

Livelihoods and Forest Resources in Aceh and Nias for a Sustainable Forest Resource Management and Economic Progress

Report of the project identification study

Suseno Budidarsono, Yuliana C. Wulan, Budi, Laxman Joshi and Sinung Hendratno

Southeast Asia



World Agroforestry Centre
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Abstract

Report summary (Bahasa Indonesia)

1. Dua tahun sudah terlewati sejak bencana gempa bumi dan tsunami pada Desember 2004. Sebagian besar upaya-upaya rehabilitasi kehidupan wilayah korban bencana sudah memasuki tahapan pembangunan ekonomi jangka panjang dan peningkatan mata pencaharian. Namun, kenyataan bahwa kejadian gempa bumi dan tsunami yang terjadi di wilayah yang sebenarnya telah mengalami konflik berkepanjangan, tampaknya terabaikan. Di seluruh provinsi dan khususnya di wilayah pedesaan, keadaan infrastruktur rusak berat dan diperburuk lagi oleh situasi keamanan yang mempersulit bahkan tidak memungkinkannya dilakukan perawatan. Tiga dekade masa konflik yang berkepanjangan berdampak pada struktur sosial di provinsi ini.
2. Dengan menggunakan analisis situasi berdasarkan data sekunder dan data primer, kajian ini berusaha mencari kemungkinan pengembangan perlestarian lingkungan hidup yang memberikan manfaat bagi pertumbuhan ekonomi, melalui pengembangan sistem pertanian berbasis pohon untuk pemulihan kondisi wilayah paska tsunami dan konflik di Aceh dan Nias. Kajian ini dilakukan di wilayah-wilayah yang dipilih berdasarkan aksesibilitasnya dan sejarah konflik: wilayah yang memiliki aksesibilitas tinggi di pantai Timur Provinsi NAD (dengan sejarah konflik yang cukup berat), wilayah dengan aksesibilitas rendah di Aceh Barat (yang juga mempunyai sejarah konflik) dan wilayah dengan aksesibilitas sangat rendah seperti pulau Nias (yang tidak memiliki sejarah konflik seperti halnya di Aceh).
3. Kajian kondisi sosial – ekonomi di Aceh dan Nias dilakukan dengan cara survey rumah tangga, Rapid Rural Appraisal (kajian perdesaan secara cepat), dan konsultasi dengan beberapa para pemangku kepentingan. Pandangan dan persepsi masyarakat setempat mengenai kebutuhan dan kemungkinan untuk pengembangan ekonomi dikaji secara sistematis. Lokasi kajian mencakup wilayah pantai yang menerima dampak langsung dari tsunami (Zona A) dan wilayah pedalaman dan pegunungan yang tidak terkena dampak langsung tsunami (Zona B).
4. Penghidupan masyarakat perdesaan di Aceh dan Nias bertumpu pada tiga sumber utama: perikanan, pertanian sawah dan lahan kering, serta budidaya tanaman tahunan. Hampir seluruh tanaman padi dikelola secara subsisten dan kurang-lebih 70% budidaya padi merupakan sawah tadah hujan.
5. Padi ladang masih umum dilakukan di daerah pegunungan (Zona B). Banyak masyarakat melakukan praktek perladangan berpindah di lahan-lahan milik komunal (desa) dengan tehnik tebas bakar dalam penyiapan lahan. Semua anggota masyarakat mempunyai hak yang sama dalam pemanfaatan lahan komunal untuk bercocok tanam, sepanjang sedang tidak dimanfaatkan oleh anggota masyarakat yang lain. Lahan-lahan yang sudah digunakan untuk budidaya tanaman pepohonan tidak bisa lagi digarap untuk bercocok tanam oleh anggota masyarakat yang lain
6. Perdamaian atas konflik politik berkepanjangan (perjanjian Helsinki) pada Agustus 2005 dan implementasi perdamaianya telah menghilangkan "faktor ketakutan" untuk melakukan pemanfaatan lahan. Di beberapa desa terjadi peningkatan praktek

perladangan yang tidak hanya terbatas di lahan-lahan komunal, bahkan masuk ke wilayah hutan negara yang telah terdegradasi.

7. Kebanyakan masyarakat bekerja sebagai petani atau terkait dengan sektor pertanian, kecuali di daerah pantai Pidie yang kebanyakan adalah nelayan. Pertanian merupakan sumber pendapatan terbesar dari rumah tangga. Hasil tanaman tahunan memberikan sumbangan terbesar dalam pendapatan rumah tangga di Kabupaten Aceh Barat dan Nias (masing-masing 60% dan 30%). Walaupun budidaya pertanian berbasis pohon dilakukan oleh hampir seluruh petani di lokasi kajian, kebutuhan akan pengetahuan dan teknologi budidaya serta pengembangan pemasaran, perlu mendapat perhatian seksama untuk peningkatan hasil. Dalam beberapa kasus, masalah kepemilikan lahan masih belum jelas.
8. Kebanyakan masyarakat merupakan petani atau terkait dengan sektor pertanian kecuali di daerah pantai Pidie dimana kebanyakan adalah nelayan. Pertanian merupakan sumber pendapatan terbesar dari rumah tangga. Tanaman tahunan menyumbangkan porsi tertinggi dari pendapatan rumah tangga di Kabupaten Aceh Barat dan Nias (masing-masing 60% dan 30%). Walaupun wanatani berbasis pohon dilakukan oleh hampir seluruh petani di lokasi kajian, peningkatan teknologi dan pasar diperlukan. Dalam beberapa kasus, isu kepemilikan lahan tidak jelas.
9. Karet merupakan tanaman tahunan yang dominan di Aceh Barat dan Nias. Kebanyakan pohon karet yang ada sudah tua dan tidak produktif. Pohon dan kebun karet tidak terawat dengan baik. Begitu juga dengan budidaya kakao; banyak lahan yang ditinggalkan di daerah pedalaman di Pidie dan juga tidak dikelola secara baik dengan produksi sangat rendah. Budidaya kelapa banyak ditemui di wilayah pantai dengan potensi yang terbatas untuk pengembangannya pada saat ini, karena melimpahnya pasokan dan harga yang sangat rendah.
10. Berkaitan dengan standard kehidupan, dengan menggunakan pendapatan sebagai tolok ukur, masyarakat di wilayah pantai (Zona A) relatif lebih baik (dengan pendapatan per kapita yang lebih tinggi) dari pada masyarakat di wilayah pedalaman (Zona B). Dengan mengacu garis kemiskinan SUSENAS 2007 (Rp 1,834,164/kapita/tahun), proporsi rumah tangga yang ada di bawah garis kemiskinan di semua lokasi kajian lebih tinggi daripada rata-rata nasional. Pidie memiliki tingkat masyarakat miskin yang tinggi, jauh dibawah garis kemiskinan. Kajian ini menemukan bahwa banyak masyarakat di Pulau Nias dan Pidie daerah pedalaman merupakan kelompok masyarakat miskin.
11. Meningkatnya kebutuhan bahan-bahan bangunan (pasir, batu, kayu, dan batu bata) telah mendorong meningkatnya kegiatan penambangan dan penambangan pasir/batu di Aceh dan Nias. Konversi hutan untuk menanam padi dan sekaligus pengambilan kayu juga meningkat. Harga beras yang semakin tinggi juga memegang peranan penting dalam meningkatnya pemanfaatan lahan untuk menanam padi. Penggunaan lahan gambut untuk pemukiman dan perkebunan kepala sawit juga merupakan salah satu masalah lingkungan yang perlu mendapat perhatian. Pemerintah daerah yang seharusnya dapat menghentikan kegiatan-kegiatan yang merusak ini, tidak banyak memiliki pilihan.

12. Sistem pertanian berbasis pohon merupakan salah satu pilihan yang dapat dikembangkan baik bagi kepentingan perbaikan lingkungan maupun untuk meningkatkan sumber penghidupan masyarakat. Petani memiliki keinginan untuk mengusahakan tanaman pepohonan: 83% dari responden di daerah pegunungan dan 60% dari responden di daerah pantai tertarik untuk mengusahakan tanaman pepohonan. Karet dengan klon unggulan merupakan tanaman favorit di Aceh Barat dan Nias. Coklat atau Kakao lebih banyak diminati di daerah pegunungan Pidie (77%). Di Pulau Nias, beberapa responden juga berminat terhadap mahoni, jati dan tanaman buah-buahan. Petani tambak di daerah pantai Pidie tidak tertarik dalam menanam pepohonan.
13. Ketersediaan modal menjadi kendala utama bagi pengembangan sistem pertanian berbasis pohon. Kelangkaan tenaga kerja juga menjadi masalah. Masalah lainnya adalah kurangnya pengetahuan dan teknologi budidaya, kurangnya bahan sarana produksi pertanian dan pasar produk-produk pertanian yang kurang memihak petani. Ketersediaan lahan bukan merupakan persoalan utama di Aceh dan Nias. Semua itu mempunyai implikasi bagi pengembangan tanaman pepohonan di masa yang akan datang.
14. Jalan dan infrastruktur lainnya perlu menjadi prioritas pembangunan di daerah. Pasar untuk hasil pertanian maupun produk pertanian masih perlu ditingkatkan, diikuti oleh pelayanan penyuluh pertanian dan lembaga perkreditan rakyat yang lebih terjangkau petani.
15. Di beberapa tempat, responden tidak mengetahui keberadaan dan fungsi dari pemerintahan desa. Lembaga perkreditan seperti bank dan credit union tidak banyak diketahui oleh responden. Dalam beberapa kasus, kredit informal disediakan oleh pedagang-pedagang produksi pertanian, dengan memberikan pinjaman bagi petani. Kelompok tani dan gotong-royong dapat ditemui di beberapa tempat, akan tetapi modal sosial di beberapa tempat terlihat lemah. Institusi keagamaan dianggap bermanfaat oleh masyarakat.
16. Manfaat positif dari penggabungan upaya – upaya pelestarian lingkungan dengan usaha peningkatan pendapatan masyarakat belum sepenuhnya tereksplorasi dalam program-program penanaman pohon dan pelestarian lingkungan yang ada di Aceh dan Nias sekarang ini. Hal ini merupakan tantangan yang perlu dijalani dalam pengembangan tanaman berbasis pohon yang sesuai.
17. Kegiatan-kegiatan yang sedang berjalan sekarang ini, utamanya yang dilakukan oleh badan-badan kemanusiaan, memberikan petunjuk bahwa walaupun mereka telah mengadopsi pendekatan "livelihood" – atau kegiatan yang berbasis pengembangan sumber penghidupan, aspek utama seperti kebutuhan input pertanian, keterkaitan pasar dan kaitannya dengan kondisi infrastuktur, belum sepenuhnya menjadi perhatian.
18. Semua itu merupakan peluang untuk melakukan kegiatan atau upaya-upaya yang mengaitkan sumber penghidupan dan lingkungan dalam pengembangan pertanian di daerah pedalaman Aceh dan Nias untuk meningkatkan kehidupan masyarakat, melalui pengembangan budidaya pepohonan sesuai dengan keinginan masyarakat pada tataran hamparan (landscape). Upaya-upaya tersebut, diharapkan memberikan

dampak positif dari integrasi pengembangan lingkungan dan sumber penghidupan melalui program yang sejalan dengan pengembangan wanatani di lokasi-lokasi yang strategis di Aceh dan Nias. Diharapkan kegiatan itu akan menjadi “model dari kegiatan yang berhasil’ dan sekaligus lokasi pembelajaran.

19. Pembalakan hutan dan degradasi lahan merupakan isu yang harus ditangani melalui perencanaan di tingkat hamparan dan diimplementasikan berdasarkan kebiasaan dan ketertarikan masyarakat setempat (misalnya hutan gampong pada tingkat pengurus Mukim) dengan berbagi pemahaman dan penyamaan visi di antara para pemangku kepentingan. Semua hal ini dapat dilaksanakan melalui pengembangan pemerintahan daerah yang efektif dan kebijakan yang mendukung. ICRAF telah memiliki pengalaman yang luas, dengan kapasitas dan jaringan kerja untuk mampu untuk melaksanakan upaya – upaya tersebut.

Report Summary (English)

1. Three years have passed since the notorious earthquake and tsunami of December 2004. Most rehabilitation efforts are now addressing longer term economic development and livelihood improvements. The fact that the earthquake and tsunami occurred in a province that was already experiencing prolonged violent conflict, somehow seems to be ignored. Throughout the province, and particularly in rural areas, infrastructure sustained serious damage and further deteriorated because the security situation made maintenance difficult or impossible. The three-decade long conflict had affected the social structures in the province.
2. This study made a situational analysis, based on secondary and some primary data, of the opportunity for combining environmental protection and economic development through tree-based systems in the post-conflict and post-tsunami recovery of Aceh and Nias. The study included locations based on access and conflict history:- accessible East Aceh (strong conflict history); less accessible West Aceh (conflict history); and the remote island of Nias (no conflict history).
3. Assessments of the socio-economic conditions in Aceh and Nias were made through household surveys, rapid appraisal methods and extensive consultation with multiple stakeholders. Local people’s views and perception of their needs and opportunities for economic development were systematically studied. Coastal areas (Zone A, with direct tsunami impact) and areas further inland (Zone B) were covered.
4. Rural livelihoods in Aceh and Nias are essentially based on three resources: fisheries; paddy cultivation (and some dry land crops grown in rotation); and tree crops. Almost all paddy cultivation is managed for subsistence purposes and about 70% of this is rain-fed farming.
5. Upland rice in a fallow rotation is commonly practiced in the inland (Zone B). Many communities maintain a ‘shifting cultivation reserve’ and practice slash-and-burn techniques. Any community member may cultivate abandoned plots unless the previous farmer has deliberately planted tree crops. All members in a community have equal access to community land. Once a plot of land is planted with tree crops no one else can re-cultivate the plot.

