Developing palm-oil production on degraded land

Technical, economic, biodiversity, climate, legal and policy implications

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# Table of Contents

**Introduction** ..................................................................................................................... 2

1. **The available potential: Size and location of the degraded land**.................................5  
   1.1. Definition..................................................................................................................5  
   1.2. Quantity and size of plots of degraded land.........................................................6  
   1.3. Suitable land.........................................................................................................11

2. **The available potential: Size and location of the degraded land**...............................12

3. **Development of degraded land with smallholders** ....................................................14  
   3.1. The smallholder on degraded land.........................................................................14  
   3.2. Addresses smallholder obstacles to developing degraded land...........................14  
   3.3. Smallholder organisation.......................................................................................16  
   3.4. Economics of the plantation...................................................................................17  
   3.5. Market access.......................................................................................................19

4. **Biodiversity impact**.....................................................................................................20  
   4.1. Conserving an area...............................................................................................20  
   4.2. Using bio-friendly methods..................................................................................23

5. **Climate change**.........................................................................................................25

6. **Conclusion and way forward**....................................................................................27

**Bibliography**....................................................................................................................29
Introduction

This publication provides detailed information on the implications of palm-oil production on degraded land. It is targeted at policy makers and the business community and is based on a unique field project lead by the PanEco Foundation, with support of the Roundtable on Sustainable Palm Oil (RSPO) and many other stakeholders. The project is executed on the ground by the non-governmental organisation (NGO) Yayasan Ekosistem Lestari (YEL).

The project represents the implementation of a resolution by the RSPO General Assembly (GA) in 2006 supporting the Switzerland based PanEco Foundation to develop a programme to “establish a palm oil estate according to RSPO Principles and Criteria on semi-degraded, unproductive land in Aceh Province, Indonesia”. Furthermore, the RSPO General Assembly in 2008 issued an additional resolution to take action to stop the destruction of the Tripa peat swamp forests for oil palm plantations.

Starting in May 2009 under the title “Pilot Study to Undertake Palm Oil Cultivation According to RSPO Guidelines on Fallow Land in the Context of Relocating Palm Oil Concessions Threatening the Last Remaining High Biodiversity Coastal Peat Swamp Rainforests in Aceh”, this project is a partnership between the Biodiversity and Agricultural Commodities Program (BACP) of the International Finance Cooperation, The World Agro Forestry Centre (ICRAF), PT Socfin Indonesia (Socfindo), LESOS, PanEco and YEL. Cordaid and Yves Rocher provided additional funds.

A similar project, known as POTICO (Palm Oil, Timber, Carbon Offset), led by the World Resources Institute (WRI), covers the whole of Indonesia, and has recently received considerable political attention. POTICO uses land use swaps to facilitate the expansion of sustainable palm oil, whilst at the same time avoiding deforestation. POTICO works with plantation companies that have permits to establish new plantations, on forested, or carbon rich areas. Under the POTICO system, the company commits to conserving these areas, and the WRI works to find suitable areas of degraded land as an alternative.

Background: a general interest to develop degraded land for oil palm plantations in Aceh Province and elsewhere in Indonesia

Indonesia has developed ambitious policies to both keep its forests, and to develop oil palm plantations on a large scale.

At the national level, during his first term (2004-09), the Indonesian President, Susilo Bambang Yudhoyono, promised a friendly investment climate, which promoted palm oil as the number one commodity for Indonesia to surpass Malaysia in the export market (Dunia Esai, 2010). In his second term (2009-2014), Indonesia continues to support agribusiness industries, including the expansion of oil palm plantations (Waspada, 2010; Dunia Esai, 2010). As a result, ambitious goals were set up to develop oil palm business in the Midterm Development Plan 2010-2014, compiled by the National Agency for Development Planning (Bappenas – Badan Perencanaan Pembangunan Nasional), based on Presidential Regulation No. 5/2010 (Bappenas, 2010). This plan is consistent with a 2005-2025 Long Term Development Plan developed by Bappennas in 2004 (Bappenas, 2004; Abusyadza, 2007).
At the same time, the Indonesian Government has set itself ambitious goals to reduce Green House Gases. At the United Nations Framework Conference on Climate Change (UNFCCC), in Copenhagen, December 2009, President Susilo Bambang Yudhoyono promised to reduce Indonesian Green House Gas emissions by 26% by the year 2020 acting alone, and by up to 40% with support from the International community. Such a reduction will only be possible by preserving the remaining forests, especially the carbon-rich peat swamp forests. In this context, Indonesia implemented a two-year moratorium on new permits for forest logging in the spring of 2011, as part of the Indonesia-Norway agreement seeking to conserve forest for its contribution to climate change mitigation.

However, promoting both oil palm development and forest conservation are two policies that are at first glance highly opposing each other (UNEP, 2011).

Oil palm plantations are primarily limited to lowland areas. Most palm oil development to date has been at the expense of lowland forests, including peat swamp forests (World Bank, 2006; Koh L.P. and Ghazoul J., 2010). Largely as a result of palm oil expansion, though of course not solely,, Sumatra lost close to three quarters of its lowland forests below 150m (76% of lowland forests on mineral soils and 63% of those on peatlands) between 1985 and 2007 (WWF, 2010). Destruction of lowland forests contributes to climate change, as these forests sequester on average between 170 and 250 tons of carbon per hectare (Malhi Y., et al, 2006; Chave J., et al, 2008; Lewis, et al, 2009). These forests are also extremely important for biodiversity (WWF, 2010). Of particular interest is the orangutan. The distribution of these high profile great apes is limited to lowland forest areas and as a result, the populations of both species are declining rapidly. In fact the Bornean orangutan is now considered to number only around 54,000 in the wild and is listed as Endangered by the IUCN (World Conservation Union), whilst the Sumatran orangutan is even more precarious, numbering only around 6,600 and listed as Critically Endangered (Wich et al,2008). Indeed, if existing trends continue, the Sumatran orangutan could actually become the first modern great ape in the world to go extinct in the wild within a very short time.

To reconcile the development of oil palm plantations with forest conservation practical alternative ways by which oil palm plantations can be developed without clear felling forests are urgently needed. The development of degraded land into new oil palm plantations, instead of forested land, seems a very promising option to promote both oil palm development and forest conservation for climate or biodiversity goals. In Indonesia, there are estimated to be around 7.3 million hectares of existing fallow, partially degraded land (Jawa Post, 2010), 200,000 hectares of which lie in Aceh Province (Aceh Green, 2008).

