Restoration of tropical peatland in Indonesia: why, where and how?

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Summary

Tropical peatland, especially in South-east Asia has been developed since the 1970s. In the beginning, projects were mostly on shallow peat near to the coast and linked to small farm agriculture. During the 1990s the size of land use change projects increased dramatically and focused on deeper peat areas further inland. Some of these were for small farmers linked to transmigration but, increasingly, they were for plantations of oil palm and pulp trees. The success rate of these has been variable and the problems created have been many, as exemplified by the Mega Rice Project in Central Kalimantan. This paper analyses reasons for failure of this large and ill-fated tropical peatland development project, considers the environmental and socio-economic problems created and proposes strategies for restoration of this degraded landscape in order to promote its future 'wise use'.

Key index words: tropical peatland, Mega Rice Project, peatland restoration

Introduction

Indonesian and Dutch scientists identified the principal problems of reclamation of tropical peatlands more than 25 years ago (Soepraptohardjo and Driessen, 1976). Apart from chemical impoverishment and the oligotrophic, acidic nature of the peat, with extremely low ash content, they also noted a range of physical problems:

- slow rate of natural decomposition of organic matter linked to the high wood content;
- rapid oxidation and decomposition of organic material after vegetation removal and drainage leading to a high degree of subsidence and subsequent increase in flooding;
- irreversible shrinkage causing adverse water retention and increased erosion;
- extremely rapid horizontal hydraulic conductivity and very slow vertical conductivity;
- high heat capacity and low thermal conductivity causing major temperature variations at the surface;
- low load-bearing capacity causing top-heavy tree crops to topple over and making it almost impossible to use farm machinery or to construct roads and other infrastructure.

They were firmly of the opinion that 'no other soil type combines so many unused possibilities with so many unsolved difficulties' and that 'a multidisciplinary effort is needed to find ways to exploit the potentially suitable peat formations in a non-destructing way'.

They concluded that the main problems encountered in attempts to reclaim Indonesian lowland peatlands result from the lack of nutrients in the peat, poor physical properties and a lack of access to the peatland areas. The first two constraints mean that only a limited range of crops can grow under these difficult conditions while the latter presents major problems for marketing, storage and transportation. Nevertheless, large areas of coastal peatland, especially within the influence of daily tidal movements were developed for agriculture and human settlement over the ensuing 20 years with limited success.

Development of lowland wetlands for rice cultivation

In the 1960s Indonesia was confronted by a serious shortage of rice, making it the world's largest importer. Various sawah (lowland coastal rice cultivation in which drainage and irrigation is assisted by tidal movements along rivers and channels) intensification programs in Java had failed to achieve the desired result because of the limited availability of land with adequate irrigation facilities. Tidal swamps in various parts of the country were assessed in order to provide a solution. These developments were still inspired by traditional techniques, but improved using a systematic soil and engineering approach so that the unit of management could cover a larger area and incorporate better soil and water management that was coupled with Javanese traditional on-farm water management (the 'surjan system'). The former system controls water at a macro scale while the latter system manages water at a micro scale. The result was remarkable as not only rice could be grown, but also corn, soybean, peanut, vegetables and perennial crops such as fruit trees, coconut, coffee and cloves (Noto-

hadiprawiro, 1997). Development projects were carried out in Sumatra, Kalimantan and Irian Jaya (West New Guinea). By the mid 1980s Indonesia achieved self sufficiency in its rice production – for which President Suharto received a medal from the FAO – but, by the early 1990s, rice had to be imported once more and this was turning into a national crisis.