6. The political settlement (Helsinki accord) of the long standing conflict of August 2005 and its subsequent peaceful implementation, has removed the 'fear factor' from the landscape. In some villages paddy ladang cultivation has increased, not only on community land, but also inside state forest areas that had already been degraded.
7. The majority of people are farmers or are engaged in the agricultural sector, except in the coastal area of Pidie where most are fishermen. Farming is the largest income source for most households. Tree crops contribute a high proportion of household income in West Aceh and Nias district (60% and 33% respectively). Although tree-based agroforestry is practised by almost all farmers in the study sites, better technology and improved markets are much needed. In some case, land tenure issues are not clear.
8. Tree-based farming (kebun), that is essentially agroforestry, contributes significantly to the income of most households in the study sites. The main products from these kebun are rubber, coconut, cacao, pinang (areca nut), fruits and timber. On average, farmers manage 0.5 – 2 ha kebun (or agroforest), a mixture of tree crops with low labour input. Most kebun have been managed for generations and a lack of knowledge and capital limit rejuvenation of these old kebun or agroforestry plots.
9. Rubber is the most dominant tree crop in West Aceh and Nias. Most rubber trees are already old and unproductive. The trees and plots are poorly managed. Likewise, cacao (which is abundant in the inland of Pidie) is cultivated under very low management with very low productivity. Coconut is common in coastal areas but has limited potential for expansion because of over-supply and a very low price.
10. In terms of living standard, people in the coastal areas (Zone A) are better off with higher per capita income compared to people living inland (Zone B). The proportion of households below the poverty line in all study sites is far higher than the national average. Pidie has a high proportion of poor people living far below the poverty line (SUSENAS' poverty definition for 2007 - IDR 1,834,164/capita/year). People in Nias Island and inland Pidie are among the poorest of the poor.
11. Increasing demand for construction materials (sand, stone, timber and brick) is leading to intensified logging and sand/rock mining activities in Aceh and Nias. Forest conversion for timber and growing paddy is also intense. The price of rice has increased, leading to greater clearance of fallow land for growing rice. The clearance of peat area for human settlements and oil palm plantations is also an environmental problem. The local authorities are unable to stop these destructive activities.
12. There is a good opportunity for tree-based systems for environmental protection and to enhance people's livelihoods. Farmers clearly have a preference for cultivating tree crops; 83% of respondents in the inland and 60% in coastal area are interested in tree crops. Clonal rubber is the favourite tree crop in West Aceh and Nias districts. Cacao is preferred in the inland of Pidie (77%). In Nias Island, some respondents also want mahogany, teak and fruit trees. The tambak farmers in coastal areas of Pidie are not interested in tree planting.
13. Capital availability is a main constraint to promoting tree-based systems. Labour scarcity is another problem. Other problems include lack of good technology, lack of

input materials and poor markets for agricultural products. Land availability does not seem to be a problem in Aceh and Nias. These constraints have implications on future tree crop development.

14. Roads and other infrastructure are a priority for development. Markets for both farm input and farm output need to be improved, followed by agricultural extension and credit services.
15. In some places, respondents did not recognize the existence and functions of village governments. Credit institutions such as banks and credit unions are largely absent or unknown. In some cases, informal credit systems exist where traders of agricultural commodities provide credit to farmers. The concept of farmer groups and mutual assistance exists in some places, but social capital in many places seems to be weak. Religion-based institutions are perceived as useful by respondents.
16. The potential benefits of combining environmental protection with income generation for the local people have not been sufficiently exploited in current tree planting and environmental programs in Aceh and Nias. This is a challenge that can be addressed through appropriate tree crops development.
17. The on-going activities of many relief agencies indicate that although they have adopted the 'livelihood' approach, key aspects of input requirements, market linkage and infrastructure settings are not yet being addressed.
18. This calls for a project focusing on the livelihood-environment links of local farming communities in the inland of Aceh and Nias, and aiming towards improved rural livelihoods in Aceh and Nias through a system of diverse trees and forests people want in the landscape. The project should demonstrate positive outcomes of integrating livelihood and environment through appropriate agroforestation in strategic locations in Aceh and Nias that may be serve as 'models of good practice' and learning sites.
19. The deforestation and land degradation issues must be addressed through landscape level planning and implementation based on local customs and interest (e.g. hutan gampoeng at Mukim level management) with shared-understanding and common vision amongst multiple stakeholders. All this can be supported through development of effective local governance and enabling policies. ICRAF has the necessary experience, capacity and network links to lead the project, if approved.

Keywords

Agroforestry, tsunami, tree crops, environment, rubber, cacao

List of Abbreviations

BAPPENAS	Badan Perencanaan Pembangunan Nasional/ National Development Planning Agency
BPN	Badan Pertanahan Nasional/ The Office of Land Affairs
BPS	Badan Pusat Statistik/ Central Bureau of Statistics
BRR	Badan Pelaksana Rehabilitasi dan Rekonstruksi Nanggroe Aceh Darussalam dan Nias/ The Agency of the Rehabilitation and Reconstruction for the Region and Community of Aceh and Nias
CPO	Crude Palm Oil
GAM	Gerakan Aceh Merdeka/ Free Aceh Movement
EAP	Economically Active Population
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
Gotong royong	Mutual assistance
Keuchik	Village Head
Ladang	Upland paddy field
NAD	Nanggroe Aceh Darussalam
NGO	Non-Governmental Organization
PODES	Potensi Desa/ Village statistics published by National Bureau of Statistics
SAU - ICRAF	Spatial Analysis Unit - ICRAF
Tambak	Brackish water aquaculture
UUPA	Undang-Undang Pokok Agraria/ Agrarian Law

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1. Introduction

1.1. Background

More than two years have passed since the tsunami and earthquake that devastated Aceh and Nias; the rehabilitation efforts have moved on to longer term economic development and livelihood enhancement. Donors and governments have pledged millions of dollars to assist in the recovery and most of their efforts have concentrated on the tsunami affected area. However, the earthquake and tsunami occurred in a province that was already experiencing large-scale disaster and damage due to prolonged violent conflict. Throughout the province, and particularly in rural areas, infrastructure had sustained serious damage and this had further deteriorated because the security situation made maintenance difficult or impossible. Years of conflict have also left an impact on the social structure of the province.

While there has been progress in the reconstruction and rehabilitation process in Aceh and Nias, the challenges of achieving environmental protection as well as economic development remain daunting. Current efforts for coastal zone management for environmental protection in Aceh and Nias are insufficient and occasionally inappropriate. The pre-defined blueprints for up to two kilometres of buffer plantations have been criticized for not considering the locally recognized needs and values. Before the tsunami, many trees and forests along the coast of Aceh and Nias (and also inland-rural areas), provided significant economic benefits to the local communities. However, the potential benefits of combining environmental protection with income generation for the local people have not been exploited in current tree planting programs. Observations of the activities of many relief agencies indicate that although they have adopted the 'livelihood' approach in name, important aspects of input requirements, market chains, and infrastructure settings are rarely considered.

The challenges of achieving environmental protection as well as economic development in the post-conflict and post-tsunami recovery process could be approached via development of proper tree-based systems, and not limited to the tsunami affected area. People living in the inland are poorer than their counterparts in the coastal areas; deforestation in the forests and land degradation inland have accelerated significantly since the tsunami and peace agreement. Broadening the efforts to the non tsunami affected area would be more beneficial in the longer term recovery process. Using this argument as a point of departure, ICRAF with support from the World Bank on behalf of Multi Donor Trust Fund (MDF), carried out an environmental project identification study.

1.2. Study Objective

The primary objective of this study was to identify and develop an environmental project that can also enhance livelihoods of rural communities in Aceh and Nias.

The study was designed to get a quick insight into the socio-economic conditions and forest resources of Aceh and Nias Island through consultation, detailed household surveys and rapid appraisal techniques. In this way, an understanding could be gained into people's livelihoods and their preference for tree-based systems from both livelihood and environmental perspectives.

1.3. Methodology

In terms of environment and development, four situations (domains) can be distinguished in the tsunami impact zone of Aceh and Nias:

1. The town and peri-urban area of Banda Aceh, with past conversion of coastal protection forest exposing a large part of the town;
2. The intensive agriculture/fish and shrimp pond area of the north and east coast, with export oriented conversion of mangroves contributing to the damage;
3. The local food sufficiency agriculture & fishing plus commercial tree crop western coastal zone, with the town of Meulaboh as the commercial hub that was severely damaged, affecting the profitability of tree crop farming in the surrounding area (including areas not directly hit by the tsunami); and
4. The mostly subsistence oriented areas on the more remote islands (such as Nias and Simeuleu), with earthquake damage to the market chain adding to the limited tsunami impact.

The study excluded towns and peri-urban areas of Banda Aceh as these do not have potential for tree-based systems. Field work and data collection were carried out in May and June 2007. The study applied a combination of Rapid Rural Appraisal and detailed questionnaire interviews with sample farmers in three target domains, i.e. north and eastern coast of NAD, western coast of NAD, and Nias Island. One representative district was selected from each domain: Pidie district represented the intensive agriculture and fish pond area of the north and east coast; West Aceh district represented the western coastal area with local food sufficiency agriculture and commercial tree crops; and Nias Island represented mostly subsistence oriented areas on the remote island.

Each study site was divided into two zones: coastal area (Zone A); and further inland (Zone B). Zone A is the coastal strip which was directly affected by the tsunami of December 2004 and this is where most reconstruction and recovery efforts are taking place. Zone B, or inland, is the area beyond Zone A. Sample villages were selected based on their ability to represent the district in terms of environmental and livelihood issues. A total of 192 households from these sample villages were randomly selected for detailed interviews. The distribution of sample respondents are shown in Table 1 and Figure 1 shows the location of the study sites.

Table 1. Study sites and number of surveyed households by village

District, Zone	Villages	Physical Characteristics	Livelihood activities	Respondents
WEST ACEH				
ZONE A	Suak Nie and Peunaga Cut Ujong	Coastal with relatively flat area, lowland	Agriculture : paddy, rubber, and coconut	31
ZONE B	Kajeung, Sakuy and Tanoh Mirah	Mountainous with steep slope, upland	Agriculture : upland paddy and tree crop	32
PIDIE				
ZONE A	Geunteng Barat and Geunteng Timur	Coastal area	Fishery: Brackish water aquaculture	29
ZONE B	Alue Calong and Lhok Keutapang	Mountainous with steep slope, upland	Agriculture: upland paddy, cacao	31
NIAS				
ZONE A	Lahusa	Coastal area with flat and lowland	Fishery and tree crops: cacao, rubber, coconut	35
ZONE B	Lakhene	Hilly with steep slopes, upland	Livestock and tree crop farming : rubber , cacao	34
Total				192

1.4. Report Structure

This report consists of five chapters, including this introduction. Chapter 2 presents a general overview of the study sites and their physical, environmental, demographic and infrastructural characteristics in relation to the tsunami disaster. Chapter 3 describes the land use systems and livelihood options. Chapter 4 details the findings of the study on livelihood, income and poverty of the communities in the study sites. Chapter 5 and 6 provide details on tsunami economic recovery issues related to environmental and livelihood enhancement. The final Chapter 7 reports on the conclusions and recommendations from the study.

