTER. 1998. Functional roles of invasive non-indigenous plants in hurricane-affected subtropical hardwood forests. Ecological Applications 8: 947–974.

HUBBUCH, C. E. AND P. CRAFT. 1995. Searching for palms in eastern Panama. Principes 39: 130–136.

JONES, D. L. 1995. Palms throughout the world. Smithsonian Institution Press, Washington D. C. 410 p.

LAURANCE, W. F. 2000. Do edge effects occur over large spatial scales? Trends in Ecology and Evolution 15: 134–135.

LORENCE, D. H. AND R.W. SUSSMAN. 1986. Exotic species invasion into Mauritius wet forest remnants. Journal of Tropical Ecology 2: 147–162.

MAUNDER, M., B. LYTE, J. DRANSFIELD AND W.J. BAKER. 2001. The conservation value of botanic garden palm collections. Biological Conservation 98: 259–271.

PHILLIPS, O. L. 1997. The changing ecology of tropical forests. Biodiversity and Conservation 6: 291–311.

REICHARD, S. H. AND P. WHITE. 2001. Horticulture as a pathway of invasive plant introductions in the United States. BioScience 51: 103–113.

5. Large juvenile of *Bentinckia nicobarica* at a leaf cutter ant nest site, the Gamboa forest.

6. Gray-headed Trush (*Turdus grayi*) foraging on *Ptychosperma macarthurii* fruits in a garden just outside the Gamboa forest.

TURNER, I. M., K. S. CHUA, J.S.Y. ONG, B.C. SOONG AND H.T.W. TAN. 1996. A century of plant species loss from an isolated fragment of lowland tropical rain forest. Conservation Biology 10: 1229–1244.

WHITE, P. S. AND A.E. SCHWARZ. 1998. Where do we go from here? The challenges of risk assessment for invasive plants. Weed Technology 12: 744–751.