CHAPTER 8

CONSERVING VULNERABLE HABITAT IN NORTHERN AND NORTH–WESTERN AUSTRALIA: THE RAINFOREST ARCHIPELAGO

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Introduction

Over the past five years substantial rainforest research programs have been undertaken both in the Northern Territory and Western Australia. While the focus of research has differed in these two regions, in common both programs have set out to document the regional distribution of rainforest patches, sample floristic and faunal composition, assess their condition, and determine whether the current network of conservation reserves encompasses their biological diversity.

Many of the findings from these programs are now, or soon will be, publicly available. For example, a comprehensive description of Western Australian rainforests, with emphasis on the distribution patterns of plants, invertebrate and vertebrate assemblages, is contained in the recently published volume, *Kimberley Rainforests of Australia*. The final paper of that volume (McKenzie & Belbin 1991), makes recommendations for a representative reserve system in the region, and discusses some evident management problems.

Data for the Northern Territory are contained in a number of recent and forthcoming papers. These include a floristic classification of rainforest types (Russell-Smith 1991), and tree species compositional patterns are considered further by Bowman, Wilson and McDonough (1991). Vertebrate assemblages are described in a number of papers submitted for publication by Woinarski, Gambold, Menkhorst, and co-workers (eg Menkhorst & Woinarski, in press). The conservation status of rainforest floristic types, their condition, and regional management issues, are considered by Russell-Smith and Bowman (1992). Papers documenting the ecology and conservation status of individual species and communities are in preparation also.

In this paper we summarise findings concerning the distribution, composition, and population ecology of rainforests across northern and north–western Australia. We then consider the effectiveness of the current system of National Parks and Reserves in meeting the conservation requirements of regional rainforests.

Such an assessment is timely given that fires, in conjunction with cattle (additionally water buffalo and pigs in the Northern Territory) are severely damaging rainforests throughout this region (McKenzie & Belbin 1991; Russell-Smith & Bowman, in press). Further, these data have relevance for land management practices generally, given that this problem applies equally over all major forms of land tenure: vacant crown land, pastoral leasehold, Aboriginal lands, and land set aside for conservation purposes (including Aboriginal land in the Northern Territory leased as National Park (Russell-Smith & Bowman 1992). Rainforests in only a few areas are free of stock.

Distribution

The distribution of tracts or, more commonly, small patches of rainforest through the monsoonal, woodland savannas of the Top End of the Northern Territory and the Kimberley region of Western Australia, is summarised in Figure 1. Using the same digitised map data, [1] it is estimated that there are over 16 500 rainforest patches over the entire region, including over 1500 in Western Australia (Kay *et al* 1991). Patches are mostly less than a few hectares in size, ranging from the cover of a few tree crowns, to riparian strips and coastal tracts thousands of hectares in extent (McKenzie & Belbin 1991; Russell-Smith 1991). The largest patch in the Kimberley is approximately 100 ha in area, with a median between 2 and 3 ha.

As indicated in Figure 1, rainforest patches are concentrated in certain higher rainfall coastal regions. In the Kimberley, patches are concentrated in rugged terrain between the Prince Regent River and the Bougainville Peninsula (Fig 1). In the Northern Territory, rainforest is concentrated