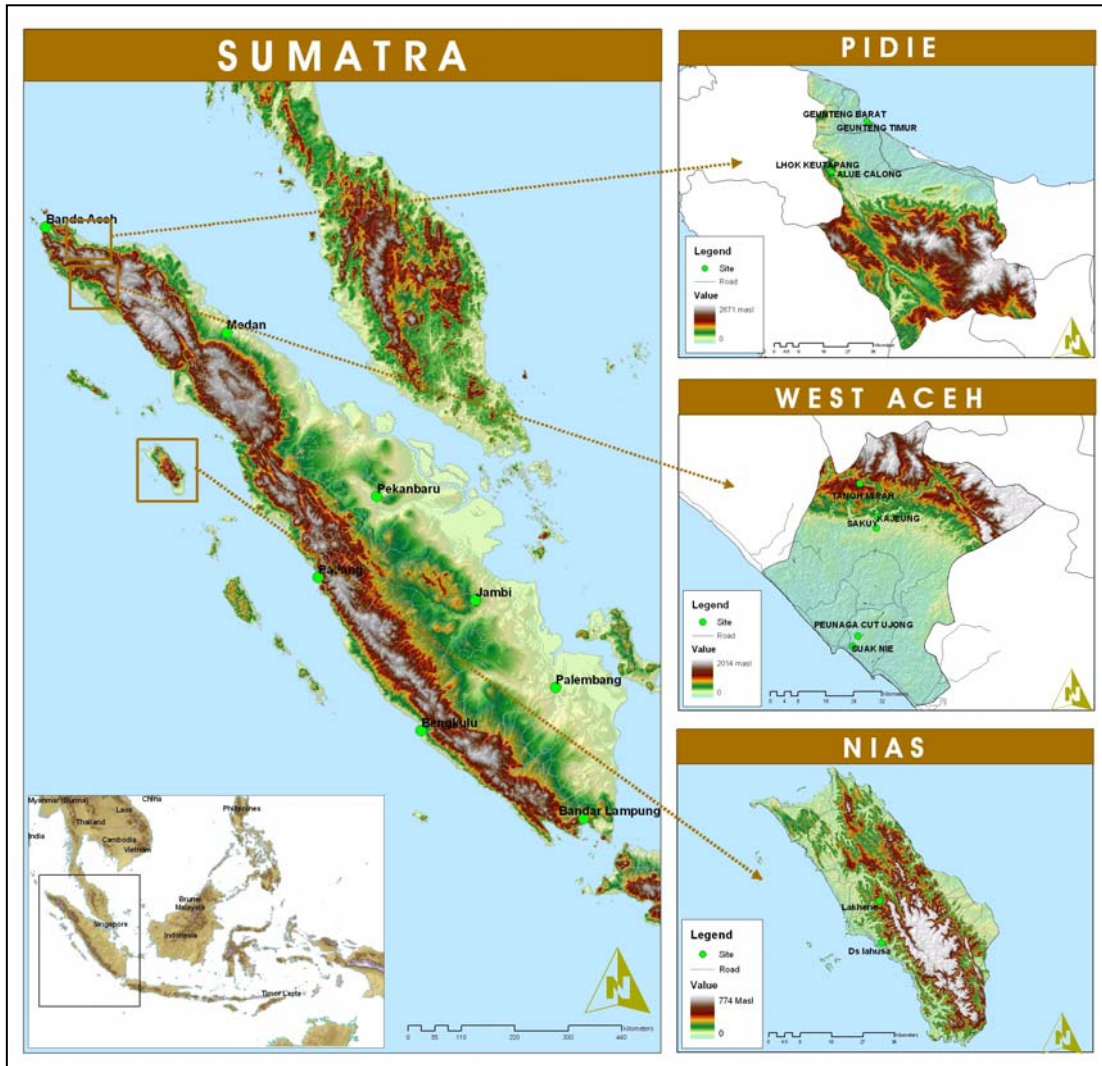


Figure 1. The study sites.

2. The Study Sites

This chapter describes the general physical and socio-economic attributes of the study sites including information about infrastructure, demography, livelihood activities and environmental issues. A brief overview of the earthquake and tsunami impact is also presented.

2.1. The Impact of Earthquake and Tsunami: An Overview

The earthquake and tsunami of 26 December 2004 that hit the northern tip of Sumatra destroyed over 600 communities and left more than 170,000 people dead or missing. Primary livelihood sources were affected, with more than 11,000 hectares of land and thousands of fishing boats destroyed. BAPPENAS and World Bank (2005) estimated that the disaster resulted in a loss of IDR 41.4 trillion (US\$ 4.45 billion) or about 2.7% of the National GDP which is more than 97% of Aceh province's GRDP. Of this total, 66% constitutes damages while 34% constitutes loss in income flows in the economy. Table 2 summarizes the damage and loss.

Table 2. Damage and loss assessment in NAD and Nias (trillion IDR)

Sector	Damage	Loss	Total
Social sector, including housing, education, health, religion and culture.	13657	532	16186
Infrastructure sector, including transportation, communication, energy, water and sanitation and dams.	5915	2239	8154
Production sector, including agribusiness, fishery, industry and trade.	3273	7721	8154
Cross-sector, including environment, government administration, banking and finance.	2346	3718	6064
Total (Trillion IDR)	27191	14210	41401

Source: Bappenas and World Bank (2005)

The CGI on Indonesia (2005) stated that damage and losses to infrastructure totalled IDR 8.2 trillion and were dominated by the damage to transportation (61% of total impact) and irrigation, flood control and coastal protection (26%); see Figure 2.

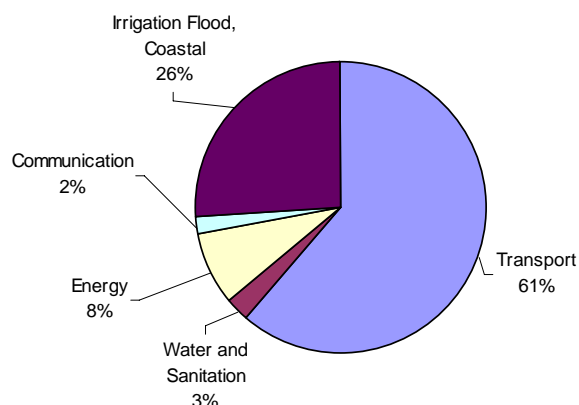


Figure 2. Proportion of infrastructure damage in NAD and Nias by the tsunami and earthquake of December 2004.

In the agriculture sector, 23,330ha of the rice fields and 22,785ha of other cultivated land were damaged. The tertiary and quarter irrigation networks in 31 kecamatans (eight kabupatens) covering 8,275ha were damaged. The damage to forestry plantations covered an area of 43,500ha. Various equipment was also damaged. Farmland lost its fertility due to mud, salinity, sand and erosion; an estimated 7,000ha was permanently lost (Ministry of Agriculture and World Bank, 2005). Table 3 presents the impact of the disaster in the study sites in Aceh and Nias.

Table 3. Land damaged by the tsunami of December 2004 in Aceh and Nias study sites

Area (hectares)	West Aceh	Pidie	Nias Island	Total Aceh & Nias
<u>Total Agricultural Land*</u>				
Total area	79163	185289	n/a	1576418
Damaged area	3016	24901	n/a	73869
<u>Irrigated Land**</u>				
Total area				
• Technical irrigated	34000	17907	1258	164060
• Semi technical irrigated	0	4825	2581	39922
• Simple irrigated	0	0	0	35258
Damage area				
• Technical irrigated	8000	7350	315	36931
• Semi technical irrigated	0	1716	891	16157
• Simple irrigated	0	0	1067	9907

Source: *RAN Database – BRR Nov 2006

**Ditjen Sumber Daya Air Departemen Pekerjaan Umum, Dinas Sumber Daya Air Provinsi NAD, Bappeda dan Dinas Pengairan Provinsi Sumut (2005)

With regard to brackish water pond (tambak), 11 districts in NAD province were affected. Almost all brackish water ponds were destroyed along with their support infrastructure of fish and shrimp pond structures, water channels, irrigation canals, buildings, houses training facilities, equipment and library collections. (NACA/FAO/SEAFDEC/BOBP-IGO, 2005) estimated the total loss, based on the establishment costs of the facilities and structures, of over US \$210 million. Table 4 presents the brackish water pond damage in the study sites compared to the provincial level damage.

Table 4. Estimated damage to brackish water ponds by December 2004 tsunami in Aceh

District	Pre-Tsunami	Post Tsunami						
		Level of Damage				Total damage	No damage	% Damage
		Light	Moderate	Heavy	Lost			
Total east coast	47218	5859	5127	7270	705	20027	27191	42.4
Pidie	5074	1002	1465	1539	18	4025	1049	79.3
Total west coast	403	0.0	0.0	0.0	317	402	0.0	99.9
Aceh Barat	61	-	-	-	-	61		100.0
Total NAD	47621	5859	5127	7270	1022	20429	27191	42.9

Source: Phillips and Budhiman 2005

The impact of the tsunami in the selected study sites varied in intensity and number of victims. West Aceh district was the worst hit among all areas in the western coast of Aceh. According to the earthquake and tsunami disaster documentation in West Aceh (2005), there are four sub-districts that were totally damaged, killing 12,873 people with 2,403 people missing and 73,915 people displaced from their homes. The livelihood sector was also seriously affected. The physical damage in Pidie was limited to 0.5km from the coast although the damage was relatively high; 2,893 people killed, 537 people missing and 5,180 houses and 21 offices heavily damaged.

In North Sumatra province, Nias Island was most affected. While the tsunami affected the west, north and south coast, the earthquake affected the whole island. More than 850 people were killed and 600 people injured. There was also extensive damage to homes, schools, infrastructure and economic activities. Over 80,000 people were left homeless and the main coastal towns, the economic centers critical for the survival of the island's subsistence farming and fishing communities, sustained 80% damage (Holiana'a, 2006).

2.2. Physical Characteristics

Table 5 presents information on the physical characteristics and road infrastructure in the study sites.

Table 5. General physical characteristics of the study sites

Attributes	West Aceh	Pidie	Nias Island
<u>Physical characteristics</u>			
Altitude (m above sea level)	0-2074	0-2787	0-800
Annual rainfall (mm/year)	3407–4812	2514	2805
Average rainy day per year	218.5	134	246
Average temperature	26.3°C	26.1°C	28.1°C
Minimum	na	19°C	25.9°C
Maximum	na	35°C	30.3°C
Humidity	86%	74%	90%
Total Area (ha)	292795	410781	591442
Settlement and infrastructure	14884	53516	24328
Arable land ¹	160378	191563	531134
Non-arable land	133435	165702	35980
<u>Infrastructure</u>			
Road ² density (m/ha)	11.4	2.3	2.9
Distance to province capital (km)	245	112	130
Distance and transportation cost to Main regional market centre (Km(Rp/kg))			
Medan	200 (300)		130 (250)
Banda Aceh	245 (n.a.)	112 (n.a.)	
Sibolga			120(150)
Padang			(250)

Source: BPS, 2005

¹ Land suitable for cultivation excluding state forest land

² All-weather road

West Aceh district (Kabupaten Aceh Barat) represents the western coastal zone of Aceh. Geographically, the district is situated between 04°06'–04°47' North and 95°52'–96°30' East. Administratively, West Aceh comprises 11 sub-districts and 314 villages. Topographically, the district is flat in the north, south and west. The eastern part is undulating to steep slope. The western coastal zone of Aceh is self-sufficient in food production. Fishing and tree crop cultivation are the major activities, and the town of Meulaboh is the commercial hub. The town was also severely damaged which affected the marketing of tree crops in the area.

Kabupaten Pidie represents the north and eastern coastal zone with intensive agriculture and brackish water aquaculture that is export oriented. Much of the aquaculture had been established in mangrove areas. The district is situated between 04° 30'–04° 60' North and 95° 75'– 96° 20' East. Kabupaten Pidie covers an area of 4,108km² with 30 sub-districts and 923 villages. Topographically, 67.63% of its area is plateau with slopes of more than 40% and relatively flat coastal plains.

Nias Island lies about 125km off the western coast of Sumatra and situated between 0°12' – 1°32' North and 97° – 98° East. Administratively the island is a part of North Sumatra province and is divided into two districts: Kabupaten Nias (3495 km²); and Kabupaten Nias Selatan (1825 km²). The terrain is largely hilly at an altitude ranging from sea level to 800m above sea level. It has a high number of rain days (246 days/year) although its total annual rainfall is less than in West Aceh.

2.3. Demographic Characteristics

Table 6 summarizes the demographic characteristics of the study sites. Among the three sites, Nias Island is the poorest with the highest population and population density. It has the highest dependency ratio but lowest school enrolment rate and education attainment. Demographic statistics from West Aceh give a different picture; population growth is negative (-0.28), and that includes the loss of human lives due to the tsunami. In terms of population and agricultural density, West Aceh is sparsely populated. With a dependency ratio of 48.7, the number of people of productive age in West Aceh is higher than those of non-productive age, meaning a greater working force with fewer mouths to feed. Labour force availability in combination with low agricultural density (less than one person per hectare) provides a good opportunity for tree crop development in this district. Whilst Pidie and Nias Island have more labour, the agricultural density is only slightly higher than in West Aceh.

The population density and agricultural density in sample zones vary among the study sites (Table 7). Both the population density and agricultural density in inland area in Nias and Pidie are higher than in the coastal area. In West Aceh, it is the reverse; population density and agricultural density are lower in the inland area.

The population density in the sample villages in Pidie is relatively high and comparable to the densely populated rural areas of Java. Agricultural densities are also highest among the selected villages; nearly 10 people per hectare in the coastal area and more than 11 people per hectare in the inland area.

