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# TROPICAL PEAT-SWAMP FOREST BIODIVERSITY: ASSESSMENT OF THE PRESENT AND PROGNOSIS FOR THE FUTURE

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## SUMMARY

Tropical peat-swamp forests (TPSF) are important biodiversity reservoirs. The biodiversity impacts of forest loss and degradation in these forests are unclear, however, owing to a lack of empirical data. To address this, OuTrop is developing an ecological monitoring programme, which incorporates monitoring of: (i) habitat condition; (ii) trends in target species' populations; and (iii) rapid-response indicators of forest disturbance. We illustrate this through comparing data from relatively disturbed and undisturbed TPSFs in Indonesian Borneo. This monitoring programme will help understand the biodiversity impacts of human activities, and has relevance for all TPSF projects with biodiversity conservation objectives.

KEY WORDS: Tropical peat-swamp forest; biodiversity; conservation; monitoring; human impacts

## INTRODUCTION

### South-east Asia's Peat-swamp Forests: Biodiversity and Threats Faced

Despite earlier opinions to the contrary, South-east Asian tropical peat-swamp forests (TPSF) are now recognised as important reservoirs of biodiversity (Posa *et al.*, 2011; Yule, 2010). For example, the Sabangau Forest is home to the world's largest population of orangutans (currently estimated at ~6,900 individuals, Morrogh-Bernard *et al.*, 2003; Wich *et al.*, 2008) and southern Bornean gibbons (Cheyne *et al.*, 2008). Unpublished data collected by Orangutan Tropical Peatland Project (OuTrop) researchers in this forest also indicate that it is home to an impressive diversity of species, including at least 68 mammal, 167 bird and 218 tree species.

Unfortunately, these forests are also under severe threat from human activities, including conversion to oil palm and other plantations, drainage, illegal logging and

mining. Analysis of satellite imagery indicates that the total area of peat-swamp forest in Peninsular Malaysia, Sumatra and Borneo declined from 11.6 Mha to 6.5 Mha from 1990-2008 (Miettinen and Liew, 2010). While it is clear that this startling level of forest loss will be detrimental for biodiversity conservation – orangutans and gibbons are only able to live in forest habitats, for example – this basis is insufficient for understanding the true impacts of human disturbance, and subsequent conservation management interventions, on TPSF biodiversity. In particular, (i) following forest loss, some species may still persist or even become more abundant, whereas other 'new' species may move in; and (ii) this knowledge does not allow us to account for the impacts of forest *degradation* on species' persistence and abundance. This second point is particularly relevant in light of the large areas of TPSF being degraded as a result of human activities: while the total area of pristine TPSF in Peninsular Malaysia, Sumatra and Borneo declined by 6 Mha between 1990 and 2008, the total combined area of "degraded" and "tall shrub/secondary" TPSF increased by 1.4 Mha during the same period (Miettinen and Liew, 2010).

### Ecological Assessments and Monitoring

Ecological assessments and monitoring are key weapons in our armoury for countering the threats faced by the region's TPSFs. Ecological assessments provide the vital data needed to determine the value of an area with respect to the conservation objectives in question, and provide a baseline against which future change can be detected through ecological monitoring. Well-designed ecological monitoring studies are also vital for effective conservation management, as they help steer projects towards implementing management interventions (activities) in such a way to successfully achieve long-term conservation goals (Gardner, 2010; Lindenmayer and Likens, 2010). This is more than simply monitoring trends in an ecosystem or "cataloguing a species' demise": a good ecological monitoring programme will provide feedback on the impacts of human activities – both "positive" (management interventions) and "negative" (e.g., logging, hunting, fire) – on biodiversity. This helps conservation managers assess whether their management interventions are helping them to achieve their stated conservation aims. Combined with information on the cost of intervention implementation, this helps managers to consider whether they should continue with their existing intervention programme, adapt it in any way and/or consider introducing new management interventions (Gardner, 2010; Lindenmayer and Likens, 2010). In this way, ecological monitoring helps ensure that the management interventions being implemented are effective and cost efficient, thereby enabling conservation projects to achieve maximum impact at minimum cost (important in the current financial climate!).

## MATERIALS AND METHODS

### Approach

In recognition of the above, OuTrop is developing an ecological monitoring programme for Bornean TPSF, with the aim of assessing the impacts of human activities on biodiversity. This incorporates monitoring of: (i) habitat condition, including forest area and condition in tree plots; (ii) trends in target species' populations, including orang-utans, gibbons and felids; and (iii) rapid-response indicators of forest disturbance, including birds, butterflies and ants. Not only will this

serve to highlight temporal changes in habitat condition and target conservation species' abundance (*what* happened), but, through sampling indirect/structural indicators, it will also enable interpretation of cause-and-effect relationships between management actions, habitat changes and biodiversity (*why* it happened). Further, because many flagship conservation species are large, slow-breeding mammals that respond slowly and/or unpredictably to environmental change (e.g., orangutans), this approach will allow us to establish suitable rapid-response ecological disturbance indicators, which are crucial for making the (near) real-time assessments of the impacts of changing habitat condition on biodiversity that conservation managers, funders and other stakeholders require (Gardner, 2010).

