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National parks on cleared pastures: a new approach to rainforest recovery in Queensland

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Abstract:
The role for national parks and protected areas is widely regarded as preserving 'what's left' rather than restoring what once was. Restoration of degraded or cleared sites is conventionally regarded as too expensive compared with saving still intact and biodiverse fragments of rainforest. The Springbrook Rescue Project is re-examining this perceived wisdom. This project is purchasing significant areas of cleared land that once was the heartland of rainforest on the Springbrook plateau. These properties will be included in the Queensland parks system. Analysis suggests that the biodiversity of the remnant fringes of rainforest will decay without restoration of the plateau forests. An LTER project is described to compare lightly managed natural regeneration with more active restoration plots for relative cost and ecological outcomes. It is hypothesised that natural regeneration need not be expensive nor as risky as active regeneration in restoring subtropical rainforests. Moreover the potential for carbon trading revenues to finance regeneration projects is expected to greatly improve the economics of restoration.

The genesis of the National Park concept in America 155 years ago was primarily anthropocentric and utilitarian, nature serving to inspire, heal or provide game for hunting at low socio-economic costs. Parks thus tended to be small, isolated or otherwise restricted to remote, inaccessible or unproductive areas. Today's world is more populous, scientifically literate and cognisant of biodiversity's serious decline as a result of pervasive land-use change, invasive species and human-induced climate change. Maintenance of biodiversity has become the core principle of modern conservation (World Commission on Environment and Development 1987; Union of Concerned Scientists 1992, 1997; World Resources Institute 2002; Millennium Ecosystem Assessment 2003; Kennedy 2006; World Wildlife Fund 2006). The old paradigm of sampling last remnants of natural areas for protection in parks is no longer sufficient to arrest declining populations and escalating extinctions. Fragmentation and modification of landscapes is threatening not only the health, viability and resilience of biodiversity at all levels and scales of biological organization but also nature's capacity for ongoing evolution.

Over the past few decades there has been a growing interest worldwide in restoring degraded and fragmented landscapes for biodiversity conservation and, more recently, for sequestering carbon to mitigate impacts of climate change. Past projects have mostly and simply been directed at restoring degraded lands regardless of tenure, size or location and were costly, largely fragmentary, and poorly monitored with little capacity to evaluate broader landscape-wide benefits. Some projects aimed to link national parks or other conservation reserves by corridors

on private land, or to ameliorate impacts of invasive species. Most have involved relatively small parcels of land because of the prohibitive costs of traditional restoration technique. Few have involved purchase of abandoned or active pastures specifically for the purpose of restoration for inclusion within a national park. Moreover, cultural perceptions of national parks as 'natural icons' represent an additional social barrier to restoring 'what has been lost' to the national park estate. A significant step forward was the creation in 2000 of a new tenure of national park in Queensland, called 'National Park Recovery'. This specifically allows degraded areas to be protected and restored. As projects inevitably increase in scale it is imperative that restoration is based on the best science available.

The Springbrook Rescue project, programmed to run for 20 years, is a collaborative initiative involving the Queensland Government, scientific and community organizations incorporating land purchase for protection and restoration of World Heritage values, scientifically based restoration and long-term monitoring involving wireless sensor networks. Almost 850 hectares of land have been purchased in the period 2004-2008. In aggregate, over 260 hectares of publicly owned land requires ecological restoration, the balance being in varying stages of natural regeneration requiring minimal active intervention. These properties are destined to become national parks and part of an expanded World Heritage Area.

The project site occurs largely on the Springbrook plateau, an area of roughly 20 square kilometres located between 28°15'S and 28°08' S, and 153°14' E and 153°18' E, approximately 500 km south of the Tropic of Capricorn. The area represents the north-east flank of the now extinct Tweed Shield Volcano, active between 23 and 20 Million years ago. Fluvial processes typically associated with volcanic landforms have effectively created a biogeographic island preserving extremely compressed environmental gradients (climatic, hydrological, physiographic, historical) over a distance of only five to ten kilometres, including the wettest, most nutrient-rich environments nationally outside its sister area, the Wet Tropics of Queensland. This complexity presents both challenges and opportunities to draw more generally applicable conceptual models of restoration from knowledge and experience gained.