Table 6. Demographic characteristics of study sites

Attributes	West Aceh	Pidie	Nias	Sumatra
Population (person)	150450	474265	712075	46294000
Number of households (HH)	34909	83238	134491	1158100
Population density (ps km ⁻¹)	49	115	120	104
Agricultural density (ps ha ⁻¹)	0.9	2.5	1.3	NA
Sex ratio (%)	104.64	92.83	97.75	102.20
Economically active population (person)	100679	295912	211,337	21276447
Dependency ratio (%)	48.72	58.39	70.37	68.03
Annual population growth, 2000-2005 (% year ⁻¹)	-0.28	0.54	1.36	1.77

Source: West Aceh in Figures, BPS (2005)
 Pidie Regency in Figures, BPS (2005)
 Nias Regency in Figures, BPS (2005)
 Indonesia Statistical Year Book, BPS (2005)

Table 7. Population and agricultural density in the study sites

Kabupaten/ Villages	Area (ha)	Population	Population Density (ps/km²)	Agricultural Density (ps/ha)
West Aceh	292795	150450	49	0.9
Coastal area	15778	62221	394	5.4
Inland	86477	3408	4	0.1
Pidie	410781	474265	116	2.5
Coastal area	10474	16354	156	1.8
Inland	75000	23550	31	0.4
Nias	591442	712075	120	1.3
Coastal area	20587	16620	81	0.8
Inland	26971	45812	170	1.7

Source: BPS, 2006

Regarding education parameters, i.e. school enrolment rate and education attainment, Nias is the worst among the three study sites (Table 8). In general, more girls than boys attended school but it was the reverse in Nias.

Table 8. Student enrolment and education attainment in the study sites

	West Aceh	Pidie	Nias
<u>Student Enrolment</u>			
Age group 7- 12	90.7	95.4	88.4
Male	90.2	95.1	89.0
Female	91.2	95.6	87.7
Age group 13 - 15	83.9	88.3	70.9
Male	83.0	87.8	74.7
Female	84.9	88.9	66.9
Age group 16 - 18	60.2	63.0	43.5
Male	59.8	61.2	49.8
Female	60.7	64.8	37.0
<u>Education attainment (%)</u>			
Never attended school	6.9	6.8	19.3
Not completing primary school	20.8	21.5	31.0
SD	26.5	24.5	20.3
SLTP	16.5	19.6	9.6
SLTA	15.3	13.8	5.9
University	3.1	3.1	0.9

Source: West Aceh in Figures, BPS (2005)
 Pidie Regency in Figures, BPS (2005)
 Nias Regency in Figures, BPS (2005)

Further demographic details at the household (sampled) level are shown in Table 9. The total family size in Nias is the highest in both coastal and inland areas but Nias has the lowest education level among the study sites.

Table 9. Demographic details of the sample households

	West Aceh		Pidie		Nias	
	Coast	Inland	Coast	Inland	Coast	Inland
Respondent mean age (years)	44	42	38	44	44	42
Age range	20-65	23-75	21- 63	25-73	22-75	20-78
Education attainment (%)						
Never attended school	19.4	25.0	44.8	12.9	29.4	20.0
Primary school	48.4	43.8	31.0	51.6	47.1	65.7
Junior high school	12.9	28.1	17.2	29.0	11.8	8.6
Senior high school	16.1	3.1	6.9	6.5	11.8	2.9
Academic	-	-	-	-	-	2.9
University	3.2	-	-	-	-	-
Total households	122	157	117	197	172	245
Household size (ps/HH)	4	5	4	6	6	7
Household range (ps/HH)	1-8	2-9	2 – 6	2-12	3-10	2-22

Source: Field survey data

2.4. Infrastructure

Before the disaster, Aceh and Nias were relatively poor in terms of physical infrastructure such as transportation, irrigation networks and electrical power (approximately 60% of Acehnese households had access to electricity). The situation was grave due to the three-decade long political conflict in Aceh. During the conflict period, road blockades, extortion, burning and damage to vehicles made transportation difficult and the cost very high. The roads were also in bad shape due to poor maintenance. These factors were a major constraint to marketing and processing agricultural and other products.

Prior to the tsunami of December 2004, Meulaboh, the capital of West Aceh, was well connected to other districts and to Banda Aceh and Medan, the provincial capitals of NAD and North Sumatra respectively. The main 245km asphalt road connecting Meulaboh and Banda Aceh was located close to the western coast. This road was badly damaged by the 2004 tsunami. There were also access roads (asphalt, gravel and dirt) connecting Meulaboh to other sub-districts and rural villages. For inter-district public transport, small buses were available, while within districts, minibuses were more common. Motorcycle taxi services (locally called ojeg) are normally available for short distances within cities and rural villages (Nugraha 2006). Road access in West Aceh was relatively good compared to other study sites (Table 10).

Table 10. Road condition in the study district in 2005

Site	Road Density (m.ha-1)	Surface Layer of the Road (km)			Condition (km)			
		Asphalt/ Hotmix	Gravel	Dirt	Un-damaged	Light Damaged	Heavy Damaged	Totally Damaged
West Aceh	11.40	3160	177	255	2,419	73	722	379
Pidie	2.30	731	212	193	198	301	219	426
Nias	2.95	1017	550	1620	2024	379	100	442

Source: Dinas Prasarana Wilayah Kabupaten Aceh Barat, 2006
 Pidie Regency in Figures, 2005
 Nias in Figures, 2005
 Nias Selatan in Figures, 2005

Although the road density in Pidie was not as good as in West Aceh, it is better connected, due to shorter distances, to two provincial capitals: Medan; and Banda Aceh. Pidie district capital town, Sigli, was well connected to other municipalities within the province along the eastern coast. However, Pidie was a GAM (Gerakan Aceh Merdeka or free Aceh movement) stronghold, and transport inside the district was considered unsafe. The district has experienced numerous wars since the 1800s with much economic suffering. Following the historical peace accord in 2005, Pidie district is now easily accessible. Due to the damaged Meulaboh-Banda Aceh highway in the western coast, the road passing through Sigli is currently the alternative for traffic between Meulaboh and Banda Aceh.

Prior to the earthquake and tsunami, Nias Island was accessible with daily ferry services from the two nearest towns in mainland Sumatra (Sibolga in West Sumatra and Meulaboh in West Aceh) to three harbor points in Nias (Gunung Sitoli, Teluk Dalam and Lahewa). There was also a weekly ship service between Gunung Sitoli and Jakarta. Air transportation was also available twice a week between Gunung Sitoli and Medan. However, for transporting agricultural commodities and other products such as rubber, cacao and coconut to market hubs such as Medan and Padang, the long distance and limited ferry service has remained a major transportation problem. At present, there are more frequent flights from Medan to Nias than there were before the tsunami; four times daily with Merpati Airlines and twice daily with Sabang-Merauke Air Carter.

Within Nias Island there are main provincial roads connecting the four main urban centers (Gunung Sitoli, Teluk Dalam, Lahewa and Lahusa), and secondary roads connecting these four urban centers to other smaller market centres. The density of all weather roads within the island is only 2.9m/ha.

The December 2004 tsunami seriously impacted on road infrastructure that was already in relatively poor condition in all three study sites. The connection from Meulaboh, Calang and Banda Aceh, that was in a relatively better condition, fell apart. Some parts of the road were completely washed away or buried under sand. Many bridges along the road were damaged beyond repair. The situation in Nias was similar. The main roads were badly damaged in many parts and many bridges were damaged then further destroyed by the earthquake in March 2005. As of July 2007, the road to Lahewa, an urban centre on the northern tip of Nias, has not been built; and there is no access road for four wheel vehicles.



Figure 3. Condition of Infrastructures in Nias Island (photo: Yuliana C. Wulan)

The statistics of tsunami reconstruction progress (BRR, 2006) demonstrate the magnitude of the tsunami damage on other infrastructure in the three study district. By the end of 2006, BRR had constructed about 70% of the needed housing facilities and 41% of the hospital and clinics were completed. A total of 675 schools have been rebuilt (16% of the total number destroyed). In Nias, 97.8% of school buildings had been damaged. In West Aceh and Pidie, about 67% of school buildings required reconstruction. So far only about 7.8% of roads and five major harbours have been restored. In NAD province, two harbours (Meulaboh and Banda Aceh) have been restored.

3. Land Use and Livelihood

This chapter describes land use and livelihood issues in the study sites, aiming to better understand the relationship between land use, agricultural practices and livelihoods in the three sample districts.

3.1 Land Use

The general overview of land use in the three sample districts provides background information on agricultural practices and livelihood activities in the sites. Secondary data and information from diverse sources was collected and compiled (Table 11).

Table 11. General land use and land cover of the three study sites.

	West Aceh ¹⁾		Pidie ²⁾		Nias island ³⁾	
	(ha)	(%)	(ha)	(%)	(ha)	(%)
Total Area	308697		410781		591442	
Land use						
Forest	127237	41.2	148633	36.2	35980	6.1
Community forest			32308	7.9		
Agroforest	25018	8.1				
Plantation	113780	36.9	13794	3.4	229006	38.7
Kebun/ladang			74596	18.2	133451	22.6
Ladang						
Paddy field	17839	5.8	37165	9.0	64396	10.9
Aquaculture			5588	1.4		
Not utilized/Fallow	3740	1.2	28112	6.8	71132	12.0
Built-up area/Settlement	14884	4.8	53516	13.0	24328	4.1
Others	6198	2.0	17069	4.2	33149	5.6
Population density (ps/km2)		49		116		120

Source: 1. ICRAF Internal Data, 2006

2. Data Report of Extension Worker (Dinas Pertanian Kabupaten Pidie), 2005

3. PODES 2003

Forest area, both in West Aceh and Pidie (41.2% and 36.2% respectively) is the largest land use type. In Nias, the forest area is only 6.1% but a large part of the island is already under multistrata agroforestry (kebun campur) with crops such as rubber, cacao and fruits. In West Aceh district approximately 52% of the total area is cultivated for growing four main commodities that support the local economy: paddy; rubber; coconut; and oil palm. Rubber cultivation (both intensive-monoculture systems and mixed agroforests) covers about 30.5% of land. Along the coastal area, coconut plays an important role. Paddy fields and other fields are usually located further inland; 800m or more from the sea. There are also home gardens with fruit trees. In Pidie, 47% of the total area is cultivated with four main commodities: coconut; cacao; coffee and fish (shrimp and milk fish from aquaculture). Coconut and cacao covers about 32% and 25% respectively of the total cultivated area in Pidie.

Nearly 70% of the total land in Nias is cultivated. A mixture of coconut and paddy fields dominate the landscape along the coastal and low-land area. In the hilly and upland areas, tree-based systems are predominant, especially rubber, cacao, clove and banana under monoculture and mixed agroforestry systems. Sweet potato is also an important crop; its leaves are used for pig feed and in some areas, the root is consumed by people. Pigs are culturally important and also a significant source of household income in Nias (Save the Children, 2006).

Farm size and land holding data are summarized in Table 12.

Table 12. Land distribution and land holding size for sample households

Landholding Size	Coastal Area			Inland Area		
	West Aceh	Pidie	Nias	West Aceh	Pidie	Nias
	n = 31	n = 29	n = 33	n= 32	n =31	n=35
Distribution land holding size of surveyed households (%)						
< 0.25 ha	25.8	48.3	12.1	15.6	12.9	0
0.26 - 0.75 ha	32.3	13.8	27.3	9.4	25.8	17.1
0.76 - 1.25 ha	12.9	17.2	15.2	34.4	9.7	68.6
1.26 - 1.75 ha	9.7	3.4	3.0	12.5	19.4	2.9
> 1.75 ha	19.4	17.2	42.4	28.1	32.3	11.4
Descriptive Statistics						
Mean	1.43	0.74	2.13	1.49	1.51	1.17
Minimum	0.04	0.01	0.06	0.13	0.01	0.50
Maximum	10.02	3.00	12.00	5.04	8.03	6.00
StdDev	2.23	0.95	2.56	1.28	1.63	0.92

Source: Field survey

There appears to be an unequal distribution of land holdings in the study area (Figure 4) with 20% of households controlling about 57% of the total land and the bottom 60% of households owning only 22% of the total land.

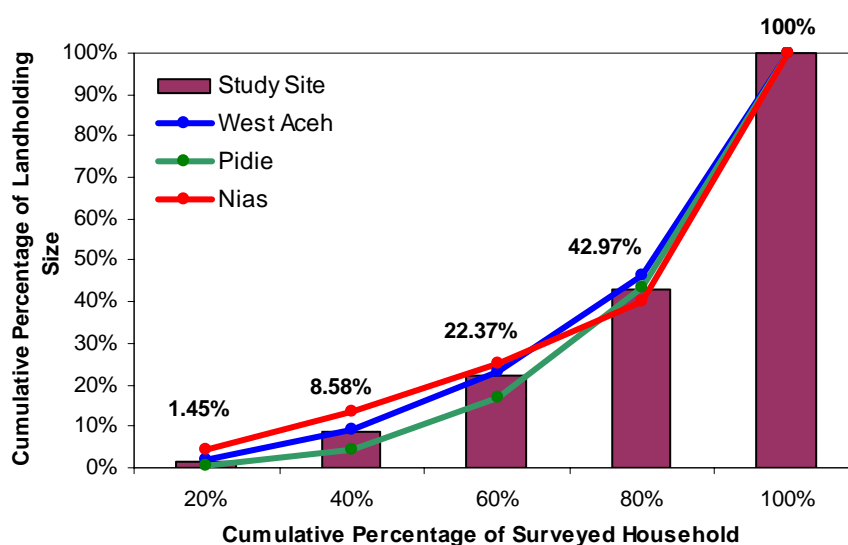


Figure 4. Cumulative distribution of surveyed household by landholding size

The land use types in the study area included home gardens, irrigated paddy fields, upland paddy fields (ladang), agroforest (kebun), aquaculture and cleared land. Paddy fields and agroforests are the most common land use types in the study area (Table 13). Mixed agroforests (kebun) occupy nearly half of the total cultivated land managed by about 69% of the households in the three study sites. The figure is much higher in the case of Nias where 72% of cultivated land is under agroforests and over 84% of households have mixed agroforests. Home gardens are also very common in all three sites. On average, about 28% of households own paddy fields that occupy 13% of cultivated land. In Pidie, 32% of households are engaged in aquaculture whereas this is not an important activity in Nias and West Aceh. Table 13 shows the share of landholding size by land use of the surveyed households.