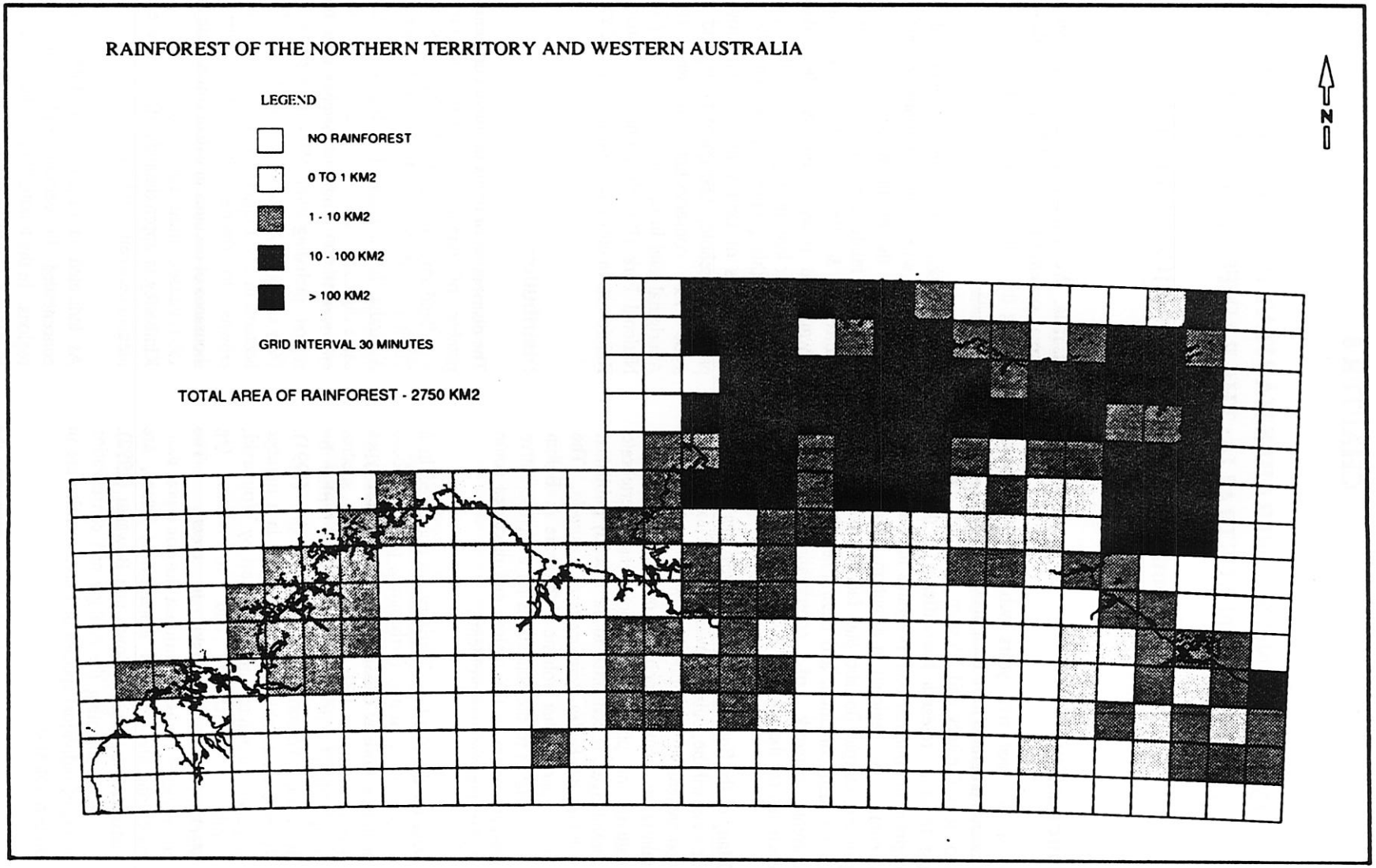

FIGURE 1 Distribution of rainforest (km^2) in northern and north–western Australia, per 30' x 30' cells [a]

(a) Distribution of rainforest in WA after Kimber, For[illegible] & Behn (1991); in NT after Russell-Smith & Lucas, upubl[illegible].

particularly in the harsh, imposing sandstone terrain of western Arnhem Land. These NT forests, comprising 41% of all rainforest in northern and north–western Australia, are dominated by a tree species restricted to that region, *Allosyncarpia ternata*.

In total, rainforest over this broad region covers 2750 km^2 (Fig 1); that is, aproximately 0.4% of the planar land surface area.

Isolation and Interdependence

Rainforest species vary in their dispersal ability and in their degree of specialisation to rainforest habitats. These characteristics largely have determined the distribution and persistence of the regional rainforest biota.

Environmental change associated with increasing climatic seasonality through the late Cainozoic at least (about the last 15 million years), has resulted in major fragmentation of the rainforests. With restriction of rainforests to increasingly precarious refuges, surviving specialist plant and animal species have become marooned in remnant patches or adept at dispersing across intervening habitats. Population sizes of plant species in any one patch are typically very small (Russell-Smith & Lee 1992).

The status of populations varies between different taxonomic groups and between regions. For example, the monsoon rainforest estate has a rich fauna of small, endemic camaenid land snails. Forty-eight species of camaenid land snail are known only from rainforests in the Kimberley (Solem 1991). By contrast, specialist rainforest ground mammals are now absent from the monsoon rainforest archipelago, presumably because such species require the continued presence of large areas of rainforest habitat. The few 'closed canopy' specialist mammals that persist in the Kimberley, with its smaller and sparser patches, also utilise mangrove and/or riverine habitats: *Melomys* sp, *Pipistrellus westralis*, *Macroglossus minimus*, *Nyctophilus arnhemensis* and *N. bifax* (McKenzie *et al* 1991). As well, only one plant species is endemic to that region, *Hibiscus peralbus* (Kenneally *et al* 1991).