Under the leadership of Aceh’s Provincial Governor, Irwandi Yusuf, since 2006 Aceh Province with its newly granted special autonomy status (the result of a long running separatist conflict) has been trying to develop a green economy based on sound forest management. The Governor of Aceh launched a moratorium on logging in April 2007 and a “Green Economic Development and Investment Strategy” in December 2007, at the United Nations Climate Change Conference (Aceh Green, 2008) As a result, Aceh is certainly a forward looking region with considerable
potential in regard to the implementation of a pilot study for developing oil palm plantations on degraded land, and subsequent up-scaling.

The implementation of a pilot project adjacent to the Tripa peat swamp forest in Aceh’s Nagan Raya District is therefore highly symbolic. Tripa is an integral part of the biodiversity rich Leuser Ecosystem and one of only three significant peat swamp forests remaining in Aceh. During the nineties, when its forests were still largely intact, Tripa harboured well over 1,000 Sumatran orangutans. Now Tripa’s forests are rapidly disappearing through conversion for large-scale oil palm plantations, with the complete destruction of the peat swamp forests predicted by 2015 (UNEP, 2011).

Tripa is one of only three remaining large peat swamp forests on the west coast of Aceh. The others are the Kluet and Singkil swamps. Administratively the 3 swamps lie within the districts of Aceh Singkil, Aceh Selatan, Nagan Raya, and Aceh Barat Daya, the latter two being were Tripa itself is located.

This West coastal region is recognized as a unique landscape with a mixture of mountains, coastal plains and swamp ecosystems. The three peat swamps are part of the Leuser Ecosystem, an area renowned globally for its exceptionally high biodiversity value. In addition, the Kluet swamp is part of the Gunung Leuser National Park and the Singkil swamp forms the Singkil Swamp Wildlife Reserve, two strictly protected conservation areas.

Despite being formally designated as a conservation area the Leuser Ecosystem remains highly vulnerable to commercial exploitation and encroachment by farming activities and other developments. It is also subject to high grazing pressure and wood collection and harvesting by surrounding communities.

Instead of using primary forest areas to establish new agricultural land, the utilisation of fallow land is potentially a genuine practical alternative for productive and profitable activities.
1. The available potential: Size and location of the degraded land

While it is often stated by government and media that there are 7.3 million hectares of degraded land in Indonesia (Jawa Post, 2010), with 200,000 hectares in Aceh Province alone (Aceh Green, 2008), there are at present still no definitive, accurate and up to date maps available showing these areas in any detail.

For this reason, YEL has developed accurate maps showing degraded land within the four districts that contain peat swamp forests in Aceh (i.e. Aceh Singkil, Aceh Selatan, Nagan Raya and Aceh Barat Daya), using remote-sensing techniques (Landsat TM, acquired in 2009, and SPOT 4 imagery, acquired in 2006) supported by ground trothing in the field. This approach has resulted in both accurate and highly cost effective information.

To identify potentially available degraded land, a three-step approach was taken. First, to define the term “degraded land”. Second, to assess how much such land exists that fits the definition. Third, to analyse potential degraded land in terms of ownership and soil quality, to assess the actual availability of degraded land for oil palm development.

1.1. Definition

The term ‘degradation’ refers to the land cover. This land was in its original state a primary forest but is not any more. In this instance, the term ‘degradation’ refers only to the above ground vegetation and does not consider any degradation in soil quality, for example.

In most cases, the degraded land was originally forest that was converted into agriculture land several years or decades ago. After some years, in many areas agriculture had been abandoned due to social conflicts (e.g. the separatist conflict in Aceh) or because the land proved unsuitable for the desired crop. Left abandoned, this degraded land evolved over time into grasslands, shrub/scrubland and even secondary forests.

As the term ‘degraded land’ gains in importance, a quantitative evaluation is needed. Since the time-averaged above ground carbon stock of an oil palm plantation is approximately 40 t carbon/ha, conversion of land with a higher carbon stock incurs a ‘Carbon Debt’, while conversion of land below this threshold can lead to a carbon stock gain (Chase L.D.C and Henson I.E., 2010). The Carbon stock value can thus serve as a threshold for what can be termed ‘degraded’ land. The threshold of 40 t carbon/ha is much below what is required for orangutan habitat, as orangutans live in the canopy of high quality lowland rainforests, which are characterised by carbon stocks much in excess of 100 tons carbon/ha.

Using this definition, degraded land is often similar to fallow land. Fallow land can be defined as unused land that has been left to its own natural growth, and not planted with seeds or saplings. Examples include land that was cleared by timber concessions and/or for agriculture or plantations, but which has subsequently been left unutilised for at least 2 to 3 years. The vegetation of such land tends to appear relatively barren (when compared to forests and plantations, or other agricultural practices), being covered mostly by unproductive vegetation such as grasses,
shrubs, and bushy scrub. In remote sensing terms, such land can normally be relatively easily sub-categorized as shrub, bush, grassland or bare land.

1.2. Quantity and size of plots of degraded land

<table>
<thead>
<tr>
<th>Districts</th>
<th>Aceh Singkil</th>
<th>Aceh Selatan</th>
<th>Aceh Barat Daya</th>
<th>Nagan Raya</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total hectares</td>
<td>4,313</td>
<td>21,475</td>
<td>15,637</td>
<td>31,925</td>
<td>7335</td>
</tr>
<tr>
<td>Number of sites</td>
<td>58</td>
<td>77</td>
<td>38</td>
<td>101</td>
<td>274</td>
</tr>
<tr>
<td>Average size (ha)</td>
<td>74</td>
<td>279</td>
<td>412</td>
<td>316</td>
<td>268</td>
</tr>
</tbody>
</table>

Table 1: Amount of degraded land and average size of sites

In the four west coast districts examined in Aceh the total area of degraded land is highly significant, with more over 73,000 hectares (Table 1).

However, when looking at the distribution of the degraded land within each district (Figures 1, 2, 3 and 4), it can be seen that degraded land tends to be highly patchy and fragmented, comprising many small areas between 50 and 500 hectares (overall average 268 ha), distributed relatively evenly over each district.

