Regeneration Barriers Facing Rehabilitation of Degraded Tropical Peatland: An Alternative Approach to Considering Just the Ecological

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Tropical Peat Swamp Forests (TPSF)

12% of global peatlands
Carbon sink
High floral and faunal biodiversity
Maintain stable hydrology and nutrient cycling
Provide local livelihoods
47% of all tropical peatlands - found in Indonesia, however only 4% of Sumatra’s and Kalimantan’s TPSF are still pristine.

47% of SE Asia’s TPSF lost between 1985 and 2006

Degraded from logging, drainage and (failed) land conversion

Degradation leads to peat oxidation, risk of fires and flooding, and loss of forest resources

Degraded areas are releasing 300-900 Megatonnes C/yr!

(Hooijer et al. 2006)
Tropical peatlands: ... to restoration

Attitudes are changing:

2007: Bali COP parties agreed positive incentives to reduce emissions from degradation of forests in developing countries

2008: Indonesian Symposium discussed routes to better management of their peatlands
Initiation of restoration projects, but lacking methods...

Local, national and international desire for restoration projects: Australia-Indonesia REDD+ demonstration project (Kalimantan Forest and Climate Partnership) initiated

Effective and cost-efficient restoration methods remain speculative

To implement successful restoration programs, transferable methods must be developed
The ecology of peatland restoration

DEGRADATION

Changes to environmental conditions

DEGRADATION

Alterations to environmental conditions after degradation lead to REGENERATION BARRIERS that must be overcome.

Human-assistance in creating RESTORATION METHODS can remove or find ways round these barriers.

NATURAL REGENERATION

e.g. seed death in harsh conditions

e.g. repeat fires

e.g. seedling transplants

e.g. fire prevention
What are the regeneration barriers?

Fire and flooding: commonly recognised barriers for TPSF
Suite of forest regeneration barriers yet to be fully explored

Normally, only ecological regeneration barriers are considered
A landscape is equally influenced by its stakeholders, pre- and post-disturbance
Social, economic and political tensions, issues and conflicts can also become regeneration barriers
Problems facing restoration ecology

To restore a degraded site, need to determine and overcome its regeneration barriers, *BUT*...

Each site’s regeneration barriers are *unique* based on the ecological and social history. Data cannot always be extrapolated to other sites. How do we tackle the vast areas of degraded land?

– No established *transferable methods*

Restoration ecology is necessarily *interdisciplinary*. How do we link the social and ecological factors influencing a site?

– No established methods to bridge the *socio-ecological gap*
This study

Investigated the ecological and social barriers facing a degraded area of TPSF in Central Kalimantan to:

- Outline appropriate restoration activities for this site
- Explore routes to linking the social and ecological data
- Explore the transferability of this data to other sites
Determining the ecological regeneration barriers

Research set-up:
Transects (dashed red lines) established in:

- Natural forest
- Closed-canopy disturbed forest
- Forest edge
- Open-canopy disturbed forest
- Degraded forest

Monitored - Changes to environmental conditions on these transects, and impact on transplanted seedlings survival and growth
Ecological regeneration barriers

Active regeneration barriers:

- Seed rain, animal-seed dispersal, reduced nutrient and mycorrhizal availability, increased light intensity, flooding

Non-active regeneration barriers:

- Seed banks, drought

Found to support regeneration:

- Invasive species facilitation
Determining the social factors influencing the landscape

Focus groups and interviews conducted in neighbouring village Kereng Bangkirai.

Discussion of:

History and degradation of the landscape

Current uses of landscape; degraded and intact

Future hopes for the landscape and attitudes to restoration
Social factors influencing the landscape

**Negative aspects** influencing the landscape’s restoration:

- community’s lack of income and livelihood options, their dependency on the forest, the lack of funding for restoration and the dislike of ‘outsiders’.

**Positive aspects** influencing the landscape’s restoration:

- the community’s attitude towards the forest and restoration and their own ecological knowledge.
Combining the social and ecological factors

Combined data analysis showed that social and ecological factors were equally as important in understanding the barriers. The data were closely linked and could often be combined to better explain a specific barrier.

**Light intensity:** ‘...other species... they grow in the forest underneath [the canopy], not directly under the direct sun, and that means that in shaded places only can they grow well.’

**Invasive species:** ‘Don’t, don’t cut [the sedges].... because it cools the ground... It’s for protection in the dry season or when it’s hot, [the seedlings] can be closed in by sedges so it doesn’t catch all the heat’.

**Flooding:** ‘...it destroys the forest when it floods, the people cutting down lots of the forest give the flood a chance, so in the wet season it can all flood... in the end the destruction of the forest, it’ll be destroyed by water, so really I would say it’s the same [risk] as fire.’
## Combining the social and ecological factors

<table>
<thead>
<tr>
<th>Barrier categories</th>
<th>Examples</th>
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</thead>
<tbody>
<tr>
<td>‘active’</td>
<td>Animal seed-dispersal&lt;br&gt;Lack of funding</td>
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<tr>
<td>‘potential’</td>
<td>Drought&lt;br&gt;Community’s physical dependence on the forest</td>
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<tr>
<td>‘non-active’</td>
<td>Seed banks</td>
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<tr>
<td>‘counter’</td>
<td>Invasive vegetation&lt;br&gt;Community’s attitude to restoration</td>
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<tr>
<td>‘compound’</td>
<td>Logging&lt;br&gt;Community’s attitude to the government</td>
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</tbody>
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Transferability

Data remains site-specific. This study highlights the importance of determining the regeneration barriers specific to every site.

The methods for determining site-specific regeneration barriers can be stream-lined:

- Investigate both social and ecological factors influencing the degraded landscape

- Integrate social and ecological data to fully explain each regeneration barrier

- Categorize barriers as: ‘active’, ‘potential’, ‘non-active’, ‘counter’ and ‘compound’

- Develop actions appropriate to each barrier, to develop a comprehensive restoration action plan for a specific site