ACEH AND THE ARCHIPELAGO ECONOMY:

Protecting forests for water, energy and food security

This study was funded by The Climate and Development Knowledge Network (www.cdkn.org). It was conducted by WCS Indonesia in partnership with the Global Canopy Programme.

The Global Canopy Programme is a tropical forest think tank working to demonstrate the scientific, political and business case for safeguarding forests as natural capital that underpins water, food, energy, health and climate security for all. GCP works through its international networks – of forest communities, science experts, policymakers, and finance and corporate leaders – to gather evidence, spark insight, and catalyse action to halt forest loss and improve human livelihoods dependent on forests. Visit www.globalcanopy.org for more information.

Authors: Matt Leggett, Muhammad I. Lubis, Nuruliawati, and Wulan Pusparini, Wildlife Conservation Society Indonesia.

INTRODUCTION

On current trends, Indonesia is on course to become the seventh-largest economy in the world by 2030 - overtaking Germany and the United Kingdom[1]. However, in order to meet its goal of becoming a high-income country by 2030 Indonesia must sustain a rapid rate of economic growth of approximately 9%[2]. To date, the steady pace of economic growth has been sustained through a strategy that builds on the use of Indonesia's abundant natural resources, with forestry, agriculture, mining and fisheries key contributors to national GDP. However, widespread environmental degradation in Indonesia has progressed hand in hand with its economic growth, and this 'business-as-usual' approach is now at risk of destabilising and, at worst, reversing the economic gains the country has made thus far. High rates of deforestation, thought to be the highest in the world[3], and recent devastating forest and peatland fires provide sobering reminders of this risk. Estimates suggest that the front-line response costs to the fires in 2015 (US $35bn) cancel out Indonesia's economic growth in that year, without taking into account the cost of future preventative measures and any wider indirect costs[4].

Recognising the need for sustainable development, the Government of Indonesia's current medium-term development plan[5] (RPJMN 2015-2019) seeks to increase development without environmental degradation. Water, energy and food security are also recognised as being at the heart of the nation's economic development strategy. The continuing provision of these securities is inextricably linked to their reliance on properly functioning ecosystems. Forests and peatlands are widely recognised as offering a low-cost pathway to securing water, energy and food security while guaranteeing biodiversity protection, and supporting efforts towards emissions reduction and climate change mitigation goals. Ensuring the ongoing delivery of these securities is increasingly recognised as requiring a holistic and integrated approach, which has been coined the 'Water-Energy-Food (WEF) nexus'[6].

A series of studies were undertaken in Aceh to explore some the challenges facing the province, as they work towards meeting the goals of the RPJMN without further environmental degradation. This demonstrates the value of a WEF nexus approach in supporting these efforts.

FORESTS AS ACEH'S 'NATURAL CAPITAL'

Aceh province still has relatively intact remaining forest areas, the bulk of which lie within the Leuser Ecosystem, a 2.6 million hectare area of forest which dominates the core inland and upland areas of Aceh. The forests of Aceh also contain the largest remaining populations of Sumatran Rhino, Sumatran Tiger and Orangutan, but their ecosystem services are also recognised as essential for sustaining food and water security, by regulating water flows in both the monsoon and drought seasons, to irrigate rice fields and other cash crops, such as palm oil. The ecosystem services provided by Aceh's forests have been estimated at US $200m annually[7]. Deforestation rates within the Leuser Ecosystem, either for large-scale monoculture plantations (predominantly oil palm) or small-scale subsistence farms remain relatively low (around 1% per year) compared to other areas in Indonesia (Sumatra's deforestation rate is around 2.3% per year). However, under Aceh's current spatial plan, deforestation rates are expected to increase dramatically, largely driven by a reclassification of forest areas to enable conversion for agriculture and the development of an expansive road network that would open up remote areas to encroachment[8]. Increased deforestation presents a serious direct threat to the biodiversity of Aceh's forests, but also represents a critical economic risk to Aceh's future sustainable development, and the water, energy and food security of its population[9]. The economic risks in particular are often poorly communicated to decision makers in district and provincial Government, and are therefore often misunderstood and not accounted for within development planning.