The first obvious consequence of this is the inherent difficulty in developing large-scale, contiguous oil palm plantations (4,000 – 15,000 ha) on these disparate degraded lands, which is the business as usual practice of the main growers within the oil palm industry. It is difficult, or non-profitable in most cases, to develop oil palm plantations on discrete plots of degraded land, as numerous independent and fragmented units would be very costly in terms of transport and labour costs etc.
Figure 1: Distribution of degraded land relative to peat swamp forest areas in Aceh Singkil District
Figure 2: Distribution of degraded land and peat swamp forest areas in Aceh Selatan District
Figure 3: Distribution of degraded land and peat swamp forest areas in Aceh Barat Daya District.
Figure 4: Distribution of degraded land and peat swamp forest areas in Nagan Raya District.

**Source:**
Interpreted from Landsat TM 2000, and SPOT 4 res 10 m 2006
1.3. Suitable land

At first glance we have found that there are more than 73,000 ha of degraded land within the four districts examined. However, in reality, some of this land may still not be suitable for palm oil development, for example if the soil is not appropriate (e.g. the case of the peat swamps), or because the legal status of the land status does not allow farming (e.g. protected areas).

<table>
<thead>
<tr>
<th>Districts</th>
<th>Aceh Sinkil</th>
<th>Aceh Selatan</th>
<th>Aceh Barat Daya</th>
<th>Nagan Raya</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peat swamp - Deforested</td>
<td>1,391</td>
<td>9,266</td>
<td>9,838</td>
<td>9,546</td>
<td>30,041</td>
</tr>
<tr>
<td>Mineral soil – Deforested</td>
<td>0</td>
<td>3,727</td>
<td>2,542</td>
<td>3,605</td>
<td>9,874</td>
</tr>
<tr>
<td>Protected area for forest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mineral soil – Deforested designated as forest</td>
<td>1,975</td>
<td>706</td>
<td>0</td>
<td>1,895</td>
<td>4,576</td>
</tr>
<tr>
<td>Mineral soil – Deforested not designated as forest</td>
<td>947</td>
<td>7,776</td>
<td>3,257</td>
<td>16,879</td>
<td>28,859</td>
</tr>
<tr>
<td>Total hectares</td>
<td>4,313</td>
<td>21,475</td>
<td>15,637</td>
<td>31,925</td>
<td>73,350</td>
</tr>
</tbody>
</table>

Table 2: Land status and soil type within degraded land in the four Districts.

Table 2 shows that only 39% of the degraded land identified, close to 29,000 ha, is on mineral soils and does not belong to state forest lands (i.e. its existing status is *Areal Pengunaan Lain* or APL, which essentially means ‘land available for other uses’). This land is therefore potentially available for oil palm plantations. Extrapolating these results for the whole of Aceh Province, with its total of 18 Districts, one can easily envision that the total amount of similar degraded and available land within the Province may well be around 200,000 ha, as stated in the Aceh Green report. The potential to develop oil palm plantations on these degraded lands instead of converting primary forest would therefore seem an extremely valid option.

Deforested peatlands comprise 41% (i.e. 30,000 ha) of the degraded land identified in the four Districts. Deforested peat swamps are far from ideal for agricultural development, especially oil palm, as it requires high levels of investment and maintenance (for drainage and maintenance of the peat) and fertilizers. In addition, development of oil palm plantations on peatlands inevitably leads to the emission of large quantities of Green House Gases due to removal of the vegetation above ground and especially to the drainage and subsequent oxidation of the peat itself. In the overall context of climate change and forest protection, the rehabilitation of these deforested peatlands into functioning wetland forestsonce again, as opposed to developing them into oil palm plantations, could generate much bigger revenues through REDD schemes (Reduction Emissions from Deforestation and forest Degradation; UNEP, 2011).

About 13% of the degraded land identified in the four Districts, or 9,874 ha, is part of existing Conservation Areas (*Kawasan Konservasi*) or otherwise “Protected Areas”, that are strictly protected and earmarked for forest rehabilitation. Finally 6% of the
degraded land, or 4,576 ha, is part of an expansive Production Forest (*Hutan Produksi*) that must be managed sustainably for timber or agro-forestry and cannot be converted into oil-palm plantations.

2. Land rights & small holders

Degraded land is often considered as “waste land” that is available for development. In reality, however, ‘someone’ has converted “degraded land” or “fallow land” from a previously forested land, and these people will normally still claim ownership of it. Before developing this land into oil palm plantations, it is therefore of paramount importance to clarify land rights.

The land rights issue was also extremely relevant to PanEco’s pilot study project. At its inception, the District Government of Nagan Raya provided PanEco with around 100 ha of degraded land. In practice, these lands belonged to different local people, each with their own individual claim of ownership. The first main aspect of this project has therefore been to take into account all these local people that formally (with land title) or informally (through customary rights) claimed to own the land. The involvement of these local people in the project began by precisely defining the exact location and size of their individual plots, followed by their inclusion in developing the oil palm plantations, and their incorporation into an organization, the Credit Union, that now manages the whole plantation area. This proved to be a complex issue, not least because of the number of people involved. Individual plots tend to be only circa 0.5 - 2.0 hectares and more than 60 people had to be considered (see Figure 5).

This leads to two main challenges in developing degraded land into oil palm plantations:

1. Each claim has to be investigated and any contentious issues resolved prior to any development on the ground.
2. Each individual recognized owner had to agree to participate in the oil palm study (he could have alternately decided to sell his land or not participate in the scheme).

Both the above processes, clarifying land ownership and convincing the potential smallholder to take part, are time consuming. Furthermore, despite PanEco’s best efforts, some land rights could not be adequately clarified and some local people did not wish to participate in the pilot study.

Once these two challenges are overcome, a final issue regarding the land rights is the formal registration of the land at the government office to get land titles for owners who did not previously possess them. This is typically a very long process in Indonesia and often takes more than two years. The programme therefore first tried an alternate route, via a free government programme that supposedly offers a straightforward and low cost method of obtaining land certificates for local people. In reality, however, this proved to be an extremely bureaucratic and complex process that potentially could take several years before certificates would be issued. The programme has now budgeted costs for obtaining the land certificates following normal procedures, which hopefully will prove faster, albeit much more expensive.

Whilst not technically necessary to develop the oil palm plantation itself, a consensus and agreement being theoretically sufficient, a land certificate does still secure the
land rights. More importantly, land certificates can be used as collateral to gain access to capital from a bank. This is important, as oil palm plantations are particularly capital intensive for at least the first four years, from the initial land preparation work until the first yields.