Table 13. Land distribution in the study sites

Land use	3 study sites (N=192)		West Aceh (n=63)		Pidie (n=60)		Nias (n=69)	
	Land area % of total	HH involved	Land area % of total	HH involved	Land area % of total	HH involved	Land area % of total	HH involved
Home garden	9.7	45%	11.7	54%	31.4	63%	1.1	19%
Sawah	12.9	28%	8.6	22%	0.2	30%	17.4	32%
Ladang	9.1	18%	21.2	41%	2.0	13%	1.5	1%
Agroforest	48.5	69%	37.7	68%	10.0	53%	72.1	84%
Aquaculture	7.9	10%	1.2	2%	49.1	32%	0.0	0%
Fallow Land	11.9	22%	19.6	32%	7.6	15%	7.9	19%
Gini Coefficient*	0.50		0.48		0.54		0.47	

Source: Data field survey

*The Gini Coefficient (or index of concentration) is a statistical measure of equality ranging from 0 to 1. A measure of 1 indicates perfect inequality. A measure of 0 indicates perfect equality (US Census Bureau based on Gini, C., 1912; 1921; Mills, J. A. and Zandvakili, S.,1997).

The study revealed the existence of privately-owned yet unused (unmanaged) land in the study sites. In the coastal area of Nias, the unused land area was estimated to be 2.2ha per household; but it is unclear whether this non-use was related to natural disasters of 2004 and 2005 or due to unavailability of farm input (capital and labour). Land holding data indicate the presence of large land owners (> 5ha) and without household labour and capital, it is hard for farmers to utilize all their land. In general, there is labour scarcity in the study sites; agricultural density ranges from 0.9 to 1.3 people per hectare, and the dependency ratio ranges from 49% in West Aceh to 70% in Nias (Table 6). In West Aceh 49 non-working people depend on 100 Economically Active People, while in Nias, 70 non-working people depend on 100 EAP.

3.2 Farming Practices

Rural livelihoods in Aceh and Nias are based on essentially three resources: fisheries; paddy cultivation (and some dryland crops grown in rotation); and tree crops. This section describes agricultural practices in the study sites, using the information provided by key informants during the surveys: local government officials; NGO staff; and village leaders. Secondary data that was

available from different sources was also consulted.

3.3 Paddy Cultivation

In general, farmers in the study sites cultivated paddy wherever possible. Almost all paddy cultivation, both in sawah and lading, is managed mainly for subsistence. About 70% of paddy cultivation is rain-fed and mainly in the inland areas. The production is relatively low as farm input is limited, irrigation is generally unavailable, and only one crop a year is possible. In irrigated paddy fields, double harvests are possible in a year (and in some places three times a year). With more rain days in Nias, even rain-fed paddy fields can produce two crops of rice a year.

Most farmers cultivate local paddy in rain-fed fields in Aceh and Nias. Paddy is grown in the fields for six or seven months, while for the remaining months the fields are left fallow. In irrigated paddy fields, improved paddy varieties with shorter maturation periods (100 – 120 days) are planted. On average, paddy production in irrigated fields is about 1,440kg/ha/crop, while in rain-fed fields it reaches about 1,080kg/ha/crop. Labour requirement for paddy cultivation is about 170 person-days/ha. Fertilizer application in paddy fields ranges between 150 to 300kg/ha.

Growing upland rice in a fallow rotation system is common in the inland (Zone B). Communities in the study sites have maintained a 'shifting cultivation reserve' on community lands, where poor households can open and clear land and grow their rice and/or other food crops. The peace agreement of August 2005 has brought peace where people earlier feared to go into the fields. This has contributed to the increased opening of fallow land for upland paddy cultivation. In some places, state forest land (already in a degraded state) was also seen to be converted to upland paddy fields.

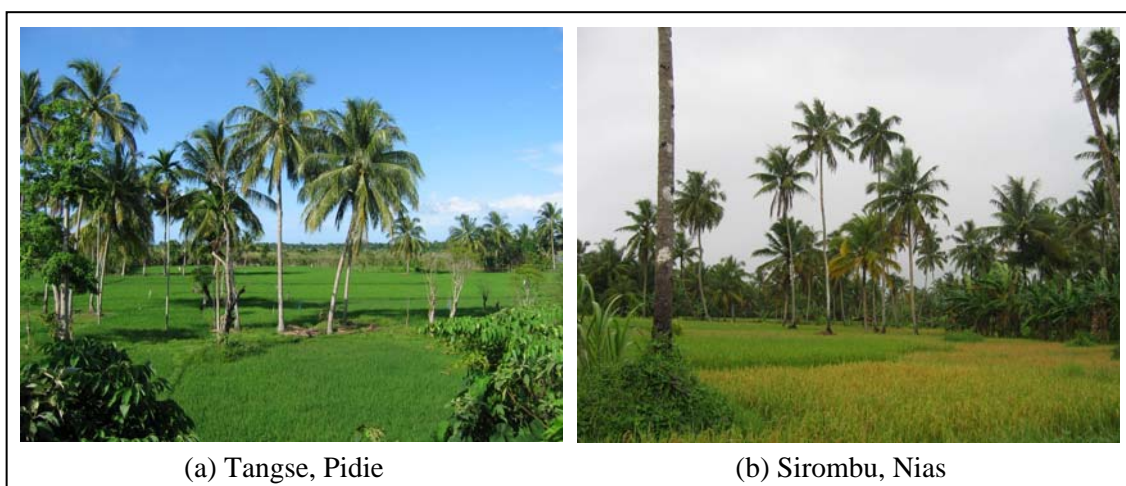


Figure 5. Paddy field in study sites (photo: Budi).

Paddy ladang is practiced extensively in the inland. Farmers usually clear land in groups applying slash and burn techniques. They grow local paddy varieties with low farm input and often intercrop with chilli. Paddy ladang cultivation lasts for three to five years, after which the land is left fallow. About 0.5 to 2ha paddy ladang is cultivated by a household at any one time, depending on family labour. Almost no external farm input is applied, except for labour that is estimated to require 133 person-days/ha. These paddy ladang fields annually yield about 540kg

paddy plus 800kg chilli per hectare.

During the field survey of this study, farmer groups in the inland of West Aceh were encountered opening community land for paddy cultivation. Labour scarcity and land abundance make this still possible. There should be a consensus among the community regarding paddy ladang cultivation on community land. When a farmer abandons land after harvest, other community members may take over to continue land cultivation, except when the former farmer has planted tree crops. As tree planting is possible, annual crop fields may be converted to longer (permanent) tree-based systems, especially where land is still abundant.

3.4 Tree-Based Farming

Tree-based farming systems, that is essentially agroforestry practices in kebun, contribute to the source of livelihood of most households consulted in the study sites. The main products from these kebun are rubber, coconut, pinang palm (areca nut), fruits and timber. On average, farmers managed 0.5 to 2ha kebun with a mixture of tree crops, and requiring labour mainly for harvesting. Most kebun have been managed for generations under extensive management systems. Most fields are over-mature and declining in productivity. Lack of knowledge and capital are the main reasons why most old kebun owners are unable to rejuvenate their fields.

Rubber is the most dominant tree crop in West Aceh and Nias. Most of these plots are already old and most tapped trees have naturally regenerated from previously planted rubber trees. Tree density is relatively high (600 – 800 trees/ha) without orderly spacing, but mixed randomly with timber trees and fruit trees. Little management or silvicultural practice is applied in these plots; weeding is infrequent, mostly in the first few years of establishment. Some farmers had planted unselected rubber seedlings some 10 to 15 years ago. Few farmers apply any fertilizers. The first tapping of latex is done when rubber trees are eight to ten years old. Tapping management is often intensive and rough, half-spiral with almost daily tapping. There are farmers who even tapped twice a day. Rubber productivity is very low, ranging between 400 to 600kg dry rubber per hectare per year. Labour input in a mature rubber garden is 65–78 person-days/ha/year. Share-tapping is also common; in West Aceh share tappers keep two portions of the income and give one portion to the land owner. In Nias the sharing is mostly a one to one ration.

Coconut trees are mostly found in coastal areas both in West Aceh and Nias. Mostly it is the local variety that has been managed for many years. Coconut trees are rarely cared for except during harvesting of fruits. The coconut productivity is approximately 3.3tons copra/ha/year on average. Two years after the tsunami, coconut production of surviving coconut trees in West Aceh is reported to have increased since the disaster. This has led to a decrease in the price of coconut fruit (up to IDR 200/fruit). Many farmers were not keen to grow more coconut trees.

Cacao was mostly found in the inland areas of Pidie and Nias (and also some in West Aceh). The trees are managed with low input under little care; hence productivity is very low. Most trees came from unselected seedlings. Generally, cacao can be harvested 2.5 to 3 years after planting. Usually the third year after planting sees a good harvest then production drops in following years due to pests and diseases. The crowns of the commonly used shade tree *Gliricidia sepium* grow too dense and affect cacao. These shade trees are used for nests by rats and squirrels. Wibawa and Bertault (2006) reported that the major problems in smallholder cacao farming were low tree management leading to tall cacao trees, unmanaged dense crowns

and subsequent pests and diseases, and low flowering and fruiting. It is estimated that the current dry bean production is only 0.8ton/ha/year.

Pinang (areca nut) is usually planted on the border of fields close to homes. Pinang trees are also rarely managed and receive very little, if any, input. Farmers also plant pinang mixed with other trees in their home gardens. Pinang can contribute, although not substantially, to household income.

Currently, oil palm is not a dominant tree-based system for smallholder farmers in Aceh and Nias. Oil palm smallholder farmers are few and scattered around large oil palm plantations. In general, the smallholder oil palm plantations are not intensively managed. In some parts of Aceh, many oil palm areas were damaged after farmers abandoned their plantations when the political conflict escalated. As the security situation has improved significantly, many investors (mainly from outside) have approached the district and provincial governments to establish new oil palm plantations.

Mainly, agricultural products from Aceh are transported to Medan, the market hub for most products in northern Sumatra. Generally, products from village traders are bought by sub-district level traders who then resell to bigger district level traders or directly to factories in Medan. Products from Nias are taken to either Medan or Padang via Gunung Sitoli and Sibolga by road and ferry.

In summary, tree-based farming systems are traditionally practiced by most farmers in Aceh and Nias in the form of mixed agroforestry systems. Problems of low productivity, that can be attributed to lack of technology, know-how, capital and marketing, are sufficiently serious to warrant attention of development institutions. But these problems also indicate potential solutions to improve rural livelihoods and economic development.

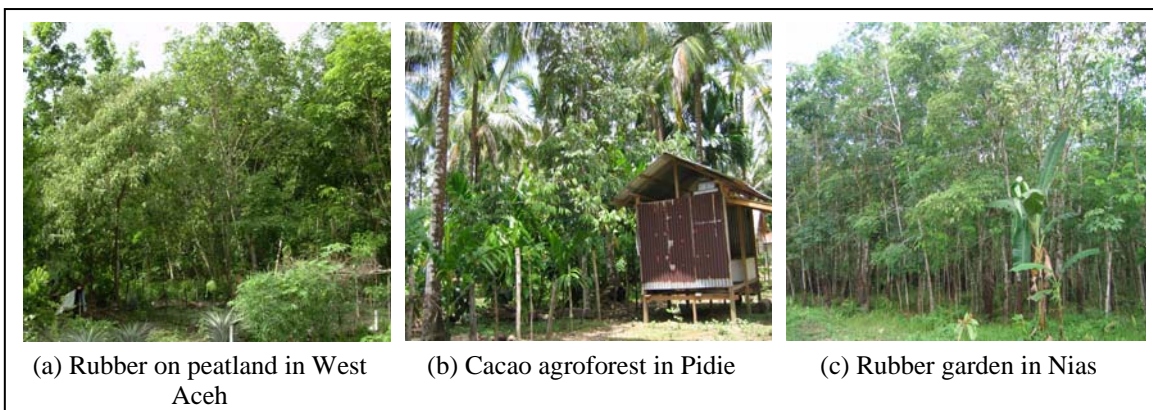


Figure 6. Tree-based systems in the study sites (photo : Budi and Yuliana C. Wulan)

3.5. Brackish Water Aquaculture (Tambak)

Brackish water aquaculture or Tambak is the main source of income of coastal (Zone A) people in Pidie. Prior to the tsunami, the tambak in Pidie covered 5,012ha but the majority (79.3%) were damaged by the tsunami. In the coastal area of Pidie, nearly all tambak were totally destroyed but since then, all of them have been restored. Some tambaks are already in full operation producing shrimp.