The following studies from Aceh demonstrate first how understanding the interdependencies between the environment and the agricultural economy can support effective development planning, and second the importance of coherent cross-sectoral coordination in establishing plans and targets that are well aligned and do not damage the forest ecosystem services which underpin their economic development model. The opportunities provided by this 'WEF nexus' approach to facilitate the reduction of deforestation in Aceh while enabling continued and sustainable economic development within the province are also then discussed.

STUDY 1: UNDERSTANDING ECOSYSTEM CONNECTIVITY – FLOODING AND DEFORESTATION IN ACEH

A critical first step towards properly accounting for the services that forest ecosystems provide within provincial development planning is to clearly understand the complex ways they can underpin the formal economy. The clearest connection between deforestation and the agricultural economy in many rural areas can be seen through the impacts of forest loss or degradation on water flows. This study therefore examines the links between deforestation, flooding and the agricultural economy in Aceh.

KEY FINDINGS:

1. The frequency of recorded flooding events in Aceh is increasing steadily.
2. Districts where there are palm oil plantations experience more frequent floods, possibly due to increased rapidity of run-off into river systems, and/or land subsidence from peatland forest clearance and drainage.
3. The current annual direct costs of flooding are conservatively estimated at US $27m per year.
4. Increased flooding frequency and inundation from land subsidence may render many of Aceh's palm oil plantations on peatland forest environmentally 'stranded assets', with a direct cost likely to be in the billions of dollars.

Background

Deforestation is thought to have multiple impacts on water flows, which include exposed soils being washed into riverbeds cutting their carrying capacity; the loss of vegetative cover that acts as a 'sponge' for heavy rainfall; and increased rapidity of runoff into hydrological systems[10], which all contribute to more severe flooding events. In Kramer et al (1995[11]) for example, annual storm flows from secondary forest were about three-fold higher than from a similar-sized primary forest catchment, and four to five times higher from a catchment dominated by swidden agriculture. Deforestation also has other impacts on the hydrological cycle, causing increases in temperatures and changes in the amount and distribution of rainfall, broadly creating a drier climate, which can both reduce agricultural yields in some areas and increase flooding in others[12]. Deforestation in upland areas has been regularly blamed by people in Aceh and local and national media for increasing the severity and frequency of flooding events in the fertile coastal areas. Despite this, definitively linking deforestation to flooding impacts remains highly contested[13 14 15] and in reality the relationship between forest loss and flooding frequency and severity is rarely linear. Given the number of independent variables to consider, causality can be difficult to attribute.

In this study we aim to demonstrate a statistically significant correlation between forest loss and flooding incidence in key districts and watersheds. Data on flooding events was drawn from official Basarnas and BNPB data and media sources[16] and a series of statistical tests were used to determine the correlation between flooding incidence and deforestation at the district and watershed scale in Aceh. Existing metrics were also used to estimate the potential economic cost of flooding loss and damage in Aceh between 2010 and 2015.

Results

In this study, all recorded flooding events between 2010 and 2015 were analysed to assess the links between deforestation and flooding, and the likely knock-on impacts on Aceh's critical agricultural economy.

We recorded 1209 unique flooding events in Aceh. These were found to be increasing year on year, particularly along the west coast of Aceh. Although deforestation rates were not initially found to be significantly correlated with the frequency of flooding events at watershed or district scales, possibly due to some limitations inherent within the data sample, flooding frequency was found to be strongly correlated with the percentage of monoculture palm oil plantations within districts. This correlation was particularly clear in western Aceh in the districts of Aceh Jaya, Aceh Barat, Aceh Barat Daya, Aceh Singkil, Nagan Raya and Aceh Selatan (Figure 1) in areas on or near peatlands.

As the study did not collect information on land subsidence or water flows it was not possible to show a causal link between plantation development and flooding incidence, however other studies do indicate that the drainage of peat and the clearance of peatland forest results in substantial and rapid land subsidence and soil degradation which results in regular inundation[17], and that drained peat swamps and cleared forests were less able to mitigate and regulate the flow of water from flooding events[18]. Examples from Malaysia demonstrate that in one peatland area in Sarawak, land subsidence from peatland drainage for oil palm cultivation will result in 42% of the area becoming permanantly inundated over 25 years, and up to 82% over 100 years[19 20].