The Mega Rice Project (MRP)

This ambitious project was initiated by Presidential Decree 82/1995 (Muhamad and Rieley, 2002; Rieley and Page, 2005). It was based on over-simplified, over-pragmatic reasoning by which agricultural production, in particular rice (later on changed into food in general), was the resolute goal to deal with the pressing challenges Indonesia was facing:

1. Rice self-sufficiency that has been achieved in 1984 by the green revolution was gone by 1993. To fulfil the national demand for rice, the country was then compelled to import up to 2 million tons of rice a year (this inflated to 3.1 million tons by 2001).
2. Rice yields of existing sawahs with the application of pre- and post-harvest technology, which were within the economic and technical reach of the average farmer were levelling off, so that the perspective of agronomic intensification was limited.
3. The best sawah lands in Java were gradually being lost owing to conversion into non-agricultural use at a rate of 15,000-20,000 ha a year (Notohadiprawiro, 1995).
4. To build irrigation infrastructures and prepare sawah plots in upland areas by conventional techniques needs big investment.
5. Farmers considered rice cultivation much less attractive in terms of profit making than other, notably horticultural crops. It should be noted that the domestic trade of rice is rigidly controlled by the Government.

The idea of launching the MRP stemmed from an *ad hoc*, reactive approach characteristic of Indonesia's policy of national development. The ideas behind the MRP were that it would:

1. substitute for the agricultural land lost in Java in such a size that it would remove the necessity to import 2 million tons of rice a year;
2. save expenditure on irrigation infrastructures because the location selected was on wetlands (peatlands) where the water needed is already present;
3. be established in Central Kalimantan where land was obtainable extensively so that there would not be any special problem for procurement;
4. be established on idle land so there would be no problem of conversion of use.
5. Involve transmigration into a region that is sparsely inhabited thereby addressing another of the Government's major policies.

The ideas generating the mega-project show a number of serious flaws. Although the swamp land in question doesn't produce common agricultural crops, it yields natural products such as timber, rattan and fish, which are important to sustain the livelihood of the indigenous inhabitants. Wetlands, especially peatlands, perform significant environmental functions, which cannot be apprehended by untrained minds. A Java-centric thinking of land idleness and emptiness should not have been applied to regions such as Kalimantan where the physical condition and cultural and social situation are quite different from Java.

Failure of the MRP and subsequent actions

The total area of the mega-project is 1,457,100 ha located in the province of Central Kalimantan. To facilitate drainage and irrigation for the proposed rice cultivation 4,618 km of channels of varying dimensions were constructed across this peatland landscape. The erroneous reasoning behind the design and alignment of these channels was the fundamental cause of the debacle of the MRP but other, probably more fundamental reasons were the following.

1. Imposition of dry land development models upon wetland realities; wetlands must never be developed separately from the whole hydrological regime they belong to and planning for their development should be based on a holistic concept forming a comprehensive, optimizing approach by which economic and ecological goals can be achieved in a complementary way.
2. Reliance on outmoded paradigms of land development and conservation that failed to address the realities of the 1990s, especially the powerful underlying structures of knowledge, political power, social organization and economy that controlled the direction of resources development in Indonesia.

The MRP was formally closed down by Presidential Decree No. 80/1999 in which previous decrees were negated and guidelines for planning and management of the Ex-MRP were issued (Box 1). Following this decree there was much indecision and uncertainty over how to proceed but some steps were taken between 1999 and 2004 (Setiadi, 2007). Attempts were made at reforestation but without either strategy or success. The people who had been settled in Block A before the MRP was closed down, initially 15,600 families but reduced to 8,487 families by the end of 2006, were supported as a matter of priority. They had suffered much from the failure of the MRP to produce rice. Many had no previous experience of growing crops on swampy, peat soils and they were provided with insufficient technical assistance and guidance. Marketing provision and transportation routes were virtually non-existent. Added to these, soil was acidic, nutrient deficient and waterlogged in the wet season but suffered drought in the dry season. Crop productivity was low in terms of both quality and yield and suffered from animal and plant pests.