Many tambak operate in traditional plus⁶ systems that produce both shrimp and milk fish at the same time (polyculture). This reduces the risk of a complete loss of shrimp production due to, for example, shrimp disease. This also reduces capital investment; no additional aerator is required, as the rippling movement of milk fish, especially at night, functions as an aerator. Milk fish can also feed on moss in an over fertile tambak. If silken moss is overabundant in the tambak, farmers add milk fish to control moss growth.

Zainun et al. (2007) carried out an ex-ante financial assessment of tambak production after reconstruction. It estimated that the traditional systems practiced by large tambak operators in Aceh are still profitable fewer than 15% discount rate. It is assumed that the survival rate for shrimp fry and milk fish is 48% and 70% respectively. Initial investment (establishment and working capital) ranges from about IDR 18.5 million to 45 million per hectare.

Tambak aquaculture generates considerable local employment, provides jobs for up to 350person-days/ha/year. Return to labour (which converts surplus to wage after accounting for purchased inputs and discounting for the cost of capital with no surplus attributed to land) is marginally higher than the average agricultural wage. This makes tambak aquaculture attractive for farmers. As a part of the post tsunami reconstruction, mangroves have been replanted in tambak areas but very few mangrove trees survive, either they are uprooted or do not establish. Most tambak farmers were against mangrove planting in tambak area.

The study of Zainun et al. (2007) indicated that not all tambak in the study site were established on privately-owned land with secure land title. Tambak have been established in adat or communal land (80%), state-owned land (16%), meunasah land or tanah wakaf (1%), and village public land (3%). About 5% of tambak are on adat land with title certificate. The use of adat land for tambak can be problematic. Prior to the 1960 Agrarian Law (UUPA) adat land was controlled by local communities. After UUPA 1960 came into effect, ownership acknowledgement issued by the Office of Land Affairs (Badan Pertanahan Nasional/BPN) is required. However, until the end of 2004 (before the tsunami), few tambak were on traditionally-owned land with clear title. Based on land status data (BPS, 2004), approximately 20% of tambak in the 12 study villages had been established on non-private land. Even among those on private land, only 36.5% have title certificates and most of these are located close to urban areas; Banda Aceh (Tibang and Lambaro Skip, 99.5% and 44.5% with certificates respectively), Pidie (Baroh Lancok, 43.9%). In rural areas, less than 10% of privately-owned land has official certificates.

The legal status of tambak located on the seashore and/or riparian zone is also open to dispute. Some tambaks are within 100-150m from the coastline as local traditional rule stipulates that the ocean and beach (with sand) remain public and cannot be privately owned. The local communities call the coast “luen pukot” or the territory of one hundred depa (about 1.5 m) from the highest rise of tide or 130 times the difference of the highest and lowest tide from the beach (approximately 150m from the beach). The Presidential Decree Number No. 32 of 1990 regarding protected zones states that land within 100m from the highest tide is public territory owned by the state. In reality, most of this ‘state’ land has been utilized for tambak for many years. Most people who hold licenses (surat izin menggarap) issued by keuchik (village head) and who pay land tax (PBB) claim they have legal ownership over the land.

⁶ Modified traditional system similar to semi intensive tambak aquaculture but the stocking density is comparably less than in semi-intensive but higher than in traditional system.

4. Livelihood, Income And Poverty

Rural livelihoods in Aceh and Nias are essentially based on three resources: fisheries; paddy cultivation (and some dryland crops grown in rotation); and tree crops. The relative importance of these three varies with landscape position; fishing for people living near the coast, rice cultivation in river valleys, tree crops both in the coastal and inland areas (rubber, cacao, coconut, pinang palms, fruit trees) and peat domes (sago palms, rubber, some conversion to oil palm). In Pidie, brackish water aquaculture or tambak cultivation is the main source of income. More people in the coastal areas are involved in off-farm jobs (Table 14), implying greater opportunities compared to people in the inland. The current reconstruction and rehabilitation activities in the coastal areas have also opened many employment opportunities whereas such opportunities remain remote in inland areas.

4.1 Economic Activities

The majority of the rural population are farmers, except in the case of coastal people in Pidie (Table 14). Almost all of the respondents have ‘side jobs’ in addition to their main occupation. Some respondents (9.8%) in the coastal area of Nias did not have additional jobs. This may be because either there are few employment opportunities or their main occupation fulfils all their needs.

Table 14. Respondent occupation (% of total) in study sites

Occupation	Coastal Area (A)			Inland Area (B)		
	West Aceh	Pidie	Nias	West Aceh	Pidie	Nias
	n=31	n=29	n=35	n=32	n=31	n=34
<u>Main job</u>						
Agriculture	80.6		85.3	96.9	90.3	94.3
Civil service or private sector	3.2				3.2	2.9
Trade		10.3			3.2	
<i>Tambak</i> Aquaculture		41.4				
Fishing		27.6	11.8			
Services (e.g. ojek)	6.5	3.4	2.9	3.1	3.2	2.9
Home Industry		17.2				
Farm Labour	9.7					
Total	100	100	100	100	100	100
<u>Second job</u>						
Agriculture	15.4	12.5	25.0	9.1	18.2	21.4
Civil service or private sector	3.8		6.3	18.2	9.1	
Trade	19.2	12.5	2.5		18.2	7.1
<i>Tambak</i> Aquaculture		37.5				
Fishing	11.5	25.0	31.3			
Services	30.8	12.5	12.5	63.6	54.5	50.0
Home Industry	3.8		6.3			21.4
Farm Labour	15.4		6.3	9.1		
Total	99.9	100	90	100	100	99.9

Source: Field survey data

Nugraha et al. (2006) identified seven major sources of livelihood of people in the coastal area of West Aceh: fishery; paddy field; tree crops; annual crops; home garden; off-farm labour; and trading. Every household in West Aceh was involved in more than one economic activity. Rubber and coconut cultivation was an important income source even before the tsunami. Dryland paddy (ladang) cultivation was important in the inland. Rubber is an important cash crop for rural households while ladang cultivation provides food for self consumption.

4.2. Household Income

Consistent with the data on occupations, agricultural income contributes the most to family income both in coastal and inland areas in all study sites (Table 15). The household income of coastal people (Zone A) is 36.8% higher than that of inland people. The current construction boom and other income generating activities in the coastal areas have partly contributed to a better income of the coastal population. In coastal areas, agricultural activities contribute nearly 69% of total household income and off-farm activities provide nearly 28%. Tree crops contribute 60% and 33% of the total household income in West Aceh and Nias districts respectively. Paddy cultivation and livestock are important income earners in Nias.

In Pidie, tambak aquaculture is the largest contributor to household income (47%). Home industries and other services contribute 20% of total household income, mostly from activities of women such as tikar pandan.

In the inland, an average of 76% of the total income (for all respondents from three study sites) comes from agricultural activities and 21% from off-farm activities. Remittance received from outside also forms an important source (5.3% for inland compared to 1.5% for coastal areas). Among the agricultural activities, tree crops are the most important in all three sites, providing on average of over 60% of total income, reaching nearly 78% in the inland of Nias.

Table 15. Farm and off-farm income sources of people in the study sites (%)

Type of Household Income	Coastal Area			Inland Area		
	West Aceh	Pidie	Nias	West Aceh	Pidie	Nias
Farm Income (%)	87.0	56.3	75.8	79.6	64.3	79.0
Paddy field	0	0	16.4	1.5	0	0
Tegalan	4.1	0.2	4.4	7.2	25.4	0
Tree crops	59.5	0.7	32.7	62.1	36.0	77.8
Aquaculture	0	46.8	0	0	0	0
Livestock	22.4	0.8	14.2	8.9	2.8	1.2
Fishing	1.0	7.8	8.3	0	0	0
Off-farm Income (%)	12.2	41.7	13.3	18.4	35.6	14.5
Carpentry	2.9	8.9	1.9	11.6	11.1	5.1
Entrepreneur/services	5.6	32	8.8	3.9	1.2	0.2
Labour non-farm	3.5	0.7	2.6	2.4	13.2	7.7
Farm labour	0.1	0	0	0.5	10.1	1.5
Other sources	0.8	2.0	10.8	2.0	6.7	8.4
Remittance	0.8	2.0	1.3	2.0	0.1	0
Government program	0.05	0	9.5	0	0	6.5
Total Income (%)	100	100	100	100	100	100

Source: Field survey data

4.3. Tree Crops

Among the tree crops, rubber takes the dominant position in providing household income (Table 16) in all study sites except in the coastal area of Pidie. While rubber plantations in the study area were poorly managed, their contribution to household income was as high as 98% in coastal areas of West Aceh. Cacao comes second, contributing significantly mainly in both inland and coastal areas in Pidie. Areca nut and coffee are important in the inland while oil palm was not so significant for smallholders, at least among the respondents.

Table 16. Household income from tree crops (IDR '000).

Tree Crops Commodities	Coastal Area								
	West Aceh (N=31)			Pidie (N=29)			Nias (N=35)		
	n	Total	%	n	Total	%	n	Total	%
Rubber	17	257810	97.8	0	-	-	14	4536	85.5
Oil Palm	0	-	-	0	-	-	0	-	-
Coconut	5	3323	1.3	4	2500	45.5	5	4370	14.5
Cacao	1	2400	0.9	1	3000	54.5	0	-	-
Areca Nut	0	-	-	0	-	-	0	-	-
Coffee	0	-	-	0	-	-	0	-	-
TOTAL		263533	100		5500	100		8906	100
Tree Crops Commodities	Inland Area (B)								
	West Aceh (N=32)			Pidie (N=31)			Nias (N=34)		
	n	Total	%	n	Total	%	n	Total	%
Rubber	10	94185	43.2	0	-	-	35	282960	93.3
Oil Palm	1	2400	1.1	0	-	-	0	-	-
Coconut	2	760	0.3	1	2000	2.3	0	-	-
Cacao	7	96345	44.2	11	38300	44.8	3	20440	6.7
Areca Nut	12	19316	8.9	20	35192	41.1	0	-	-
Coffee	1	5160	2.4	6	10040	11.7	0	-	-
TOTAL		218166	100		85532	100		303400	100

Source: Field survey data

In terms of living standard, people in the coastal areas (Zone A) are better off than those living further inland (Table 17). The highest income per capita is in the coastal area of Pidie (IDR 6.86 million). However, the difference between the two zones in Pidie is very wide, reflecting a very high income from tambak cultivation in the coastal area. Per capita income was lowest in Nias.

Using SUSENAS⁷ poverty line of 2007, per capita income of both coastal and inland areas of Nias and inland areas of Pidie fall below the poverty line. Both coastal and inland areas of Nias are still above the poverty line. In Pidie, income per capita in the inland area is more than three fold the SUSENAS poverty line, but coastal areas of Pidie are less than the poverty line. Similar to inland areas of Pidie, income per capita of the two zones is also lower than the poverty line. The proportion of households below the poverty line in the study sites is far higher than the national average; Nias Island and the inland of Pidie were the worst. In Nias, 74% and 66% of

⁷ SUSENAS (Survey Sosial Ekonomi Nasional) or National Socio-Economic Survey, is a series of large-scale multi-purpose socio-economic surveys initiated in 1963-1964 and fielded every year or two since then.

households in coastal and inland areas respectively are poor. In Pidie, there are more poor households in the inland than in coastal areas (Table 17).

Table 17. Average household income and per capita income (IDR 000) in West Aceh, Pidie and Nias.

	Coastal area			Inland area		
	West Aceh	Pidie	Nias	West Aceh	Pidie	Nias
Number of respondents	31	32	29	31	34	35
Number of family members	122	117	172	157	197	245
Total family income (IDR 000/year)	442019	802625	302648	351536	237392	389875
Average family income per HH (IDR 000/year)	14259	25082	10436	11340	6982	11139
Income per capita (IDR 000/year)	3623	6860	1760	2239	1205	1591
Proportion of household below poverty line ¹ (%)	43	39	74	47	74	66

Indonesia poverty line – BPS 2007 IDR 1,834,164 capita⁻¹ year⁻¹

National figure of people below poverty line is 17.75%

The data are consistent with the SUSENAS 2007 results that mention the poverty level in NAD province has sharply increased from 28.4% in 2004 to 47.1% in 2005 and to 49.8% in 2006. The SUSENAS data indicate that the poverty figures vary from 2.95% in Kota Banda Aceh to 86.33% in Kabupaten Gayo Lues. Among the 21 kabupaten/kotas in NAD, Pidie has the highest number of poor people. In Kecamatan Tangse of Pidie (inland), 85% of the households are considered poor.

5. Environment, Economic Recovery And Institution

This chapter highlights some environmental issues in the study sites, related to damage caused by the tsunami and earthquake, and also related to the impact of ongoing rehabilitation and reconstruction measures. The section also includes people's perception of the household economic recovery measures through tree planting and supporting institutions.