Alongside flooding incidence, data was also collected on flooding severity where it was available. From 112 such records from 2010-2015, an estimated 223,000 people in Aceh were displaced, over 100,000 houses damaged and there were 10,000 records of damage to agricultural land from flooding events. A conservative cost estimate indicates the likely cost is, at a minimum, US $136m over 5 years (an average of US $27m per year[21]). Given that damage was recorded for less than 10% of flooding events, the real cost may have been considerably higher.

Damage type	Number of incidences (2010-2015)	US $ est. cost (2015)
Agricultural land damage (events)	10,237	23.1
Damage to private property (no. houses)	107,189	103.7
Damage to infrastructure (events)	596	9.7
Displaced people (individuals)	223,370	Unknown
Deaths (individuals)	9	Unknown
	Total Cost	136.5

Conclusions

The increased risk of flooding in districts with monoculture palm plantations is significant. Although the dynamics are not yet clear, any increased incidence of flooding in plantation areas which are also on peat (the majority of the plantation areas in western Aceh), combined with likely land subsidence from peatland drainage may lead to permanent inundation, which could render whole plantation areas environmentally stranded assets[22]. This would represent a major loss of investment, both for the private sector in terms of capital investment into the plantation, but also for the public sector in terms of forgone tax revenues. The likely loss of land values in the Malaysian example amount to US $7.9bn[23]. Land subsidence also removes huge swathes of forest land from other forms of viable use (non-timber forest products, ecotourism etc.), not to mention the loss of forest with enormous biodiversity value. It is also not inconceivable that future legal action could be taken by private companies against the Government for allowing/failing to prevent actions (e.g. enabling deforestation) upstream that would lead to the devaluation of assets that can be proven to strand major agricultural investments downstream.

In Aceh, the link between flooding and plantation development should be of considerable concern. Both palm oil development rates and deforestation rates are set to rise substantially under Government targets (RPJMN, 2015-2020) and under the Aceh spatial plan (see study 2). Yet, according to the results of this study, deforestation, the establishment of monoculture plantations (particularly in peatland areas) and flooding present a real economic risk to Aceh's agricultural economy. If current flooding frequency trends continue, Aceh runs the risk of being burdened with ever-increasing costs of loss and damage from flooding, followed by a gradual decline in palm oil yields through land inundation, followed by eventual plantation abandonment in high-value coastal areas.