Figure 5: Distribution of smallholder land ownership on the Lamie pilot study plot

3. Development of degraded land with smallholders
3.1. The smallholder on degraded land

Local people own the degraded land. They are either Acehnese or Javanese. The Acehnese traditionally live on the coast itself, and along major rivers. They tend to be predominantly fishermen, or farmers practicing extensive agriculture. The Javanese in the area mostly came from Java as plantation labour, arriving in the 1980s and 1990s as part of the government’s own trans-migration programme.

The typical owner of the degraded land is 40 years old and male. Over half (57%) are farmers, about 10% private sector workers and only 5% work as labourers in oil palm plantations. The remainder were government employees or had no clearly defined activities or employment. Education levels are rather low, with only a third of the members having graduated from high school. Fertility rates on the other hand are rather high, close to three, an issue in terms of environmental and economic sustainability.

The average pilot study member’s global monthly income from all activities ranges between US$120 to US$160 (IDR 1.2 to 1.6 millions), with about 70% of the overall spending going on food. The main income of the RSPO Pilot Study members is from farming. Most of them grow cacao on 0.5 to 1.0 hectare plots. The reason for selecting cacao as a main crop is due to its low capital needs, low maintenance costs, easy harvest processing and competitive market price.

In the development of agriculture, livestock or crops, local farmers in the region have not historically had access to bank loans or a lending agency. Most pilot study members (87%) rely on their own capital in order to generate income from agriculture or plantations. Therefore it has been highly recommended to support the members of the RSPO Pilot Study to build their own capital in future, through either a well-functioning cooperative or credit union.

From a smallholder perspective, the development of oil palm plantations from degraded land had not previously been possible for three main reasons, in addition to the above mentioned land ownership challenge (i.e. securing the land through a proper title deed or recognised customary law). These were:-
   a. Capital to meet upfront expenses.
   b. Access to good seedlings and necessary start-up technology.
   c. Smallholder aversion to risk.

3.2. Address smallholder obstacles to developing degraded land

Lack of access to capital to meet upfront expenses is a key issue from the smallholder’s perspective. Oil palm plantations are capital investment intensive (more than 3,000 USD/ha) and most of the smallholders did not have title deeds as collateral for bank loans. PanEco provided financial cover for the necessary initial work (i.e. clearing the area, initial pesticides, land cover crops). This financial cover was later incorporated within the Credit Union loan to the farmers and was instrumental in bridging this financial gap. As explained in chapter 3.4 below, the first seven years of oil palm development are normally at a financial loss and access to capital investment is therefore a crucial aspect to oil palm development.
Lack of access to good seedlings, and necessary start-up technology (e.g. land cover crops, pesticides etc.) was addressed through support in partnership with PT Socfindo. It was indeed, above all, when smallholders were promised seedlings from PT Socfindo that they really showed interest in the project and a desire to develop their plantations. The offer of this initial assistance by PT Socfindo and by PanEco to develop the plantations was important in formalizing smallholder commitment.

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Smallholders face a number of constraints in maximising their potential from palm oil production while maintaining local choice and autonomy. There are isolated examples of innovations to deal with these problems and improve the contribution of smallholders to sustainable palm oil production. Examples of constraints and responses include:

- **Ownership status**: Disagreements and uncertainty over land tenure are widespread – and can be violent. While strong public policy is essential for resolving long-standing conflicts over land, initiatives led by companies and government agencies to improve fairness and transparency have included granting of full land title once loans are paid off, going beyond legislation in terms for settling land disputes, and share-based land management in place of individually owned smallholder blocks.

- **Securing capital to meet upfront expenses**: Smallholders typically cannot meet basic conditions of collateral and minimum loan size to secure bank financing. Micro-finance institutions are the main solution. These may include interest-free loans for specified inputs, renegotiable terms and equity based on forms of recognition of land ownership other than formal land title.

- **Getting good technical, policy and market information**: Access to trustworthy information – on prices and pricing policies, market opportunities, technical aspects of production and site management, and more fundamentally on rights and options under national law or formal agreements – is a also a major difficulty. Responses to this problem include access-to-information services from NGOs and international agencies, but their reach is geographically specific.

- **Balancing cash crops with food security**: Early palm oil developments often deprived smallholders of sufficient land and time to feed their households. Both intercropping among young oil palms and set-aside land for agriculture have become more common. Some companies have introduced flexible labour schemes for smallholders and labourers to help them allocate their time optimally.

- **Coping with market risk**: Independent smallholders are particularly at risk from crop price fluctuations, and this is the main incentive to enter into or remain within supported schemes. Monopsony purchase by mills and lack of bargaining power among smallholders exacerbates the problem. Innovations have included national or internationally-indexed pricing standards and emergence of smaller-scale independent mills, but formal insurance for palm oil smallholders remains elusive.

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**Box 1: Smallholder constraints (Vermeulen, S. and Goad, N. 2006)**

Finally, smallholders tend to minimize risks and time allocation to properly develop degraded land. Busy in their normal daily lives, most of the farmers simply did not have time to develop their land into an oil palm plantation, even if technology and capital were provided. Only some smallholders directly worked on their own land. Others contracted other farmers (often relatives) to clear and prepare their land. The pilot study has striven to adapt to each particular situation. The diversity of smallholder approaches reflects the available funds and the time they can spend on their degraded land, as well as their overall desire to minimise risks. With higher incomes, smallholders tend to hire relatives and tend to be more directly involved in the pilot study. These smallholders take a larger financial risk, but hope for a better
return. With lower incomes, smallholders tend to do the minimum themselves and in fact minimize their involvement in the pilot study. They take a lower financial risk.

In summary, developing oil palm production on degraded land with smallholders, is very similar to all the key constraints in developing oil palm plantation with smallholders for any other type of land (Susila W.R., Bourgeois R. 2007, Box 1). The difference here is that there is not a conflict of needs between cash crops and food security, as oil palm development on degraded land does not replace pre-existing food crops.

3.3. Smallholder organisation

The last initial challenge, and probably the most important to be addressed in the long term when developing degraded land with smallholders, is that typically there are “Independent smallholders”. Potentially, these will cultivate their crop without assistance from government or private companies. Without support, they will sell their crop to local mills either directly or through traders. Such a situation at the starting point of developing degraded land into oil palm plantations can have a very negative long-term impact. Indeed, independent smallholders tend to get much lower income than supported smallholders or collective landowners (Box 2) as independent smallholders typically have low yields (for lack of technical support for plantation development) and tend to sell their product at a lower price (for lack of bargaining position).

