PARTICIPATORY PLANNING FOR FOREST AND LANDSCAPE RESTORATION IN SOUTH SUMATRA, INDONESIA

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Cost-effectiveness of dryland forest restoration evaluated by spatial analysis of ecosystem services

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Although ecological restoration is widely used to combat environmental degradation, very few studies have evaluated the cost-effectiveness of this approach. We examine the potential impact of site-level restoration on the value of multiple ecosystem services across four dryland areas in Latin America, by estimating the net value of ecosystem services benefitted under different reforestation scenarios.

The values of selected ecosystem services were mapped under each scenario, supported by the use of a spatially explicit model of forest dynamics. We explored the economic potential of a change in land use from livestock grazing to restored native forest using different discount rates and performed a cost–benefit analysis of three restoration scenarios. Results show that passive restoration is cost-effective for all study areas on the basis of the services analyzed, whereas the benefits from active restoration are generally outweighed by the relatively high costs involved. These findings were found to be relatively insensitive to discount rate but were sensitive to the market value of carbon. Substantial variation in values was recorded between study areas, demonstrating that restoration has proved more difficult to produce credible, quantitative estimates of ecosystem service values (14). In particular, there is a need for spatially explicit analyses of how the provision of multiple ecosystem services and their associated values might change under alternative land use scenarios (15).

Here we attempt to provide such analyses for the specific example of dryland forest restoration. The problem of environmental degradation is recognized to be most intense in arid and semiarid areas (15), which together constitute half the surface area of the world’s developing countries (16). Rural communities in dryland areas are often highly dependent on forest resources to support their livelihoods. However, in many areas dryland forests are severely threatened because of unsustainable land use practices, including livestock husbandry, use of fire, and overharvesting of fuelwood (17). These processes have caused widespread degradation of dryland forests, resulting in negative impacts on biodiversity, soil fertility, and water availability, as well as on the livelihoods of local people (16). Such degradation has been linked to widespread poverty and environmental degradation (18).

**Opportunities:** More than two billion hectares of land around the world that would benefit from some type of restoration intervention (GPFLR, 2011).

**Depending on the state of degradation of an initially forested ecosystem**, restoration can at least partially restore levels of biodiversity and ecosystem services given adequate time and financial investment.

**Past work has been overwhelmingly focused on site-level restoration**, and relatively little effort has been directed toward understanding links between restoration and factors that determine historical contingency.

**Few attempts have been made to systematically evaluate restoration economic effectiveness.**
Forest and Landscape Restoration Assessment [FLORAS]
Piloting An Inclusive-Integrative-Informed Planning Processes for FLR in Indonesia

• Restoration should be focused on restoring function at the landscape level. Consider and restore entire landscapes as opposed to individual sites.

• Restoring forward. Restore the functionality of the landscape, making it better to provide a rich habitat, prevent flooding and withstand the impacts of climate change.

• The planning process should be inclusive where it involved all relevant stakeholders.

• Integrative planning system which include a multi-level planning processes. To ensure successful implementation, it is important to include restoration bigger development objective.

• An informed process of restoration planning based on the best data and local knowledge available.
**Objectives**: Increased capacity of stakeholders in two targeted landscapes in South Sumatra and Jambi to conduct forest and landscape restoration (FLR) through informed, inclusive and integrative planning processes.

**Study sites**: Musi Watershed (7.7 million hectares) in South Sumatra and Batanghari Watershed (4.4 million hectares) in Jambi, Indonesia.
**[FLORAS]** in 6 Steps

- **[FLORAS]** strive to adopt Restoration Opportunities Assessment Methodology (ROAM) framework into technical steps which are suitable for local context and stakeholders mindset in Indonesia.
- **[FLORAS]** aims to facilitate and strengthen capacity of local partners through multi-stakeholders dialog and training sessions to produce feasibility analysis, strategy, and action plan on forest and landscape restoration in Indonesia.

Identifying and engaging **key stakeholders**

- Works together with key stakeholders at provincial, district and land management unit level to facilitate restoration planning at landscape scale
- Strengthen knowledge and capacity of through series of join study and training
- Initiate a watershed restoration planning processes through participatory approach
Identify environmental issues, drivers and identifying restoration objective (1)

- **Driver-Pressure-State-Impact-Response (DPSIR)** is a framework commonly used by policy maker to decide an intervention to environmental problem.
- Identify and map environmental issues and its drivers in Musi Watershed
- Map environmental issues/ problems and discuss the drivers
Identify environmental issues, drivers and identifying restoration objective (1)

Illegal logging
Sedimentation
Forest conversion
Insutrial activities
Agriculture expansion
Swamp reclamation for settlement
Expected function of a landscape based on local policy or trade-off between demands, economic benefits, culture, development objective, tenure

**Proxy**: land use plan, spatial plan, development master plan, forest designation map, land allocation etc.

The observed landscape does not functioned as expected >> FLR required

Actual function of a landscape based on field assessment, scientific research, satellite image observation, local information, statistic data

**Proxy**: land cover map, disaster map, environmental services map, erosion prone map, biodiversity/habitat degradation data
1. Create planning unit using combination of classes from layers of designated function and actual function

2. Conduct focus group discussion to capture stakeholders perception on designated vs actual function

3. Identify land with function degradation by building consensus on degradation of function

4. Assess potential restoration options using *pebble distribution method* 

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http://www.springerlink.com/content/p413465746536731/fulltext.pdf
More than 1.2 million hectares or 17% of Musi Watershed are identified as potential area for restoration, which have deviation/degradation from expected function.