Through extinctions of formerly connected populations, and divergence in environmental conditions after patches were isolated, the entire distributions of many sedentary rainforest specialists is now restricted to one or a few neighbouring rainforest patches. The endemic palm, *Ptychosperma bleeseri*, is a well-known example, with a distribution restricted to a few scattered jungle patches in the near vicinity of Darwin. Equally notable is the predominantly northern hemisphere frog family, Ranidae, known in Australia from two species: one occurs in a limited area of Cape York; the other, recently discovered, is known from two small rainforest patches in eastern Arnhem Land. The average Kimberley camaenid land snail was recorded in just three neighbouring sampled patches (Solem 1991). Such species are by no means atypical; 30% of rainforest plant species occurring in the Northern Territory were sampled at 10 or fewer patches from a sample of over 1 200 patches.

A consequence of such restricted, idiosyncratic distribution patterns is that patches occupying similar ecological settings, even when adjacent, commonly support different species assemblages. As well as plant assemblages, this applies equally to reptiles (Gambold & Woinarski, forthcoming), snails (Solem & McKenzie 1991), and earthworms (McKenzie & Dyne 1991).

The ability to disperse affords a release from the prison of the rainforest patch. Many monsoon rainforest plants and non-camaenid land snails are readily dispersed by birds, bats, wind or water. The fleshy fruits of many rainforest plants are attractive to a rich guild of frugivores that includes fruit pigeons, flying foxes, and more facultative species such as trillers, orioles, honeyeaters, cuckoos, even turtles. Despite being far more extensive, the surrounding open forests and savannas contain such a relatively low abundance of fleshy-fruited plants that frugivores (and nectarivores) in the Top End and Kimberley are forced to be reliant upon the isolated patches of monsoon rainforest for at least most of the year.

Movements of vertebrate species between rainforest patches provide a means of escape for rainforest plants, enabling them to colonise other patches, maintain gene flow between isolated populations, and to expand their range in response to environmental change. This process has many scales of interdependence. Frugivores can persist only if fruit is available year-round; they need high floristic diversity within and between patches (with different species fruiting at different times of the year, or separately in different patches), phenological succession, or keystone fruiting species such as certain figs which fruit through the year. On a landscape scale, frugivores will persist only where the distance between patches is not prohibitive. Once a patch is too distant to be accessible, it is likely bound for floristic decay. As

disturbances impoverish or remove patches from the network, the abundance and diversity of dependent frugivores will inevitably decline.

Finally, the rainforest system houses not only obligate rainforest species, but is used also as seasonal, daily or occasional refuge by many animal species from surrounding vegetation. For example, rainforests on floodplain fringes in the Northern Territory are invaded by the rodent *Rattus colletti* when floodplains are inundated during the wet season (Friend *et al* 1988); many savanna insects congregate in relatively cool, humid rainforests during the long dry season (Kikkawa *et al* 1981); the Agile Wallaby, *Macropus agilis*, shelters in rainforests during the heat of the day; populations of many other vertebrate species take refuge in rainforests during the frequent fires that characterise tropical savannas (Friend *et al* 1991). Thus, rainforests provide ecological resources important to the population dynamics of many species which utilise open forest and savanna communities for much of the year.

Conserving the rainforest archipelago

Given this biological background we can begin to address the question of whether the conservation requirements of rainforest communities in this region are met. In making this assessment we will consider first the representativeness of the present reserve system, and then other management issues associated with conserving regional rainforests.

Recent assessments of the conservation status of rainforest communities in the Northern Territory and in Western Australia have found that the current, basically *ad hoc*, reserve network, is deficient (Burbidge *et al* 1991; McKenzie & Belbin 1991; Woinarski, in press). This is true in the Kimberley even if 19 current reserve proposals (Burbidge *et al* 1991) are added to the reserve system for this assessment. In the Northern Territory, five of 16 floristically defined rainforest types are unreserved at the present time. These include three types which occur mostly on Aboriginal land (Melville and Bathurst Islands, eastern Arnhem Land), and two other types well represented on leasehold land in the south and south-west of the Top End (Russell-Smith & Bowman 1992).

In Western Australia, 21 of 28 defined species assemblages are unreserved (McKenzie & Belbin 1991). After inclusion of proposed reserves, these authors found that 11 assemblages were still unrepresented, and additional areas have been identified. The inclusion of species groups with differing ecological characteristics and requirements in this classification afforded fine scale community definition (birds as representatives of mobile fauna; land snails for their small size and poor dispersal capacity; plants for habitat and primary resources).