**Box 2: Different types of smallholders. Vermeulen, S. and Goad, N. 2006**

Based on their culture, educational background and life experiences, it is indeed sometimes difficult for the smallholders to trust and to rely or depend on each other. It is therefore not easy for them to generate solidarity to achieve a common goal together. Farmers prefer to borrow money from an individual lender or from an agricultural agency at the local village level, rather than from other institutions. The process is often simpler and does not require collateral. As far as farmers subsequently producing an agricultural product, which is then normally sold to the lending agent/agency, who is then able to control prices, the farmers will usually be able to obtain the loans they need. This kind of system has been established for a long time and leads to a situation in which farmers often have no other alternative sources of capital to invest in a new plantation. Despite the fact that this kind of
system disadvantages the farmers, they do not normally see any other practical alternative.

A major challenge is therefore to develop an organization that will be able to carry out the technical aspects (i.e. access to seedlings, management of fertilizers, renting equipment, etc) and marketing aspects (negotiations to get fair prices, ensuring quality control). Development of such an organization is also a requisite from the point of view of established actors in the supply chain, especially oil palm companies and traders, who much prefer negotiating with one overarching actor than with numerous small ones.

In the case of the pilot study, a Credit Union, the Credit Union Makmur Indah Lestari, was established as early as July 2009 for these very reasons. Development of an effective Credit Union, however, has to address several internal and external structural barriers. Internally, development of a Credit Union is a long process, as local people, especially in Aceh, are not used to making decisions and working on agricultural issues collectively. A culture of trust and collaboration first had to be established. Identification, and then inclusion of the smallholders into the oil palm development is a learning process, where the local people need to be interested in participating in oil palm plantation development and then agree to be part of the Credit Union. Each stage of the development of these activities (i.e. identification of plot ownership, agreement in developing oil palm plantation activities and agreement to be part of an overall organization, the credit union), requires negotiation with each individual smallholder, and they may decide to participate in the development, or not.

Externally, development of a Credit Union faces challenges too, as it must demonstrate it has functioned correctly for one year to be formally recognised by the District Government as a legal entity. Only then can a CU have its own bank account and be able to access loans. It is difficult for a CU to function if it is not legally registered, as it cannot then be recognized as an institutional partner by third parties.

3.4. Economics of the plantation

As the development of the oil palm plantation is still only in its first two years, it is difficult to provide an accurate overview of exactly what will happen over the full 20 years of the oil palm plantation cycle. We can already conclude, however, that developing oil palm plantations on degraded land is technically relatively easy and in all points similar to the development of any other small palm oil plantation. Indeed, limiting factors for oil palm development appear to be the climate (humidity and temperature) and the amount of fertilizer provided. As this degraded land is adjacent to areas where the highest palm oil yields in the world are recorded (Jacquemard J.Ch., et al, 2010), one can assume that the climate is optimal. As for fertilizer, the programme strives to provide optimal fertilization, using organic methods.

Given the optimal climate, the financial projection for the pilot study has been assumed to be as follows. For the first seven years the plantation will operate at a loss, the first four seeing only investment and no harvest. Furthermore, the CU will suffer financial losses in the three following years as well, after the pre-harvest period, due to the low fresh fruit bunch production, with selling revenue not covering the costs and expenses, or the interest.
The investment for the Pilot Study plantation up to the first crop yields (the first four years) is USD 3,140 (IDR 26,979,700 per hectare with an exchange rate of 8600 IDR to 1 USD in May 2011). 52% of the investment costs are labour costs, whilst the rest include mostly tools, equipment and materials (e.g. seedlings, fertiliser).

The annual cost of plant maintenance during the crop yield period (i.e. after first harvest) varies with the age of the palms. During the crop yield period, labour costs account for approximately 55% of the total costs of plant maintenance. Furthermore, a large proportion of the infrastructure maintenance costs, around 80%, is for workers. The main income for Pilot Study members is realised through selling the fresh fruit bunches.

![Figure 6: Economics of the pilot study](image)

If financial management is carried out well by the CU, starting from the 7th year (the Break Even Point; see Figure 6), the Pilot Study members will be in a position to begin paying back their investment credit and working capital by instalments. Instalments for investment credit are projected to span eight years, and for working capital, six years.

The average income per hectare per year is predicted to be US$ 583 (or Rp. 5,014,227), which is Rp. 250,714 per hectare per harvest (assuming two harvests per month for a conservative 10 months per year). Over the life of the plantation (i.e. one crop cycle), investment is expected to amount to circa 69% of total overall cumulative revenues. The payback period of the project is 11 years. Based on the feasibility study for the project, the Benefit Cost Ratio (BCR) is greater than 1, meaning that it is financially viable.
3.5. Market access

With regard to market access, there are currently two places where the project can sell fresh fruit bunches in the immediate area (i.e. Darul Makmur sub-district of Nagan Raya District). There are also several big oil palm plantation companies operating in the region, to which the product can be sold.

As mentioned earlier, efforts will be made to ensure that the production is sold through the CU. Not only is this expected to get a better price, it is also important to differentiate this production from the business-as-usual oil palm development in the region that converts indigenous forests for large-scale plantation. In the case of degraded land development for oil palm plantations, it is indeed expected that a premium will be achievable for such a product, as it directly involves smallholders land, local communities, and respects biodiversity. Regarding biodiversity, PanEco decided to apply organic methods throughout. It is possible to go beyond RSPO requirements that still authorise harmful chemicals, and instead opt for a truly environmental and socially sustainable product. As such, this product may have access to a niche market.

It is also important to mention that when using organic methods to develop degraded land, the plantation not only minimises its impact on the environment, but also offers an opportunity for the farmers to produce their own organic fertilizer. This reduces maintenance costs, while simultaneously providing a new business opportunity.
4. Biodiversity impact

It is generally assumed that degraded land is wasted land with little biodiversity value. At the same time, others propose that this degraded or fallow land can be a very unique habitat for some plant or animal species. Debate is ongoing, especially due to the lack of information generally on degraded land that until now was little studied. By studying the changes and trends in biodiversity in the pilot study's PanEco can provide a first glimpse into the answer to this question.