Alarmed at the lack of progress in rehabilitating the Ex MRP the Government of Indonesia decided to accelerate the process by issuing a further Presidential Decree in March 2007 (No. 2/2007). This endorses PD 80/1999 but specifies a large number of Indonesian Ministries and Agencies that will be involved and detailing the spectrum of projects that would be implemented under the headings of (1) Conservation, (2) Cultivation, (3) Empowerment of

Box 1

PRESIDENTIAL DECREE NO. 80/1999 on general guidance of Planning and Management of the Ex Mega Rice Project Zone in Central Kalimantan

Article 1

1. Planning, development and management of the peatland zone will be regulated based on principles of productivity and sustainable conservation of land and water resources, and compatible with zone development and growth based on land suitability criteria and biodiversity of wetland for the sake of the welfare and goodness of society.
2. Consolidation for the development and management of the zone outside the conservation zone at working zones (Blocks) A and D, at the peatland development zone, is to be conducted under the co-ordination of the Governor of Central Kalimantan Province.
3. Land with peat thickness less than 3 (three) metres at the working zone of peatland development can be used for cultivation of forestry, agriculture, fishery and estate plantations, with their development and management executed functionally under the co-ordination of the Governor of Central Kalimantan Province.
4. The wetland zone that possesses peat with thickness over 3 (three) metres and the zone that will function as a protection area in the working zone of peatland development must be set as a conservation zone whose management is under the Department of Forestry and Estate Plantations.
5. Planning, development, management, utilisation and or zone conservation as stipulated by items (2), (3) and (4) should be adjusted with the Spatial Planning of the Peatland Development Zone.

Local Community and (4) Transmigrants and Evaluation of Project Implementation (Table 1). It also requires that a 'Master Plan' with actions for implementation be prepared that will be used to guide the process and used to monitor its progress and success within a particular timetable.

Discussion

It is twelve years since the MRP commenced, and almost nine since it was closed down. In three and a half years it achieved nothing but a deforested, fire-prone landscape and increased poverty of the people who live in its surroundings. The only beneficiaries were logging companies who removed the timber and contractors who excavated more than 4,500 km of drainage and irrigation channels. This landscape is degraded with its ecological functions destroyed, leaking carbon to the atmosphere and rivers and subject to alternating drought and floods.

There has been much time for reflection and debate about what went wrong and what to do but mostly there was indecision and a lack of positive activity. There has also been an absence of strategy and co-ordination on the part of the Indonesian Government. Too many Government Agencies and Ministries were involved, each with its own sectoral policies and objectives and little co-operation and co-ordination between them. The EU-funded projects STRAPEAT, RESTORPEAT AND CARBOPEAT have devoted much time and effort to obtaining a better understanding of the problems created by the MRP using a scientific approach and making numerous presentations to policy makers and stakeholders (Rieley and Page, 2005). The principal problems that need to be addressed were identified at the International Symposium and Workshop that was held in Palangka Raya, Central Kalimantan in September 2005 (Rieley *et al.*, 2007) as biodiversity, fire, peatland restoration and water management, and poverty.

Biodiversity

Peat swamp forests (PSF) have high natural biodiversity in unique and variable habitats. This should be conserved and enhanced. Conservation of the PSF habitat must include all fauna, flora and ecological and physical processes necessary to ensure their long-term survival. Wherever possible, and especially where fragments remain, peat swamp forest should be rehabilitated to increase the area of this ecosystem in order to provide the maximum habitat for its biodiversity. Conservation areas should be managed according to 'Wise Use' principles and contribute to the livelihoods of local people in a sustainable manner.

Fire

Forest and land fires have become an annual event that causes public health and socio-economic problems locally, nationally and globally in addition to unwanted trans-boundary smoke/haze across the South-east Asian region. Fires remain the primary tool for land-clearing, although fire is not acknowledged as a major problem by the Indonesian Government at local and national levels as shown by the lack of funding and control resources allocated by them. A lead agency, staffed with experienced people, utilizing local communities, supported by proper legislation, funding, and fire mobilization capabilities, is essential to assess existing resources, determine requirements and coordinate activities on the ground within Central Kalimantan in order to prevent and combat fire.