Community-level representation, however, is not the only criterion of biological conservation; conservation of genetic diversity is desirable also (eg Conservation Commission of the Northern Territory 1990). Given both the level of genetic isolation apparent in the distributions of many sedentary species, and the dependence of many other species on ecological resources and/or interbreeding populations scattered through a network of patches, a strong ecological case may be made for conserving the entire rainforest archipelago. This includes protection of linking habitats or corridors, such as mangrove fringes and vegetation along watercourses, that facilitate seasonal movements between patches by birds (eg Torresian Imperial Pigeon) and fruit bats.

The daunting practicalities of attempting to reserve, let alone manage, over 16 500 patches, even given improbable political support for such a move, speaks for itself. Further, while protected area status (reservation) for rainforest patches clearly does provide tangible conservation benefits, it provides no guarantee that currently threatened populations and habitats will receive effective management (Russell-Smith & Bowman 1992). It is thus important here to distinguish between reservation and conservation.

In Western Australia and the Northern Territory data are now available to facilitate development of management priorities for rainforests both within and outside the reserve system. In some situations it is evident that fencing is required to eliminate continued disturbance from cattle and other introduced animals. An example here is fencing recently undertaken to protect rainforest habitats of the endangered palm species, *Ptychosperma bleeseri* (cf Duff *et al*, chapter 9 in this volume). The costs associated with such management, including establishment and maintenance of fences, weed eradication, and implementing protective burning programs, necessitate strategic planning.

For the Northern Territory, Russell-Smith and Bowman (1992) identify five major rainforest areas likely to remain severely affected by cattle/water buffalo at the end of the current Brucellosis and Tuberculosis Eradication Program (BTEC), by 1992. In the Kimberley, the introduction of cattle to the Mitchell Plateau in the last 10 years has led to

rapid degradation of rainforest patches. Elsewhere, on pastoral leases, patches are now restricted to sites protected from both frequent fires and cattle (McKenzie & Belbin 1991). Given the destructive impacts of cattle (additionally water buffalo and pigs in the Northern Territory), and severe late dry saeson fires, on rainforest habitats across northern Australia, stock exclusion and fire management are clearly integral to rainforest conservation throughout this region.

Conservation of rainforest patches outside the reserve system (as most are) requires community and industry support. This process, we suggest, is best addressed through education, incentives and, where appropriate, contractual agreements or enforcable covenants.

Epilogue: the conservation of vulnerable habitat and species in a shifting and fragmented environment

We have inherited a philosophy of nature conservation management that rests largely on the precept of reservation of representative samples of major habitats. This system reinforces marked contrasts in attitudes towards, and management of, natural resources under different forms of land tenure. The system is based, in theory at least, on detailed knowledge of the distributions of individual species, and the presumption of environmental stability.

While very important, reservation alone will not protect the rainforest estate in northern and north–western Australia. This applies equally to her fragmented habitats in this region; for example, wetlands (Whitehead *et al*, chapter 11 in this volume), and even eucalypt woodlands (Woinarski & Tidemann 1991).

By itself, the reservation system is inadequate because it does not cater for:

a) rare habitats and species which fall outside reserve boundaries. This applies particularly to plant and animal species which are poor dispersers;

b) a capricious climate which forces vagile species to change distribution in response to seasonal and yearly variation in rainfall, or other resources — these species need to have options;

c) appropriate conservative land management practice over different forms of land tenure.

Effective conservation across northern Australia requires, therefore: expansion of the reservation system so that it is representative of major habitats; active management of vulnerable species and their habitat, both on and off reserves; a shift in current attitudes to land exploitation by both the public and industry; and greater flexibility on the part of conservation Authorities. Legislation is required both in the Northern Territory and Western Australia to meet this last need.

Notes

1. The area of rainforest per 30' cells of latitude x longitude in Figs 1a and 1b was computed from digitised rainforest maps. For the Kimberley, rainforest mapping was undertaken from Landsat Thematic Scanner Images (Kay *et al* 1991). The area of rainforest, totalling 68 km^2, was calculated by summing Landsat image pixels classified as rainforest (Kimber *et al* 1991). Mapping of Northern Territory rainforests was undertaken visually from full aerial photo coverage of the region, at scales ranging from 1:15 000 to 1:80 000. These maps were then scanned/digitised, and subsequently compiled using the ARCINFO geographic information system.

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