There are two complementary viewpoints that should be adopted when studying the biodiversity impact of developing degraded land into oil palm plantations.

On the one hand, one needs to consider the impact of developing the oil palm plantation at the site level itself. From this perspective, what is important is the zoning of the site, and the allocation of areas to different land uses, such as conservation areas and oil palm areas.

At this level, most important from a biodiversity conservation perspective is to try to allocate the largest, contiguous, area possible for conservation. As the size of any area set aside for conservation ultimately depends on the decisions of those that actually own the land, in this case the smallholders, the main question is then how large an area can they be persuaded to set aside?

On the other hand, one needs to look at the issue from a micro-level perspective, at the level of the land itself, within the zones established on the site. In this case, what is important is to effectively monitor changes that occur within areas of the site under

Figure 7. Land use map for the RSPO_Lamie plot
different land uses. In the case of the pilot study these include the conservation area that has been set aside, the degraded land already cleared and planted (i.e. the planted land), and remaining degraded land not yet cleared or planted with oil palms.

4.1. Conserving an area

The sum of each individual’s ‘normal’ behaviour would lead to the total transformation of all the degraded land into oil palm plantation, as each smallholder would naturally seek to maximize oil palm production on their own individual plot. As a result, the destruction of any HCVF (High Conservation Value Forest), as defined by RSPO Principles and Criteria (P&C), that should be set aside for conservation would be the most likely outcome. Under this kind of scenario, how can the locally dire profit seeking reality, meet RSPO P&C that require keeping HCVF.

Initially, the pilot study’s conservation area was defined after checking against the RSPO P&C. Following RSPO criteria 7.3, regarding the conservation of HCVF for biological importance and Indonesian law (Box 3), a secondary forest area within the site was earmarked to be set-aside as a conservation area. It covered a total of 4.3 ha, mostly comprised of a single contiguous forested block, with a few outlying fragments.

Species listed in the IUCN Red List of Threatened Species and found to be present at the pilot study site included White-handed gibbons (*Hylobates lar;* IUCN Vulnerable), Thomas’ langurs (*Presbytis thomasi;* IUCN Vulnerable), Malayan Sun bears (*Ursus malayanus;* IUCN Vulnerable), Whitehead’s spiny rat (*Maxomys whiteheadi,* vulnerable), and 13 bird species, including the Large green pigeon, *Treron capellei* (listed by the IUCN as Vulnerable). Evidence of Sumatran tigers (*Panthera tigris sumatrae;* IUCN Critically Endangered) also using the site was found too.

Three species of Pitcher plants (Nepenthaceae) were also found; *Nepenthes albomarginata, Nepenthes ampullaria,* and *Nepenthes gracilis,* all of which are notable carnivorous plants protected by Indonesian law since 1999.

12 near-threatened forest dependent bird species were recorded in the area, as well as three species of threatened reptiles and amphibians (although these were all outside of the pilot study boundary itself when seen, they are highly likely to frequent it as well).

Box 3: Threatened species found on the pilot study

However, from the perspective of the local smallholders, it is important to note that this area still represented 5% of the total initial smallholder area for the pilot study. It therefore represented a substantial percentage of the total area that would not be developed and instead would be effectively ‘lost’ to them for economic development. It should also be realised, however, that this viewpoint does not take into consideration the fact that set-aside conservation areas can actually provide economic benefits to an oil palm plantation, for example by hosting predators and other important animals and plants, that might play a role in regulating pests and diseases that could potentially be detrimental to the oil palms and their productivity.
After defining the conservation area against RSPO P&C, two main options were discussed (Figures 8 and 9). Option 1 seeks to preserve most of the re-growth or secondary forest area (the best conservation option) and Option 2 seeks to preserve only those areas that were most in tune with the smallholder’s own social realities. After discussing the two options at length, the smallholder group eventually decided to opt for option 2. The smallholders as a group agreed to compensate the two smallholders that could not develop their land, or at least a significant part of it. It was agreed to buy this land based on the average market price per hectare of farming land in the local District (Nagan Raya) and amounts to IDR 10 million per hectare (around US$ 1,100).

Unfortunately, whilst the whole group of smallholders initially agreed on option 2, in the end it was still not realised. The farmer, who should have put aside the majority of his land parcel for conservation purposes and agreed to the compensation terms outlined above, subsequently refused to comply with the collective decision. He decided instead that he would leave the group and develop his land independently for oil palm. By way of a compromise, however, the other smallholder, who had only a fraction of his land within the proposed conservation area (just over a quarter) offered to conserve the majority of his land instead. This land is located adjacent to the land belonging to the other smallholder, who had refused to give up his land for conservation. As the characteristics of its vegetation are similar (secondary forest) to the initially earmarked conservation area, this seemed a practical solution, and the owner is now being compensated by the other Pilot Study members under the same conditions outlined above.

Strict application of the RSPO P&C concerning HCVF, as a means to identify and define conservation areas within plantations, was considered a good way to start, to determine which areas should be protected from an ecosystem perspective.
However, in a case like the Pilot Study, the smallholders are ultimately the ones who decide since they are the actual landowners. The process outlined above shows that despite early good will and a lengthy, collective decision making process, individual stakeholders and the decisions they make can still have an enormous bearing on what actually results during practical implementation on the ground. This therefore often demands additional compromises to achieve a particular goal, in this case establishing a set-aside conservation area within the pilot study.

During the negotiation process and its implementation, the size of the area to be conserved shrank markedly, as the smallholder’s keen interest to develop the land tended to override biodiversity considerations. The initially defined conservation area totalled 4.3 ha. Option 1 would have resulted in 3.7 ha being conserved and Option 2, 2.8 ha. The smallholder group chose this second option, but when actually trying to implement the conservation area, only one smallholder agreed to conserve most of his land and only 2.32 ha (54% of the original planned conservation area) was in the end set aside as the Pilot Study conservation area.

4.2. Using bio-friendly methods

PanEco monitored various indicators of environmental impact in the three defined areas within the Pilot Study; the secondary forest (conservation area), degraded land not yet cleared and planted, and the planted land (the oil palm plantation area itself). In each area, regular surveys of birds, reptiles and amphibians, small mammals, insects, vegetation, plankton and benthic fauna were carried out.

For each of the biodiversity parameters identified for the study, three main indicators were monitored:

1. Number of individuals (where applicable).
2. Number of species or orders (where applicable).
3. Number of threatened species recorded in the IUCN red list of threatened species, CITES appendix I and II listings, and the Government of Indonesia’s own protected species lists.