Peatland restoration and water management

Peat Swamp Forests (PSF) are unique ecosystems with many complex interrelations. Until recently they were regarded as waste land that had to be put into use for humankind. Recent fire, erosion and flood events show the need for restoration of degraded PSF in order to maintain livelihoods and protect the environment. Restoration involves initiating or accelerating the recovery of the ecological functions of peatland ecosystems, as far as possible, for a variety of uses including agriculture, agro forestry, carbon store and wildlife conservation. Because peat occurs, and is maintained, only under water saturated conditions, water management is the basis of peatland restoration.

Table 1. PRESIDENTIAL DECREE (INPRES) No: 2/2007

	Peat Swamp Forest (C pool)	Oil Palm Plantation	Acacia Pulp Plantation	Degraded Peatland e.g. ExMRP*
Peat deposit pool at start of 25 years (before land use change)	+2218	+2218	+2218	+2218
Forest above ground biomass	+150	0	0	0
Forest root biomass	+15	0	0	0
Peat accumulation	38.5	0	0	0
Peat subsidence	0	-862.5	-1,715	-862.5
Peat loss as a result of fire	0	-135	-68.6	-620
Secondary vegetation biomass after 25 years	N/A	0	0	+27.5
PEATLAND CARBON POOL AFTER 25 YR	2421.5	1220.5	434.4	763
C IMBALANCE WITH PSF ECOSYSTEM AFTER 25 YR	N/A	-1201	-1987.1	-1658.5
CARBON GAIN/LOSSES OVER 25 YEARS	+38.5	-997.5	-1783.6	-1455.0
MEAN ANNUAL C GAIN/LOSS	+1.54	-40.0	-71.3	-58.2
MEAN ANNUAL CO_2 GAIN/LOSS	+5.65	-146.8	-261.7	-213.6
annual CO_{2e} change for area of 1 Mha (Mt)	+5.65Mt	-146.8Mt	-261.7Mt	-213.6Mt
Predicted years with peat (after 25)	n	30	6	13
Predicted lifespan of peatland under each land use	Forever!	55yrs	31yrs	38yrs

N/A: not applicable

*ExMRP – The former Mega Rice Project area in Central Kalimantan.

Poverty

People's ability to escape from poverty is critically dependent on their access to livelihood maintaining assets. The sustainable livelihoods (SL) approach, which is participatory in nature, seeks to determine poor peoples' livelihood priorities and link these with different socio-economic solutions depending upon specific circumstances. SL options for communities living near peat swamp areas include: the potential of different land uses, integrating the conservation and development of tropical peatland, and forging partnerships between local communities, local governments, DC government agencies, NGOs and international donors and experts in order to promote the sustainable restoration and management of peat swamp forest and peatland in general.

Conclusion

The key to success is to prepare a management plan that contains strategies for implementing all of the priorities mentioned above and operates in a coordinated manner that does not favour any particular sector. There must be integration at all levels, especially at the bottom where stakeholders must be empowered to be part of the process and not the problem. There are many constraints to be

overcome, including lack of coordination and funding and the need to integrate local knowledge and culture into implementation programmes. Negating the over-drainage effects of the extensive system of channels will be a major, possibly impossible, task for which the technology may not be available and the cost enormous. Rewetting may not succeed even if resources can be found to promote it. There are insufficient people with the skills necessary to implement a restoration and rehabilitation plan for the ex-MRP and resources must therefore be allocated to training and institutional capacity building. The financial resources needed are great, beyond the ability of the Indonesian Government to pay. The restored landscapes will unlikely provide profitable incomes or livelihoods for many people so it will be unwise to bring in more transmigrants to this poverty stricken and environmentally damaged area and alternative sources of funding will need to be sought from actions related to biodiversity and carbon conservation. It will be interesting to see how the Master Plan currently being prepared, funded by the Dutch Government, will address these problems and to find out whether or not the Indonesian Government will implement them.

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