5.1. Environmental Concerns

While most parts of Sumatra went through rapid deforestation and environmental degradation, forest resources in Aceh experienced relatively less damage mainly due to ongoing political conflict. Aceh is one of the most forested provinces in Indonesia with 3.3 million hectares of contiguous forested area with the richest assemblage of biological diversity left in Southeast Asia. These forest ecosystems are rich in biodiversity and genetic pools, are important for watershed protection and local hydrology, and also function as carbon pools that regulate the global climate. In Aceh, deforestation and forest degradation has intensified in recent years caused by natural habitat conversion, illegal logging and monoculture plantations. The volume of timber required for reconstruction in Aceh alone (Ministry of Forestry estimates 8.5 million cubic meters of timber) exceeds Indonesia's total supply of wood, and represents a serious potential threat to forests in Aceh. It is estimated that 85% of logs in Aceh's markets come from illegally logged forests in northern Sumatra. On the political front, the debate about sustainability and legality of the sources of wood continues.

Based on a recent field survey conducted by Greenomics, reconstruction works in Aceh had already used around 850,000 cubic meters of illegal logs (48% by international agencies and 42% by BRR). Recent reports from WALHI claim that illegal logging is destroying around 20,769 hectares of rainforest every year in Aceh and that a total of 374,327ha of Aceh's rainforests were destroyed by 2006 (The Jakarta Post, 22 September 2007). Of the total 1,524,624 hectares of river basin in Aceh, around 46% had been degraded due to deforestation. The reconstruction and rehabilitation projects have been partly blamed for ignoring the status and procedures of protected and ecologically fragile areas.

The impact of the tsunami and earthquake in NAD province and Nias Island needs no detailed elaboration as this is copiously documented and described in the literature. Aceh and Nias experienced unprecedented damage and destruction of human lives and assets, infrastructure, agriculture and other natural resources. Destruction of coastal resources received much attention, and rehabilitation efforts focused along the coastal region. However, the issues of deforestation and environmental destruction in Aceh and Nias are linked to the past political conflict, insecurity and existing poverty. The December 2004 tsunami caused damage in the coastal area to mangroves, coral reefs and seaweed cultivation, standing crops, agriculture fields, plantations and irrigation facilities, and water sources, in addition to human lives and assets. BAPPENAS and World Bank (2004) noted that the damage extended to 90% of the 525ha of mangroves, 30% of the 97,250ha of coral reef and 20% of the 600ha of seaweed farming. The entire land affected reached 667,066ha from a total of about four million hectares of land in 17 districts/municipalities in Aceh and Nias.

5.2. Impact of Post-Tsunami Reconstruction and Rehabilitation

5.2.1. Sand and Stone Mining

Increasing demand for construction materials has increased logging and sand/rock mining activities in Aceh and Nias. In the three study districts, the mining of sand and rocks for construction materials is already a serious problem affecting many parts of coastal areas, along the rivers and also agricultural land. Some coastlines in Nias have collapsed due to sand and coral mining. Illegal rock and stone mining in Nias and sand mining in West Aceh has increased significantly. However, district officials are unable to stop these mining activities. Increasing demand for timber is also encouraging people to cut down trees on private land as well as public land. Without any control measures, these activities are becoming serious environmental concerns.



Figure 7. Rock quarry and sand mining in Nias (photo: Y.C. Wulan and S. Budidarsono)

5.2.2. Forest Clearing

The attraction of clearing forest land, partly to extract timber, has increased in Aceh and Nias. On the other hand, the price of rice has nearly doubled in about two years from late 2004 (IDR 4,500/kg) to early 2007 (IDR 8,000/kg). This has encouraged farmers to open up fallow land for rice production. The post Helsinki peace agreement between RI Government and the GAM has contributed significantly to reducing earlier fears amongst farmers about going into forests to clear and cultivate annual crops. However, the opportunity cost of labour has increased due to the construction boom currently taking place in Aceh and Nias. This has raised the local wage rate. With the shift away from wood (from illegal sources) to bricks (produced inland) for construction work, labour costs further inland have also risen significantly in recent times.

Time series land cover data for West Aceh was used to show the changes taking place in Aceh. An object-based hierarchical classification system was used to examine land use/cover changes in West Aceh prior and post tsunami using time series satellite images. The land cover maps show that between 1990 and 2002 about 4,200ha of forest area was cleared annually to other systems. During the intensive conflict period (2002 and 2005), the deforestation rate slowed down to only about 300ha per year. After the tsunami, this deforestation rate increased to over 4,400ha/year. Two thirds of the deforestation took place in conserved forest zone, most of which is located further inland. The pressure on forest after tsunami is intense. Furthermore, empirical relationships of land use/cover trajectories were tested with poverty rates under the

different levels of road access. In areas of West Aceh with good road access, converting low productive land uses to tree crops and maintaining mosaics of multifunctional landscapes may be a way to address the current problem of rural poverty. The deforestation trend and opportunities for tree crop development are likely to be similar for other parts of Aceh and Nias.

5.2.3. Peat Land Conversion

As a country, Indonesia is already the third highest emitter of greenhouse gases in the world. A large part of these emissions come from clearing peatland forests and conversion to monoculture plantations by peat drainage, decomposition and compaction. Peatland areas play an important role in water storage and supply, as well as in the storage of carbon. In many areas, they are crucial for mitigation of droughts and floods. NAD province has a peat area of around 274,051ha and West Aceh has about 25,079ha with rubber in mainly sites (SAU-ICRAF, Internal Data). These sensitive peatlands are being converted for settlements and oil palm plantations. A study by Wetlands International shows that peatland conversion releases CO₂ and methane gases into the atmosphere. It is estimated that production of one tonne of palm oil (CPO) will result in an average emission of 20 tonnes of CO₂ from peat decomposition alone.



Figure 8. The booming timber collection and trading business in Nias and Pidie (photo: Budi)



Figure 9. Housing program in peat area near Meulaboh, West Aceh (photo: Budi).

5.2.4. Tambak

Mainly along the north and eastern coast of Aceh, tambak aquaculture is a major issue related to mangrove destruction. Tambak are usually established close to the seashore and/or riparian

zone, often on mangrove areas. Zainun et al. (2007) identified tambak as close at 100-150m from the coastline. Local rules do not allow individual claims over land and sand close to the sea. The Presidential Decree Number No. 32 of 1990 also protects the coastline up to 100m from the sea, but this is ignored by tambak owners. The selling of tambak inside protected state land is common in all the study sites. This is likely to develop into serious conflict in future.

6. Tree Crop Development And Institutions

This section includes the study results related to people's views on what and how they want to improve livelihood options through tree planting, their perception of the opportunities and challenges, and also their perception on how the development may contribute to protecting the environment.

6.1. Trees People Want

Farmers' preferred components, which they see as important in supporting their longer term livelihoods, are summarised in Table 18. People are clearly interested in tree crops both in coastal (60% of respondents) and inland areas (83% of respondents). Clonal rubber was the favourite tree crop in West Aceh and Nias (Table 18. Preference for tree can annual crop planting (% respondents).). In inland Pidie, most respondents preferred cacao (77%), while in the coastal area, Pandanus, leaves used for tikar pandan, was preferred by nearly 38% of respondents. In Nias, many respondents also wanted to plant mahogany and teak trees and a few people preferred to plant fruit trees and annual crops. About 18% of respondents in the coastal area, in Pidie where Tambak cultivation is common, have no interest in planting either trees or annual crops.

Table 18. Preference for tree can annual crop planting (% respondents).

Topic	Coastal area			Inland area		
	West Aceh	Pidie	Nias	West Aceh	Pidie	Nias
Tree crops	61.3	52	66.7	93.8	90	65.7
Clonal rubber	45.2	-	57.6	59.4	-	51.4
Cacao	6.5	-	9.1	31.3	77.4	14.3
Coconut	6.5	13.8	-	-	-	-
Oil palm	3.2	-	-	3.1	3.2	-
Areca nut	-	-	-	-	9.7	-
Pandanus	-	37.9	-	-	-	-
Timber trees	3.23	3.4	24.2	-	-	34.3
Cemara Laut	-	3.4	-	-	-	-
Teak	-	-	-	-	-	11.4
Kayu manis	3.2	-	-	-	-	-
Mahagoni	-	-	24.2	-	-	20
Simalambuo	-	-	-	-	-	2.9
Fruit trees		6.9	-	-	3.2	-
Mango		6.9	-	-	-	-
Durian		-	-	-	3.2	-
Annual crops	22.6	3.4	-	3.1	6.5	-
No interest	12.9	34.5	9.1	3.1	-	-
Total	100	100	100	100	100	100

Source: Field survey data

6.2. Current Limitations

Table 19 presents respondents' perceptions about the constraints to tree crop planting of their choice. Lack of capital is a major constraint, according to most respondents, followed by lack of technology, lack of agricultural inputs and a lack of sufficient labour. Few respondents saw lack of an appropriate market to sell their products as a big problem. To sell their tree products in the villages was easy, but this wasn't satisfactory to them. About 10% of respondents see land unavailability for agricultural activities as a serious limitation.

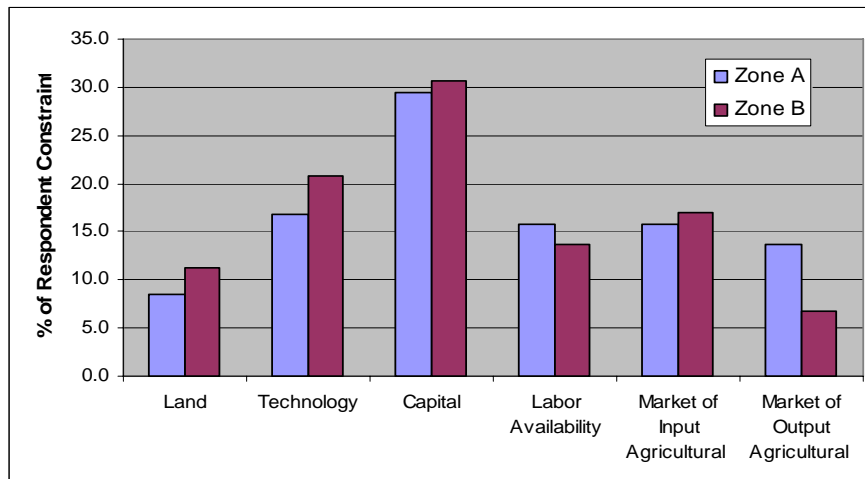


Figure 10. People perceived problems in tree crop cultivation.

In order to improve the production sector, all respondents indicated that capital and agricultural asset improvement should be a priority (Table 19). Except in West Aceh, most respondents in the study sites considered labor scarcity as the second priority to be addressed. The response of respondents reflected their experiences. In the coastal area of Pidie, where respondents are tambak farmers, a credit service is more important than market and agricultural extension. The market for tambak production (shrimp and milk fish) is not a problem. The more credit available, the more farm input they can afford (increased seed stocking), and the more profit they can make. While for areas where tree and crop cultivation are the main agricultural sources of income, a credit service is not so crucial for them, as compared to agricultural extension services.

With regard to infrastructure and institution development, most of the respondents saw road and other infrastructure as the first priority to be developed. Other aspects of priority varied among districts and between zones. In Nias, all respondents (both coastal and inland) had similar perceptions; markets for farm input and farm outputs are the second priority to be improved, followed by agricultural extension and credit. While for West Aceh, all respondents put agricultural extension services as the second priority, followed by credit services and access to a market. In Pidie there are different perceptions between coastal and inland respondents. Coastal respondents mentioned credit services as their second priority, followed by market and agricultural extension. Most inland respondents mentioned that credit is less important compared to market improvements and agricultural extension.

Table 19. Respondents' ranking of supporting components for improving agricultural production.

Component	Coastal area			Inland area		
	West Aceh	Pidie	Nias	West Aceh	Pidie	Nias
Production factors						
Capital and agricultural assets	1	1	1	1	1	1
Available and accessible technology	2	3	3	3	3	3
Labor	3	2	2	2	2	2
Infrastructure and institutions						
Market	4	3	2	4	2	2
Road and infrastructure	1	1	1	1	1	1
Agriculture extension	2	4	3	2	4	3
Credit and banking	3	2	4	3	3	4

Source: Field survey data

6.3. Agricultural Support Institutions

The study considered four agricultural support institutions: government services; credit institutions; social institutions; and direct product market and farm input supplies. These institutions play critical roles in the success of tree-based systems in Aceh and Nias Island. The assessment was based on farmers' perspectives about the existence, functionality and their access to services provided by these institutions.

Government services included village administration, agricultural extension service, and tree crop extension service that are expected to provide coordination, technical advice, assistance and supervision at the village level. Most respondents recognized the existence and functionality of the village government, and also mentioned that they have access to the services (Table 20. Respondents' perspectives on government services: their existence, functionality and access to services (%)). Although only a few respondents in the coastal area of West Aceh did not know about the existence of the village government, this may imply their dissatisfaction with the existing village government.

Table 20. Respondents' perspectives on government services: their existence, functionality and access to services (%).