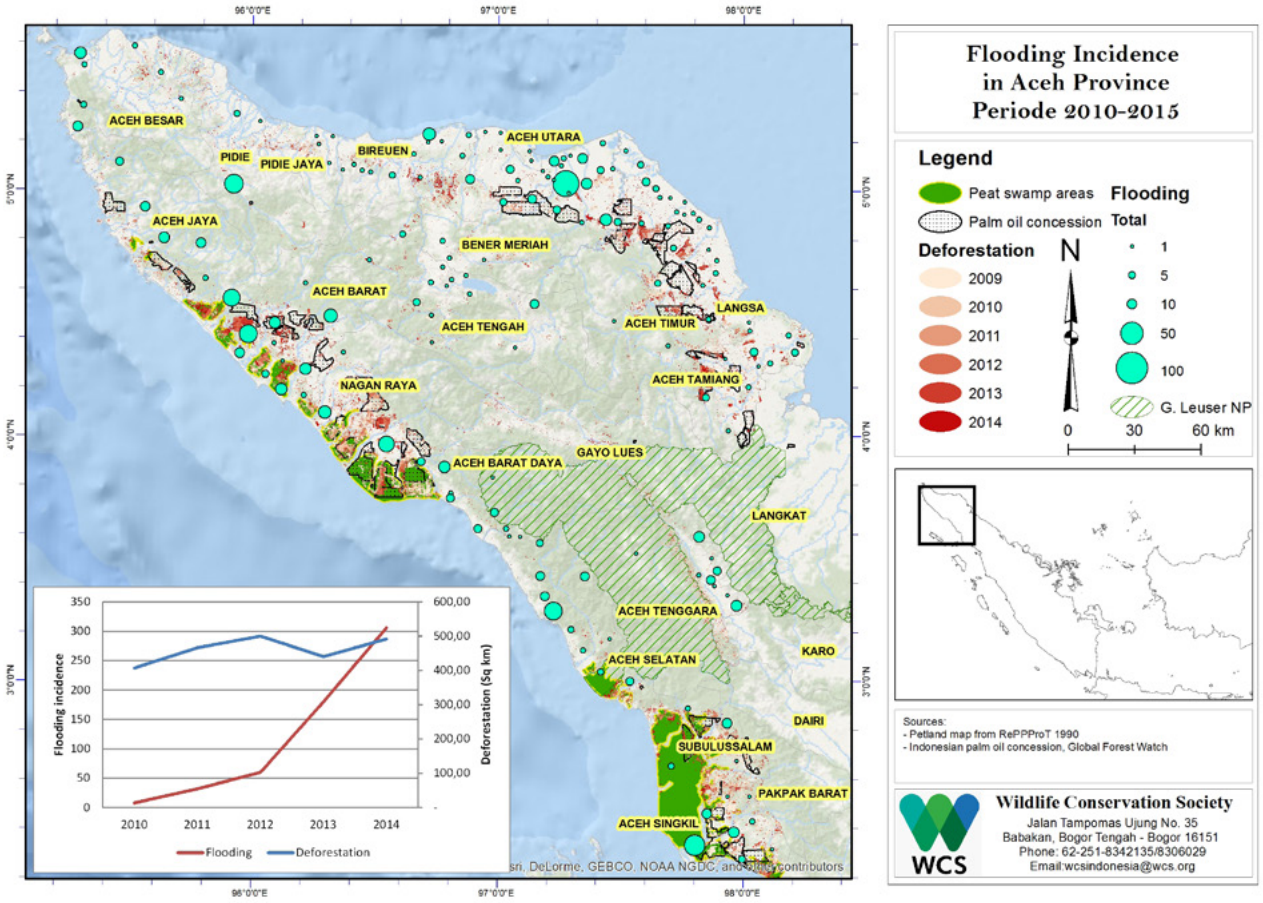

Figure 1. Flooding incidence and major palm oil concessions in Aceh.

STUDY 2: EVALUATING TRADE-OFFS IN THE AGRICULTURAL SECTOR

Where the connections between ecosystem services and economic development are well understood, coordinated cross-sectoral planning is still necessary in order to avoid a 'tragedy of the commons' with respect to forests – where the cumulative effect of each sector's 'sustainable' practices may still lead to a decline in the provision of ecosystem services. The second study in Aceh used a WEF nexus approach to assess the feasibility of implementing existing Government rice and palm oil targets and to analyse the potential environmental and economic trade-offs and synergies which would result from their implementation.

KEY FINDINGS:

1. Business-as-usual palm oil production targets will result in the conversion of a minimum of 220,000 hectares of land into plantations.
2. Increasing tonnes/hectare productivity of palm oil to meet Indonesian industrial averages will reduce the amount of land required by 2019 to 41,000 hectares less than the current plantation area.
3. At only a 1% increase in productivity per year between 2015 and 2019, the land required for rice production in Aceh to meet targets will more than halve.
4. There is insufficient suitable land in Aceh to meet current targets for palm oil production without yield increases or worsening deforestation.

Background

In response to ambitious national sectoral targets mandated by the Indonesian mid-term development plan (RPJMN), the Government in Aceh has set similarly ambitious targets across the energy, water, and agricultural sectors[24]. While these developments are likely to make significant economic contributions, as well as support national and provincial targets for food security and food sovereignty, concern has been expressed by environmental groups that significant land conversion will be required to meet these targets, and that this will result in further forest loss. Thus, this study seeks to collate and analyse existing Government targets for rice and palm oil expansion in Aceh; to model the available suitable land area for agricultural expansion for both commodities; and to analyse the likely trade-offs and synergies which would result from the implementation of plans to achieve these targets. It makes particular reference to the potential risk of further deforestation as a result of these targets.