The programme also monitored soil and water quality.

The first obvious finding is the existence of an important number of plant and animal species on the degraded land: More than 100 bird species, 25 reptiles & amphibians, close to 300 different species of insects, more than 10 small mammals, 2 threatened primate species, and 1 bear species, and the critically endangered Sumatran tiger were still found to frequent the site. This diversity is almost certainly largely a result of the remaining diversity of the habitat itself, both within the site and in the surrounding area.

Overall, these studies of the Pilot Study since 2009, from the initially degraded land to an established (albeit young) oil palm plantation with associated small conservation area and some remaining degraded land, recorded mostly the same species from year to year. The numbers of species and total population sizes appear to decline only slightly for some taxa. Only the bird community seems to have lost at least 20% to 30% of its original species. Insects, after an initial loss seem to be recovering, as well as reptiles and amphibians. Mammal species populations seem stable so far.
This may well be directly linked to both the conservation of conservation area and the use of biodiversity sensitive organic methods from the outset of developing the plantation.

Organic methods have almost certainly contributed to some degree in maintaining the species populations and facilitating recolonisation of the area, especially by plants and insects, and ultimately other fauna too. The plants and insects are the two basic categories at the base of the food chain, and hence largely determine what other species can survive in a given area.

Establishment of the conservation area has been effective in keeping most of the endangered plant and animal species, with the notable exception of birds. The only threatened bird species recorded from the site, the Large Green Pigeon (*Treron capellei*) has not been seen since, however, and the same is true for eight of the 12 near-threatened birds. A simple conclusion to draw from the perspective of threatened bird species conservation is that the decision to set aside a 2.7 ha conservation area within the pilot study may have little or no tangible long-term positive impact on currently seriously threatened or endangered birds species. This is consistent with recent findings on bird populations in forest fragments in oil palm landscapes elsewhere, e.g. Edwards, et. al, 2010, who suggests that any investment in the retention of fragments would be better directed towards the protection of contiguous forest. Similar concerns exist for the mammal species still found in the conservation area, since they may also need much bigger areas in which to survive in the long-term. However, this conclusion is still under review, as small conservation areas may still be important as occasional food sources and refugia for birds in nearby, or even far away areas, including some threatened species. Interconnectivity often does matter, and any attempt to evaluate the importance of a conservation area, however small, must be viewed from a landscape perspective, especially when considering animal species with large potential ranges.

It also seems clear that even small forested conservation areas retain a high number of species and individuals, even if they are not necessarily globally threatened species, showing that they are still important for regional and local biodiversity conservation. This is supported by the conclusions of several studies that have followed the trajectory of species populations in fragmented forests (e.g. Benedick, et al 2006, Struebig. et al, 2008, Struebig, et al 2011).

Analysis of the different land use types, shows that the use of the most biodiversity friendly methods available, i.e., organic methods, offers some potential to control pests and diseases, as the local biodiversity richness helps maintain a balanced ecosystem, by maximising the likelihood that natural predator-prey relationships can continue to function. However, maintaining high levels of biodiversity, both in terms of numbers of species and of individuals, can have both positive and negative effects. Some species can develop into pests, attacking the oil palms, whilst some other species are their natural predators, and help to control these pests. It is therefore essential to try as hard as possible to maintain an ecological balance, and if necessary, to complement this with targeted actions against specific pests, if absolutely necessary.
The most notable potential pests found in the early stages of the plantation’s development are: the black rat that according to the farmers attacks the young plants and later the fruits, the rhinoceros beetle (*Oryctes rhinoceros*) attacking the palm hearts, the nettle caterpillar (*Parasa lepida*), that eats the palm leaves and causes significant reductions in palm productivity, and also the extremely invasive grassland species *Imperata cylindrica*, that must be kept under control.

Rats are predated by birds of prey, in particular the Black-shouldered Kite, a pair of which has already been observed in the area, and Barn Owls *Tyto alba*, which may soon colonise the area naturally, or will be assisted to do so by encouraging them with special nest boxes. Rats are of course also preyed on by snakes, the conservation status of many of which remains poorly known in the region, due to a paucity of targeted fieldwork. Continuing production using organic methods is therefore considered important in promoting the natural regulation of pests by their natural predators, thereby encouraging and facilitating the long-term survival of these species in the area.

Most insect predators are birds. Cuckoos, of which a few species can be found in forest areas adjacent to the site, are the main consumers of the nettle caterpillar. A myriad of other insectivores keep leaf-eating caterpillars and bugs under control. Insects are also controlled by other insects, such as predatory species of the Mantidea, and Dermaptera, and many Coleoptera species, and parasitic species, such as the majority of the Hymenoptera and some of the Diptera. Of interest is that many species of these orders were found in the pilot study’s conservation area. The pilot study may therefore also consider planting additional beneficial plant species that encourage and host predators of oil palm pests along the boundaries of the site. Potential plant species to consider would include *Tunera subulata*, *Cassia cobanensis*, and *Antiginon leptopus*.

*Imperata cylindrica*, a domineering grass that established itself as a dense cover on the degraded land prior to the pilot study, remains a problem. It spreads both through small seeds, which are easily carried by the wind, and via rhizomes. Manual control of *Imperata cylindrica* is necessary, but it is also difficult, as the dense rhizome system impedes establishment and development of other beneficial crops, especially the Land Cover Crop species planted prior to the oil palms themselves. Herbicides would normally be used to address this aggressively invasive grass species, but the project is reluctant to use them, since to date it has adopted only organic methods of pest control. This situation needs to be carefully addressed and a decision made on how best to deal with it, bearing in mind that organic certification of the palm oil produced can still be achieved at a later stage of production, even if some chemicals are used in the early stages of plantation development.

In addition to its role in the control of pests and diseases, it will also be important to discuss the exact role of the conservation area in the coming years, both from the perspective of the smallholders, as it could be enriched for economic value, e.g., by adding timber tree species, other economically valuable trees or plants, and from a biodiversity conservation perspective, to enhance its biodiversity conservation potential, e.g., by adding plants that might specifically attract threatened species.
5. Climate change

Development of oil palm plantation from degraded land on mineral soil has a direct positive impact for climate mitigation in most cases. Indeed, oil palm plantations sequester on average 40 tonnes of carbon per hectare during their 25 year plantation cycle, with a peak of about 60 to 80 tonnes of carbon per hectare in mature plantations. This is much more than the grassland, shrubs and scrubs that compose most of the degraded land.