	Coastal area			Inland area		
	West Aceh	Pidie	Nias	West Aceh	Pidie	Nias
Village government						
Existence	100	100	100	97	100	100
Functionality	100	100	100	91	100	100
Accessibility	94	100	100	91	100	100
Agricultural extension office						
Existence	81	11	3	69	34	6
Functionality	71	7	3	53	25	6
Accessibility	65	7	3	56	25	0
Tree crop extension worker						
Existence	16	0	0	6	16	0
Functionality	13	0	0	6	13	0
Accessibility	16	0	0	3	13	0

Source: Field survey data

With regard to the agriculture extension office, respondents in the three districts had different opinions. More than half of respondents in West Aceh recognized the existence and the functionality of this office, and also mentioned they have access to its services. Most respondents in Nias and coastal Pidie, however, appeared to be unaware of either the agriculture extension office or its services. The tree crop extension service is even less known than the agriculture office. Only a few people in the coastal area of West Pidie and the inland of Pidie had knowledge of its existence and functionality. There was a government initiated tree crop development (cacao and coffee) program in the inland of Pidie several years ago.

Credit institutions such as banks and formal and informal credit unions have a role in providing financial support for agriculture development. Their presence, function and access seemed to be very limited in the study sites (Table 21). Very few respondents know about the existence of the bank except in the coastal area of West Aceh and inland of Nias. Some NGOs have provided technical assistance to farmer groups to establish a credit union, however as it serves only its members, not many farmers outside the group knew about its existence. In the coastal area of West Aceh, there is no credit union. Some respondents in West Aceh and Pidie recognized the existence of an informal credit system that is a partnership between a trader and farmers. The trader provided financial support for working capital, and in return, farmers sold their products to the trader.

Table 21. Respondents' perspectives on credit institutions (%).

	Coastal area			Inland area		
	West Aceh	Pidie	Nias	West Aceh	Pidie	Nias
Bank						
Existence	6	4	3	3	6	6
Functionality	6	0	3	0	6	6
Accessibility	6	0	3	0	6	6
Credit union						
Existence	16	11	6	0	6	18
Functionality	10	4	6	0	3	18
Accessibility	10	4	6	0	3	18
Informal credit institution						
Existence	29	18	3	9	22	0
Functionality	29	14	3	9	16	0
Accessibility	29	14	0	9	16	0

Source: Field survey data

Local traders and markets for purchasing farm input are important for supporting agriculture development. At least one third of respondents, except in coastal area of Nias, knew about the existence of traders and markets for purchasing their farm input (Table 22). Most people have to go to nearby towns for farm input. In the coastal area of Nias, with fishery and tree crop farming (cacao, rubber, and coconut) as their economic mainstay, the lack of a trader in their area made marketing their products very problematic.

Table 22. Respondents' perspectives on product market and farm input supplies (%).

	Coastal area			Inland area		
	West Aceh	Pidie	Nias	West Aceh	Pidie	Nias
Trader						
Existence	55	46	0	47	34	35
Functionality	48	46	3	31	28	26
Accessibility	52	46	0	41	31	26
Farm inputs supplies at local market						
Existence	16	0	0	0	3	0
Functionality	16	0	3	0	0	0
Accessibility	13	0	0	0	3	0

Source: Field survey data

Social institutions include farmer groups, arisan, gotong royong (mutual assistance), and religious-based organisations that provide necessary social and cultural backing. Although they may not provide direct support to agricultural development, they do play a significant role in information dissemination and knowledge sharing.

Table 23 presents respondents' perspectives on five selected social institutions and their existence, functionality and accessibility. Most respondents from Nias were not aware of the existence of farmer groups and the system of gotong royong. This signals a lack of strong social capital among the Nias farmers. Whereas in West Aceh and Pidie, although more than half of the respondents recognized the existence of farmer groups and gotong royong, some of them do

not understand their function and do not access them for support. However, religious-based institutions, such as the pengajian, and other social activities are better known and used by the people.

Table 23. Respondents' perspectives on social institutions (%).

	Coastal area			Inland area		
	West Aceh	Pidi e	Nias	West Aceh	Pidi e	Nias
Farmer groups						
Existence	87	61	6	81	78	0
Functionality	68	50	9	53	41	0
Accessibility	65	50	9	63	44	0
Arisan						
Existence	32	25	41	59	19	32
Functionality	32	21	19	53	19	29
Accessibility	26	18	25	44	22	29
Gotong royong (mutual assistance)						
Existence	87	82	0	81	75	3
Functionality	74	79	0	72	78	0
Accessibility	71	82	0	72	81	0
Religion based institutions						
Existence	90	100	78	94	91	91
Functionality	77	96	72	84	94	85
Accessibility	71	100	69	84	94	85

Source: Field survey data

7. Concluding Notes

Aceh is still one of the most forested provinces in Indonesia. The forest ecosystems are rich in biodiversity and genetic pools, important for watershed protection and local hydrology, and also function as carbon pools that regulate the global climate. While Aceh experienced relatively less forest destruction during the political conflict, the peaceful conditions in the inland areas as well as the demand for timber for post-tsunami reconstruction have intensified (illegal) logging in recent years, linked to forest conversion and establishment of monoculture plantations. The volume of timber required for reconstruction in Aceh and Nias indicates a large gap between demand and supply (legal). It is estimated that 85% of logs in Aceh's current markets come from illegally logged forests and illegal logging is destroying around 20,769 hectares of rainforest every year in Aceh alone.

Deforestation, land degradation and natural resource management are strongly linked to rural poverty and economic opportunities. Despite its rich natural resources, Aceh remains one of the poorest provinces in Indonesia. The three-decade long political conflict, economic isolation, lack of technology and weak institutional set-ups are part of the reason. There is much disparity in the poverty of people living in the coastal areas and those living further inland. The inland people have suffered more from political isolation, conflict and fear. The current study result is consistent with the findings of the Kecamatan Development Program 2006 that the inland areas are poorer and less developed with many Internally Displaced People. The 2004 earthquake and tsunami occurred in an area that was already experiencing large-scale disaster and damage.

The victims of the political conflict are worse off than the tsunami victims. Many post-tsunami reconstruction and rehabilitation projects largely ignored the inland issues. However, the environmental and economic impact of reconstruction is reaching far inland. Mining for sand and stones, forest clearance for timber (illegal) and growing paddy, conversion of peatland for monoculture plantation and settlements, and tambak for shrimp production are becoming serious environmental problems. While government rules and regulations emphasize the need for a sustainable forest management by preserving ecological functions, protecting high conservation value forest and implementing environmentally-based sustainable development, the reality is far from this.

A recently conducted survey indicates the disproportionate distribution of poverty between coastal and inland areas, as well as between locations (accessible East Aceh with a strong conflict history), less accessible West Aceh (conflict history) and the remote island of Nias (no conflict history). The scoping study revealed that about 54% of the district population live inland and nearly 94% of the inland population rely on agriculture compared to 55% in the coastal areas. Yet there is a little development effort being directed towards the development of inland Aceh and almost no (applied) research and development related to tree crops and the environment-livelihood linkages.

Tree crops form an important source of rural livelihood in Aceh and Nias. Rubber, cacao, coconut, areca nuts (pinang), coconut and fruit trees are significant to rural livelihoods and local economies in many parts of Aceh and Nias. Even before the tsunami, the economy of West Aceh and Nias depended on tree crops cultivated in agroforests. The dependency on tree crops remains significant both in coastal areas and in the inland in all surveyed villages of Aceh and Nias. Rubber is dominant in West Aceh and Nias, while cacao is important in the inlands of Pidie, West Aceh and Nias. With knowledge of available technology, market opportunities and

increasing demand and price of timber and other tree products, farmers' interest in tree crops has increased.

Many of the environmental problems in Aceh and Nias cannot be solved through short-term measures and conservation oriented programs alone. In many rural areas, forest and other natural resources that provide environmental protection are also used by local communities to meet their economic requirements. These environment-livelihood links are often ignored in environmental projects. Environmental programs that also address the needs of the local people are more desirable and likely to succeed than those providing mere protection functions. A focus on trees and tree-based systems and how such forest and agroforest systems can be managed in a sustainable manner is key to the success of environmental program in Aceh and Nias.

This calls for a project focusing on the livelihood-environment links of local farming communities in the inland of Aceh and Nias that can lead to an improvement in rural livelihoods in Aceh and Nias as well as sustainable management of forest resources through a system of diverse trees and forests people want in the landscape. The project can demonstrate livelihood development and environmental protection through better forest and agroforest management in strategic locations in Aceh and Nias. These learning sites can serve as a source of knowledge and 'models of good practice' towards effective local governance based on an understanding of drivers of land use change and emerging economic opportunities in Aceh and Nias. However, it is important to consider current constraints and opportunities develop shared understanding and a common vision among multiple stakeholders. Landscape-level planning and implementation based on local customs and interest (e.g. hutan gampoeng at Mukim level management) may lead to better natural resource management and environmental protection. Furthermore, the policy environment and markets for agroforest and forest products must be improved ensuring a better market integration in rural-urban linkages.

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Annex

Table 1. People and institutions consulted in the study.

No	District	Institutions	Institution type	Person	Position
1	Nias	YPKM (Yayasan Pengembangan dan Kesejahteraan Masyarakat)	Local NGO	Sabaaro Lahago	Field Manager
2	Nias	LPAM (Lembaga Pencerahan dan Advokasi Masyarakat Nias)	Local NGO		Director Executive
3	Nias	Save The Children	International NGO	Tito Panggabean	Livelihood Division
4	Nias	Holiana'a - Heks	Local NGO		Executive Director
5	Nias	BRR	Govt Agency	Vence Lasse	Institution division
6	Nias	BRR	Govt Agency	Jupiter Gulo	Kepala District Nias
7	Nias	Dinas Pengairan Kabupaten Nias	Govt Agency	Damanik	Kepala Pengairan
8	Nias	UN-FAO	International NGO	Alfizar	Livelihood Division
9	Nias	UNDP	International NGO	Kusnadi	Livelihood Division
10	Nias	UNORCH	International NGO	Yolanda Piliang	
11	Nias	BAPEDA	Govt Agency	Baziduhu Zebua, Nur Kemala Gulo	Kepala Bapeda, Kabid Penelitian
12	Nias	Kecamatan Mandrehe	Govt Agency	Abia Waruwu	Camat
13	Nias	Dinas Pertanian	Govt Agency	Aliran Telambua	Kasubdin Program
14	Nias	Dinas Kimpraswil	Govt Agency	Masaledi Zega	Kasie Pemeliharaan
15	Nias	Subdistrict Institutions	Sect. Sirombu		Govt Agency
16	Nias	Village Institution	Lahusa Vil. Head		Govt Agency
17	Nias	Subdistrict Institutions	Head of Mandrehe		Govt Agency
18	Nias	Village Institution	Lakhene Vil. Head		Govt Agency
19	Pidie	Badan Perencanaan Daerah	Govt Agency		Economic Division
20	Pidie	Badan Pengendalian Dampak Lingkungan Daerah	Govt Agency	Ayub Ahmad	Kepala Bapedalda
21	Pidie	Dinas Perikanan	Govt Agency		Kepala Dinas
22	Pidie	Dinas Kehutanan dan Perkebunan	Govt Agency		Kepala Dinas
23	Pidie	KPPKP (Kantor Penyuluhan Pertanian dan Ketahanan Pangan)	Govt Agency		Office Staff
24	Pidie	GTZ	International NGO	Maitanur	Coordinator Camp
25	Pidie	Dinas Pertanian	Govt Agency	M. Hasa	
26	Pidie	Subdistrict Institutions Batee	Govt Agency		Kecamatan Sec.
27	Pidie	Village Institution Genteng Barat	Govt Agency		Head of village
28	Pidie	Village Institution Genteng Timur	Govt Agency		Head of village
29	Pidie	Subdistrict Institutions Tangse	Govt Agency		Head of subdistrict
30	Pidie	Village Institution Lhok Ketapang	Govt Agency		Head of village
31	Pidie	Village Institution Aloe Calong	Govt Agency		Head of village
32	Pidie	Mukim		M. Hasbalah	Head of Mukim
33	W. Aceh	Dinas Kehutanan dan Perkebunan	Govt Agency	Rasyidin	Kepala Dinas
34	W. Aceh	Dinas Pertambangan	Govt Agency	Irna	Staff
35	W. Aceh	Dinas Pertambangan	Govt Agency	Sofyan	Kepala Dinas
36	W. Aceh	Mukim	Tokoh Masyarakat	Tengku Umar Wahab	Imam Mukim Sungai Mas
37	W. Aceh	Kecamatan Sungai Mas	Govt Agency	Ramli Yusuf	Camat Sungai Mas
38	W. Aceh	Extension Worker	Govt Agency	Muser	Head PPL Sungai Mas
39	W. Aceh	BAPEDA	Govt Agency	Syahril	Kabid Ekonomi
40	W. Aceh	BRR	Govt Agency	Dita F. Adnan	Pusdatin

Who we are

The World Agroforestry Centre is the international leader in the science and practice of integrating 'working trees' on small farms and in rural landscapes. We have invigorated the ancient practice of growing trees on farms, using innovative science for development to transform lives and landscapes.

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Our Vision is an 'Agroforestry Transformation' in the developing world resulting in a massive increase in the use of working trees on working landscapes by smallholder rural households that helps ensure security in food, nutrition, income, health, shelter and energy and a regenerated environment.

Our mission

Our mission is to advance the science and practice of agroforestry to help realize an 'Agroforestry Transformation' throughout the developing world.



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