Results

Palm oil production targets in Aceh are set to rise by almost half a million tonnes between 2015 and 2019, which the business-as-usual scenario predicts will result in the conversion of approximately 220,000 hectares of land into new palm oil plantations within five years. However, only a 5% increase in productivity per year between 2015 and 2019 would lead to a substantial drop in the amount of new land required for palm oil (a reduction of more than 100,000 hectares). Furthermore, if yields were supported to reach the national industry average (3.67 t/ha), through a 15% increase in productivity per year, the land required for palm oil in Aceh would fall year on year to 41,000 hectares less than the current total plantation area, while still meeting Government production targets (Table 1). Taken further, if all of Aceh's oil palm plantation areas were to reach the average productivity of companies who have signed up to Roundtable on Sustainable Palm Oil (RSPO) standards (5.13 t/ha), the required land area for palm oil in Aceh to meet existing targets falls by over 155,000 hectares to only 252,403 hectares in 2019, which is over 100,000 hectares less than the current total plantation area.

Similarly, rice production targets in Aceh are set to rise by approximately 200,000 tonnes between 2015 and 2019, requiring an estimated additional 52,000 hectares of land for conversion into rice fields. Due to Aceh's relatively high productivity per hectare (approximately 6 t/ha) the degree to which yield improvements can reduce land conversion is lower in comparison with the potential gains in the palm oil industry, though still significant. With a yield increase of 1% per year, the total estimated land required for conversion to rice production more than halves, and at a 3% yield increase the required land for future rice production to meet Government targets by 2019 is also less than the current baseline area.
In order to assess the feasibility of these targets, the total suitable land area for

Year	Palm oil production target (tonnes)	Plantation area (ha) with productivity increase to under BAU	Plantation area (ha) with productivity increase of 5%/yr	Plantation area (ha) with productivity increase of 15%/yr
2015	825,867	393,270	393,270	393,270
2016	857,330	408,252	388,812	355,002
2017	987,160	470,076	426,373	355,445
2018	1,195,440	569,257	491,746	374,296
2019	1,294,060	616,219	506,965	352,325
Total additional req. ha 2015-2019		**222,949**	**113,695**	**- 40,945**
Yield tonnes/ha 2019		2.10	2.55	3.67

Table 1. The impact of improved productivity on land required for palm oil cultivation against the business-as-usual (BAU).

Year	Rice production target (tonnes)	Plantation area (ha) with productivity increase under BAU	Plantation area (ha) with productivity increase of 1%/yr	Plantation area (ha) with productivity increase of 3%/yr
2015	2,029,503	331,156	331,156	331,156
2016	2,107,642	341,656	340,420	332,197
2017	2,160,342	352,156	345,477	328,989
2018	2,214,343	362,656	350,607	325,809
2019	2,269,449	373,156	355,774	322,625
Total additional req. ha 2015-2019		**52,500**	**24,618**	**- 8,531**
Yield tons/ha 2019		6.08	6.38	7.03

Table 2. The impact of improved productivity on land required for rice cultivation against the business-as-usual (BAU).

conversion was modelled, taking into account a number of variables such as population density, distance to roads, distance to rivers, slope, aspect, and elevation. Areas where land conversion for agriculture is currently not allowed were excluded from the analysis, e.g. Gunung Leuser National Park, all areas within peat swamps, and other land classification types, including protection forest (hutan lindung) and forest reserves (hutan suaka alam). The Leuser Ecosystem was also excluded – the legality of conversion here is in dispute, but the Aceh government have granted concession licenses within this area in the past.

Based on existing production targets and BAU productivity (2.1 t/ha), and assuming a commitment to zero deforestation (no conversion of primary or secondary forests identified in the model) there is currently insufficient land in Aceh suitable for conversion to meet the palm oil productivity target by 2019. When the potential danger of palm oil plantation yields being negatively affected by inundation and regular flooding is also accounted for the palm oil production target may be at considerable risk.

Conclusions

Without concerted efforts to improve spatial planning and to rigorously ensure palm oil developments remain outside of forested areas and peatlands, forest within the Leuser Ecosystem will be at considerable risk of conversion – 115,000 hectares inside the Leuser Ecosystem were identified during the modelling exercise as potentially viable cultivation areas for palm oil. Given the recent failure of the Aceh Government to protect these areas from palm oil concessions this forested land could be at particular risk under the BAU development scenario.