Altitudinal gradients range from lowlands (less than 400 m) through uplands (400-800 m) to highlands (800-1051 m). Each zone shows further segmentation of microenvironments on the basis of geology, rainfall and aspect, the key present-day determinants of plant and animal distributions, abundances and movements since they determine energy, moisture and nutrient fluxes upon which all life forms depend. Mean annual precipitation ranges from 1600 mm to over 3000 mm over short distances, peaking in summer, with a pronounced dry season for the two months of August/September. Rainfall in the highland zone is significantly augmented by cloud stripping. Cloud forests are generally recognised as among the most threatened by impending climate change. The Springbrook plateau also conserves major gradients in soil types of differing water retention behaviour and nutrient content ranging from Black Earths through Red Kraznozems, Prairie soils, Yellow Podzolic soils to Lithosols (Willmott and Hayne 2001). Topographic gradients range from largely flat to undulating land to highly dissected and variable topography resulting in major and condensed gradients in photoperiod and temperature that

affect net primary productivity and phenological patterns.

The plateau area above 600 m has been strongly affected by human occupation for the past 100 years of settlement with forests selectively logged for timber and cleared for farmland and more recently, semi-rural urban development. The primary industries such as dairying, grazing and banana growing for which clearing originally occurred have all declined (Hall 1990) leaving nature-based tourism virtually the sole economic base for the small local community. Of the 2000 hectares of cleared forest, 64 per cent is in varying stages of natural regeneration. Thus the area is now a complex mosaic of primary, secondary or regrowth forest, agricultural land, active and abandoned pastures over a wide range of environmental gradients. Human population pressures are increasing and current planning and management guidelines and practices are not consistent with protection of a globally significant 'evolutionary hotspot'.

The current National Park is too small (2,500 ha at the time of its World Heritage Listing in 1995), unrepresentative, fragmented and dysfunctionally configured to viably protect the region's biodiversity and World Heritage values. Virtually none of the high plateau, the most ancient and least modified part of the shield volcano, is represented within the park. As part of the Tweed volcanic province, the Springbrook precinct, particularly the plateau region, contains outstanding levels of biodiversity, narrow-range endemism and relict disjunctions of phylogenetically significant plant and animal lineages. This small area is home to nearly 1100 species of higher plants (77 rare, vulnerable or endangered), 154 bird species (12 rare or threatened), 31 mammal species, 39 reptile species, and 21 amphibian species (7 rare or threatened). Twenty-one per cent of all bird species are obligately or significantly frugivorous. The largest guild of almost 50 per cent of all bird species present comprises ground-dwelling, invertebrativorous, ancient lineages of song birds including Albert's Lyrebird, the Rufous Scrub Bird and Logrunners. At least 124 invasive or alien plant species have been identified on the plateau that are potentially or actually seriously threatening both wildlife habitats and entire ecosystems. The presence of so many range-restricted habitat specialists potentially affected by climate change and invasive species highlights the urgency for restoration.

At the landscape level, forest types encompassing the wide environmental gradients include cool and warm temperate rainforests, cool and warm subtropical rainforests, 'wet sclerophyll' ecotonal forests and drier eucalypt forests, as well as small areas of wetlands and montane heaths.

The ultimate goal of the project is the restoration of degraded ecosystems and wildlife habitats on the Springbrook plateau to historical levels of integrity, health and potential for long-term sustainability. The challenges lie in identifying, quantifying and addressing key ecological, financial and social constraints to the establishment of trajectories capable of ongoing recovery with minimal further interventions over the longer term.

The emerging science and technology of wireless sensor networks (Porter et al. 2005) will significantly enhance a capacity to discern abiotic and biotic factors responsible for patterns of establishment, growth and viability of regeneration at spatiotemporal scales relevant to ecological processes and varying intervention intensities.

The capacity for long-term monitoring of multidisciplinary, multi-scale experimental interventions and responses over wide environmental gradients, including near-orthogonal ones, provides opportunities for multivariate analyses and hypothesis testing (Cardinale et al. 2006). The project also trials novel approaches to securing financial sustainability for long-term projects of this kind, given the predictable uncertainty of philanthropic and grant-based funding.

Clearly the project is not only important for its specific conservation objectives but also for the important opportunity to test ecological theory and its cost-effective application to larger land parcels elsewhere.

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