- Around 0.2 million hectares or 18% of the potential area for restoration are located on peatland.
- More than 0.3 million hectares or 26% are located in protected areas.

**Restoration Options**

- Natural regeneration: 23.7% (286,484 ha)
- Assisted regeneration: 43.7% (539,255 ha)
- Rehabilitation/reclamation: 35.6% (436,640 ha)

**Mapping opportunities, option and priority**

Step 3
Developing strategy & analyzing ex-ante impact of FLR

- **Land Use Planning for Multiple Environmental Services (LUMENS)**

- **LUMENS** is a framework accompanied with a user-friendly and publicly available software that allows inclusivity, integration and informed negotiation of land use within a landscape. It is a spatially explicit, semi agent-based model that can accommodate a broad range of scenarios.

- **LUMENS** was used to develop restoration strategy and assessing restoration impact on environmental services, land use profitability, regional economic and other indicators.
On-going LUMENS process

Supports from: EU, DANIDA, BMU-ICI, MACF, FTA
Partnerships with: Bappenas, local government offices, GIZ, CCROM-IPB, Brawijaya University, NGOs, private sectors
Developing strategy & analyzing ex-ante impact of FLR

LUMENS MODULES

PUR
Planning Unit Reconciliation

QUES
Quantification of environmental services

SCIENDO
Scenario simulation and development

TA
Trade-off analysis
Developing strategy & analyzing **ex-ante impact of FLR**

**PUR**

**PLANNING UNIT RECONCILIATION**

**“INCLUSIVE PROCESS TO DEVELOP PLANNING UNIT”**

- Develop rules to resolve conflicting perspectives on land allocation
- Modify planning unit attribute table
- Dissolve planning unit per unique ID
- Apply AHP/fuzzy to simplify planning unit modification process
Developing strategy & analyzing **ex-ante impact of FLR**

**PRE-QUES**

**LAND USE CHANGE ANALYSIS**

**“UNDERSTANDING PATTERNS OF CHANGES”**

- Build lookup table
- LC change analysis
- LC trajectories analysis
- LC zonal statistics
Developing strategy & analyzing ex-ante impact of FLR

“QUANTIFYING CARBON DYNAMICS”

- Carbon density mapping
- Carbon sequestration & emission mapping
- Generate database

Carbon stock of land use systems are obtained from plot-level measurement and allometric modelling.
“DIVERSITY AT LANDSCAPE SCALE”

Measure Degree of Integration of Focal Area, based on:

• User defined habitat
• Plot level data or expert judgment
• Landscape configuration and composition

Reduction in DIFA between T-1 to T: 12.61%
"EXPLORE MULTIPLE SCENARIOS"

- NPV as an indicator
- Regional economic indicators: GDRP, labor absorption, sectoral linkages
- Opportunity cost curve
- Co-benefit among ES
- Costs and benefit of providers vs users of ES

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<th>Land cover</th>
<th>NPV ($/ha)</th>
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Transition Probability Matrix

Developing strategy & analyzing ex-ante impact of FLR
Developing strategy & analyzing ex-ante impact of FLR

PROJECTING THE FUTURE, WITH AND WITHOUT INTERVENTION

• Spatial variables as drivers
• Economic, policy, conservation strategies as drivers of land use changes
• Various Transition Potential Modeling Methods, e.g. ANN
• Spatially explicit cellular automata simulation
• Model validation
Developing strategy & analyzing ex-ante impact of FLR

- Natural regeneration scenario
- Assisted regeneration scenario
- Rehabilitation/reclamation scenario

Periods: [2014-2015] [2015-2016] [2016-2017] [2017-2018] [2018-2019] [2019-2020] [2020-2021] [2021-2022] [2022-2023] [2023-2024] [2024-2025] [2025-2026] [2026-2027] [2027-2028] [2028-2029] [2029-2030]
5. Developing action plan at site level

1. Mapping to identify priority area for restoration, derived from watershed-level potential restoration area;

2. Developing common objectives and restoration actions among key partners;

3. Assessing biophysical characteristics of the restoration site and in-depth discussion on restoration option with the local community in the vicinity of the site;

4. Assessing feasibility using Restoration Diagnostic questionnaire;

5. Developing strategy and business plan;

6. Conducting cost benefit analysis
• Public consultation was conducted at multiple levels to assess restoration strategy and action plan with broader stakeholder including key decision makers.

• Financial dialog was also conducted as a part of the public consultation processes to assess potential funding mechanism beyond state budget. Donors, CSO, bank and private sectors were invited to join the processes.
Achievement and Conclusion

In South Sumatra, the restoration potential maps has been mainstreamed into the Masterplan of Green Growth for South Sumatra which will be launched during Bonn Challenge Ministerial Meeting in Palembang on 9-10 May 2017;

The ‘restoration’ terminology in Indonesian policy context currently refers to a very narrow set of activities within reforestation of forest land or ecological restoration into pristine forms. FLR that aims to restore function within the landscape rather than merely planting any trees anywhere is a new idea that in more interesting to stakeholders;

Valid data and clear framework of FLR are useful in guiding the participatory process in identifying gaps between designated and actual function as degraded areas that is potential for restoration;

Future steps beyond FLORAS include: policy engagement, financing options, capacity strengthening for implementation and M&E.
Thank you