According to the model designed in this study, enough suitable land exists for Aceh to meet its rice production targets without productivity increases. Trade-offs in investing in improving productivity on existing land (such as through fertiliser use and improved irrigation), versus the costs of land conversion and new irrigation schemes under rice area expansion plans should be considered. Additionally, if palm oil conversion is allowed to continue on forest areas it may have knock-on impacts on water flows for major rice producing areas, particularly in northern and western Aceh, and could also increase the risk of flooding in districts where palm oil and rice production exist alongside each other.

Despite these trade-offs, improvements in productivity will enable land to be spared for other agricultural uses, which may indirectly reduce the conversion pressure on forested lands in the province. Given that the land requirements for other agricultural commodities (e.g. corn, coffee etc.) were not taken into account in this analysis, our evaluation of the available land for rice and palm oil is therefore likely to be optimistic. Competition for land between palm oil and rice industries was also expected ex-ante, however the model initially only identified 26,000 hectares of land as potentially suitable for both commodities, although this deserves further study. Refinements to the model would be expected to reveal a greater overlap of the potential cultivation area of palm oil with rice production.

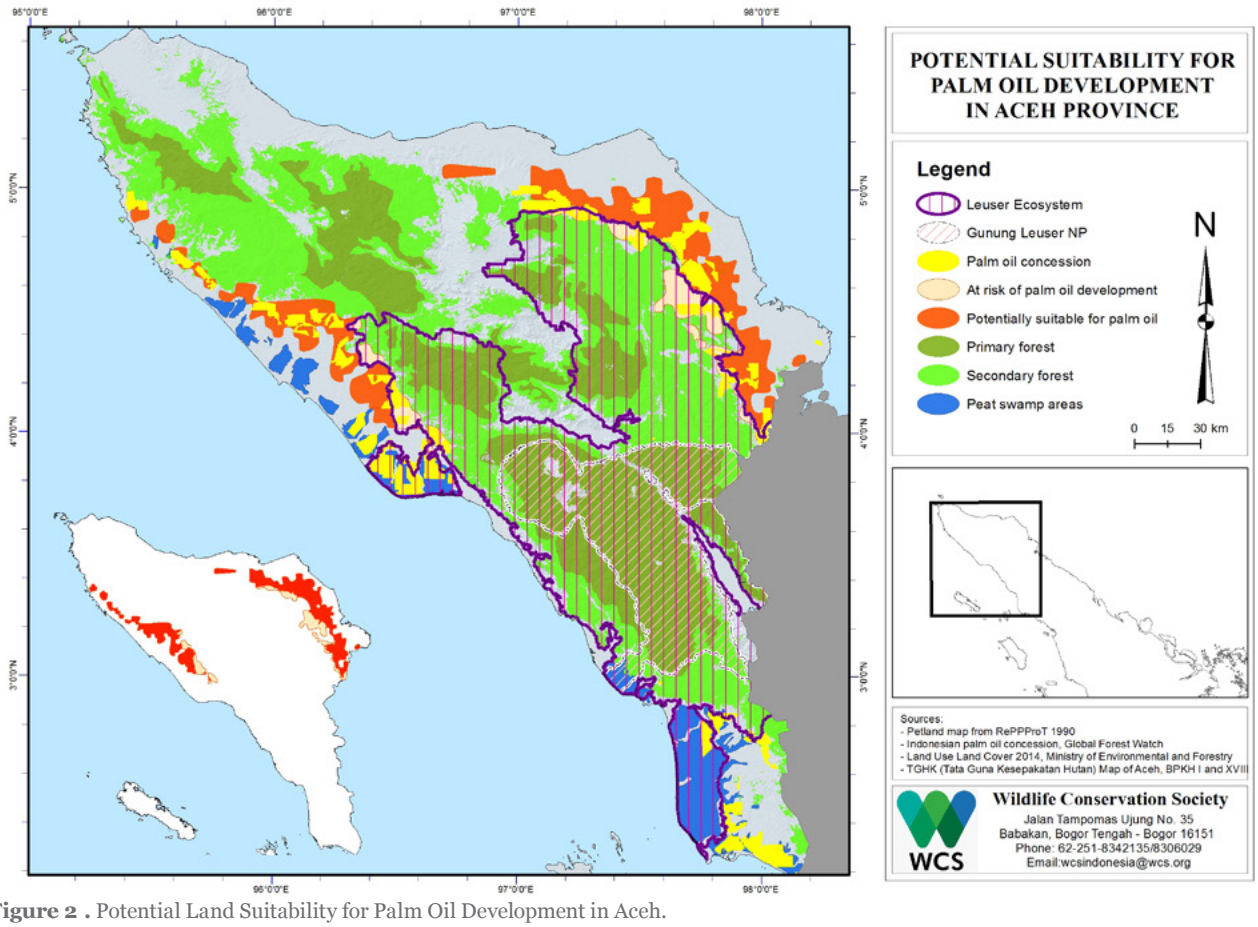

Figure 2 . Potential Land Suitability for Palm Oil Development in Aceh.

THE VALUE OF THE WATER, ENERGY AND FOOD NEXUS APPROACH

The intention of these studies is to support policy makers in Aceh and Indonesia to better understand the complexity and interconnectedness of their environmental systems, and in particular the role that forests can play in underpinning the economy, in addition to their unique role in supporting biodiversity and climate mitigation. The study findings demonstrate how poorly coordinated decisions made in sectoral silos can have unforeseen and potentially damaging impacts across the water, energy and food sectors through their impacts on forests. The findings clearly indicate that:

1. Multiple trade-offs are likely to exist within national agricultural development plan targets which are poorly understood, and that, if unaddressed, may result in future economic and environmental losses for Aceh.
2. Significant investment in improved productivity in the palm oil sector within existing plantation areas on non-peat soils may mitigate the future impacts on Aceh's forests, and may support a sustainable future for the industry in the province.