To illustrate this, we present an initial comparison of data collected in relatively disturbed and undisturbed areas of Sabangau in Central Kalimantan, Indonesia, including the Natural Laboratory of Peat-swamp Forest and highly-degraded Kalampangan Research Stations, and assess long-term datasets collected in the NLPSF since 2003, when illegal logging was eradicated in the area and conservation efforts began in earnest.

## RESULTS AND DISCUSSION

At the time of writing (February 2012), data collection and analysis for this project were still ongoing, precluding us from presenting final research results prior to presentation of our poster at the meeting. A preliminary assessment of the patterns observed so far is, however, presented in Table 1, although we caution readers against citing this information without first consulting with us.

Although full data collection and analysis have not yet been completed, this very preliminary assessment certainly indicates that there are differences in the variables monitored between less and more disturbed areas of TPSF in Sabangau, and that these variables are changing over time within our long-term Natural Laboratory study site. We anticipate that later formal statistical analyses will substantiate these preliminary assessments and support the assertion that these variables can form useful components of an ecological monitoring programme for South-east Asia's TPSFs. Consequently, we also anticipate that this monitoring programme will be important for understanding the current, and predicting the future, impact of human activities on TPSF biodiversity, and will therefore have relevance for all TPSF projects with biodiversity conservation objectives, including High Conservation Value Forest (HCVF) assessments, Reduced Emissions from Deforestation and Degradation (REDD+) projects and other businesses employing high Corporate Social Responsibility (CSR) standards.

Finally, while this programme is being developed with the aim of being useful throughout the region's TPSF, it is important to note that it is essential for the ecological monitoring programme used in an area to be tailored to the forest and conservation project in question. This is because: (i) different forests will have a different history of disturbance and current threat exposure; and, moreover, (ii) ecological monitoring is intended to provide feedback on the effectiveness of management interventions for achieving their biodiversity conservation aims, which

Table 1. Preliminary impressions of patterns in ecological variables based upon comparisons of data collected in relatively disturbed and undisturbed areas of forest in Sabangau, Central Kalimantan, Indonesia.

| **Variable** | **Method** | **Differences between dist. *vs*. undist. areas?** | **Changes over time in NLPSF?** |
|---|---|---|---|
| *Habitat condition* | | | |
| Forest area | Inspection of remote images | N/A | Decrease in total forest area; increase in burnt area. |
| Forest quality | Tree plots, with identification and measurement of individual trees (DBH, basal circ.) | Less disturbed plots have: lower stem density, larger trunk diameter and basal area (and subsequently also predicted higher biomass), and higher lianas density. | Increases in tree size documented. |
| *Ecological disturbance indicators* | | | |
| Forest birds | Line transects, detection by sight and call | Some species more abundant in disturbed forest; others more abundant in less-disturbed forest. The ecological characteristics of different butterfly species also appear to reflect this disturbance. | N/A |
| Ants | Honey-baited traps | Differences in species composition and abundance between disturbed and undisturbed areas apparent, with several habitat specialists identified; proportion of habitat generalists *vs.* specialists varies between disturbed and undisturbed habitats. | N/A |
| Butterflies | Fruit-baited canopy traps | Some species more abundant in disturbed forest; others more abundant in less-disturbed forest. Some species prefer forest edge; some have only been recorded from the tall-pole or low-pole forest areas. | N/A |
| *Flagship conservation species* | | | |
| Orangutans | Line transects of nests | Generally lower density in disturbed areas, in the absence of population compression. | Stable and increasing population. |
| Gibbons | Triangulation of morning duets | Generally lower density in disturbed areas, in the absence of population compression. | Stable and increasing population. |
| Felids | Camera trapping | Surveys in highly-disturbed areas planned for 2012. | Clouded leopard density at low end but stable; leopard cat widely present; marbled cat and flat-headed cat rare; bay cat presence not yet confirmed. |

will differ from project to project (Gardner, 2010; Harrison *et al.*, in press). This notwithstanding, with careful adaptation to suit the needs of particular conservation projects, we anticipate that the monitoring programme outlined briefly in this paper will be useful in supporting conservation-policy decision making throughout the region's TPSFs.

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