When degraded land is a secondary forest, however, conversion into oil palm plantation may often result in a net carbon emission. Fortunately, and as demonstrated in the biodiversity section, in most cases this secondary forest must be kept as a conservation area for its biodiversity value as it is represents HCVF according to RSPO P&C.

Development of oil palm plantations from degraded land on mineral soils also has an indirect positive impact for climate mitigation as forested land, especially peat swamp forests, should then not be used for oil palm development.

Lowland peat swamp forests are disappearing in Southeast Asia at a rate of around 100,000 ha per year, most of it being converted for agriculture in the form of plantations (IRIN, 2011). It is well known that the major oil palm companies within Indonesia still have large tracts of as yet undeveloped concessions of peat swamp forests in their reserve banks (Greenpeace, 2008).

Conversion of rainforest --and especially peatswamp forest-- releases huge quantities of greenhouse gases. Above ground, in the tree and litter, conversion of lowland tropical forest releases between 170 and 250 tonnes of carbon per hectare, including in Sumatra (Tata H.L. and van Noordwijk M., 2010). Below ground, in the peat layers, drainage and oxidation of the peat releases vast amounts of carbon into the atmosphere, and this is exacerbated by the use of fire and fertilizer application.

Burning of peatlands is strictly forbidden under Indonesian law, and also under the Roundtable on Sustainable Palm Oil's (RSPO) P&C. Despite this, peatland fires are still very common in the country. Fires release a minimum of 50 tonnes of carbon per hectare (Page S.E., et al. 2000; Siegert F., et al., 2002; Page S.E. et al., 2002). After logging and possible burning to clear any remaining vegetation from the land, oil palm plantations establish drainage canals to lower the water table to below the surface of the peat. This dries out and oxidizes the peat as it is exposed to the air. Although debatable, as the coefficient of correlation is low, it has been estimated that for every 10 centimetres drained, 2.5 tonnes of carbon (or nine tonnes of carbon dioxide) per hectare are released annually (Hooijer, A.,Silvius, M., Wosten H. and Page, S. 2006.). Under even the best management practices, with the drainage depth of oil palm plantations ranging from 50 to 70 cm, this leads to an annual carbon loss in the region of 14 tonnes per hectare.
6. Conclusion and way forward

Developing degraded land on mineral soils to ensure oil palm supply and to protect remaining lowland rainforest biodiversity is at first glance a very interesting option to combine two apparently opposing policy goals: economic development of the oil palm sector and forest protection for climate change mitigation. In addition, developing oil palm plantations on degraded land can have a positive impact on climate change mitigation.

In fact, our study showed that development of degraded land on mineral soils provides equal or even better economic returns than the development of oil palm plantations on forested land (Figure 6). Indeed, development of land on mineral soil does not present any special technical challenges compared to any classical oil palm development on mineral soil with indigenous or primary forest. Furthermore, development of oil palm plantations from degraded land on mineral soils can be more economically profitable than in peat areas, as investment costs are lower than on peat soils and yields can be higher. Under best management practices, financial analyses have shown that ‘degraded’ land offers superior rates of return to oil palm growers than either un-forested, or forested, peatlands (BAPPENAS, 2009).

In fact our fieldwork shows that the preference for plantations on peat soils instead of degraded land is due to the fact that there tend to be fewer claims by local communities on land ownership, that are both time consuming and can cause conflicts. The possibility to get income from logging the primary forest trees, prior to establishing the oil plantation may be an additional incentive, though this seems secondary and marginal compared to the complex land issue.

In addition to positive financial returns, development of degraded land into oil palm plantations also has climate change mitigation benefits and a low impact on biodiversity, especially if key conservation areas can be identified and preserved. Even if these conservation areas are difficult to maintain, development of oil palm concessions on degraded areas have a much lower impact on climate and biodiversity than the development of forested land, and especially peat swamp forests.

Given the above, the first results of the Pilot Study provide a strong case for developing oil palm plantations from degraded land, including land swaps in the plantation sector from peatlands to mineral soils.

However, two key policy barriers have been identified that will first need to be addressed both to optimize oil palm production and to really secure conservation areas: the amount and type of degraded land available, and the willingness of local farmers (small-holders) to participate.

Amount and type of degraded land available
The degraded land consists of 50 to 500 hectare plots distributed rather randomly though the four districts assessed. As such, it is impossible to propose a land swap with a business-as-usual large scale-oil palm concession (3 to 13,000 hectares) to degraded land. Furthermore, these small patches of land are also not of direct interest to the oil palm sector at first glance due to the economies of scale, namely
the extra costs of transport and communications between many small sites, as opposed to a few large ones.

**Participation of local farmers and the business model**

The other policy issue is that degraded land is by definition land that has been degraded by people, who may well have a claim to it. Development of degraded land therefore requires clarification of land rights and prior consent of the owners. Land tenure security is a prerequisite for any serious business investment on the land. In addition, these smallholders tend to have only between 0.5 to 2.0 hectares of land, which means many stakeholders, lots of time, and potential conflicts.

Local farmers are also very keen to benefit from the business-development of oil palm plantations within the context of their own existing livelihood and farm systems, as they want to be resilient to market fluctuations and not entirely dependent on any single monoculture crop. However, to develop oil palm plantations local farmers often lack some of the basic requirements such as materials (e.g. seedlings, fertilizers), technical knowledge (e.g. plantation management, developing cooperatives) and direct access to markets, in order to make well-informed decisions.

Overcoming these two shortcomings would need a reform in the oil palm sector, necessitating government intervention and private sector support.

Corporations seeking to develop degraded lands would need to revise their business practices towards enhanced community-business partnership models, or innovative community-based plantation models. If companies realize that their comparative advantage is mostly at the processing, rather than the primary production stage, new win-win solutions can emerge for both farmers and companies.

Government intervention is also needed to clarify land tenure, facilitating processes to clarify and certify individual land ownership or developing schemes to recognise customary land rights to possess and use the land. The second option may be important, as the ‘right to use’ is key to developing the land, while the right to own (land title) may be counter-productive as individual farmers can then sell their individual plots instead of participating in the collective local development. Government intervention may also be important in regard to access to technology (e.g. seedlings) and accurate, updated information on the market.
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