3. Yield improvements for other commodities, such as rice, may also represent the lowest cost option for mitigating impacts on ecosystem services and securing economic growth.
4. Numerous synergies are likely to exist between water, energy and food sectors. These must be better understood in order to maximise the effectiveness of Aceh's investments into these sectors. They may include, for example, investment in irrigation schemes which can increase the productivity of rice, and also stabilise water flows, increase water security and quality, and reduce downstream flooding in palm oil areas. Upstream reforestation schemes and payments for water services schemes in Aceh also offer a huge potential for generating positive benefits from environmental protection, and successful schemes already exist in Indonesia which can be replicated.

These studies therefore represent a small step towards a comprehensive analysis of the WEF nexus interactions that are embedded within Aceh's existing development plans. Under the current business-as-usual development plan Aceh's economy is both heavily reliant on the ecosystem services provided by forests, and also responsible for degrading them. A deeper WEF analysis would help decision-makers in district and provincial Government understand the interdependencies between Aceh's provincial economy and the environment, and the long-term impacts of planned investments across different sectors. A well designed WEF approach could then become a core part of a unique development pathway for Aceh, one that values environmental protection not only for its biodiversity and climate mitigation benefits, but as a core part of their future economic development strategy within the archipelago economy.

REFERENCES AND END NOTES

[1] McKinsey. (2012) The Archipelago Economy: Unleashing Indonesia's Potential. McKinsey Global Institute.

[2] Jakarta Globe. (2015) Accessed at: http://jakartaglobe.beritasatu.com/business/indonesia-needs-near-9-growth-avoid-middle-income-trap-world-bank/

[3] Margono,B. Potapov, P. Turubanova, S. Stolle, F. Hansen, M. (2014) Primary forest cover loss in Indonesia over 2000–2012. Nature Climate Change, 4, 730–735.

[4] Bloomberg. (2015) Haze Crisis Cost Indonesia Almost 2% of GDP, World Bank says http://www.bloomberg.com/news/articles/2016-01-20/haze-crisis-cost-indonesia-almost-2-of-gdp-world-bank-says

[5] Rencana Pembangunan Jangka Menengah Nasional 2015-2019 (RPJMN) (2015). Accessed at: http://www.bpkp.go.id/sesma/konten/2254/Buku-I-II-dan-III-RPJMN-2015-2019.bpkp

[6] The Water, Energy and Food Security Resource Platform (2015). Accessed at: http://www.water-energy-food.org/en/whats_the_nexus/background.html

[7] Van Beukering, P.J.H., Cesar, H.S.J. & Janssen, M.A. (2003). Valuation of ecological services of the Leuser National Park in Sumatra, Indonesia. Ecological Economics 44(1): 43-62.

[8] Clements, G.R.; Lynam, A.J.; Gaveau, D.L.A.; Wei, L.Y.; Lhota, S.; Goosem, M.; Laurance, S.; Laurance, W.F. (2014) Where and how are roads endangering mammals in Southeast Asia's forests? PLoS ONE 9 (12):25.

[9] Van Beukering, P.J.H., Cesar, H.S.J. & Janssen, M.A. (2003) Valuation of ecological services of the Leuser National Park in Sumatra, Indonesia. Ecological Economics 44(1): 43-62.

[10] Van Beukering, P.J.H., Cesar, H.S.J. & Janssen, M.A. (2003) Valuation of ecological services of the Leuser National Park in Sumatra, Indonesia. Ecological Economics 44(1): 43-62.

[11] Kramer, R.A., Sharma, H., and Munasinghe, M. (1995) Valuing Tropical Forest: Methodology and Case Study of Madagascar. World Bank Environment Paper 13, Washington DC.

[12] Lawrence D, Vandecar, K. (2015) Effects of tropical deforestation on climate and agriculture. Nature Climate Change 5, 27–36.

[13] CIFOR and FAO. (2005) Forests and floods Drowning in fiction or thriving on facts? RAP Publication 2005/03 Forest Perspectives 2.

[14] Van Dijk et al. (2009) Forest–flood relation still tenuous – comment on 'Global evidence that deforestation amplifies flood risk and severity in the developing world' by C. J. A. Bradshaw, N. S. Sodi, K. S.-H. Peh and B. W. Brook. (2009) Global Change Biology 15, 110–115.

[15] Bradshaw C.J.A., Sodi N.S., Peh K.S.H., Brook B.W. (2007a) Global evidence that deforestation amplifies flood risk and severity in the developing world. Global Change Biology, 13, 2379–2395.

[16] The National Search and Rescue Agency (http://www.aceh.basarnas.go.id); the Badan Nasional Penanggulangan Bencana (http://www.bnpb.go.id); Aceh Tribune News (http://aceh.tribunnews.com); Kompas (http://regional.kompas.com); and Antara News http://aceh.antaranews.com).

[17] Deltares. (2015) Flooding projections from elevation and subsidence models for oil palm plantations in the Rajang Delta peatlands, Sarawak, Malaysia. https://www.deltares.nl/app/uploads/2015/06/Rajang-Delta-Peatland-Subsidence-Flooding-Deltares-2015.pdf

[18] Kramer, R.A., Sharma, H., and Munasinghe, M. (1995) Valuing Tropical Forest: Methodology and Case Study of Madagascar. World Bank Environment Paper 13, Washington DC.

[19] Deltares (2015) Flooding projections from elevation and subsidence models for oil palm plantations in the Rajang Delta peatlands, Sarawak, Malaysia. Accessed at: https://www.deltares.nl/app/uploads/2015/06/Rajang-Delta-Peatland-Subsidence-Flooding-Deltares-2015.pdf

[20] Agrimoney. (2015) Plantation deal highlights Malaysian land premium. Accessed at: http://www.agrimoney.com/news/palm-plantation-deal-highlights-malaysian-land-premium--8431.html

[21] World Bank. (2006) Aceh Flood Damage and Loss Assessment. Accessed at: http://siteresources.worldbank.org/INTINDONESIA/Resources/Publication/280016-1168483675167/AcehFloodReport_en.pdf

[22] When unsustainable assets suffer from unanticipated or premature write-offs, downward revaluations or are converted to liabilities. In this context, rapid environmental changes (e.g. climate change, land degradation etc.) can convert assets to liabilities. For more information see: http://www.smithschool.ox.ac.uk/research-programmes/strandedassets/Stranded%20Assets%20Agriculture%20Report%20Final.pdf

[23] Agrimoney. (2015) Plantation deal highlights Malaysian land premium. Accessed at: http://www.agrimoney.com/news/palm-plantation-deal-highlights-malaysian-land-premium--8431.html

[24] Rencana Pembangunan Jangka Menengah Daerah Kota Banda Aceh Tahun 2012 – 2017. (2012) Accessed at: http://bappeda.bandaacehkota.go.id/rpjm/