Using Data Tools to Optimize Indonesia's Land Resources: An Overview of Natural Capital Assessment

Climate Policy Initiative

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CPI Brief

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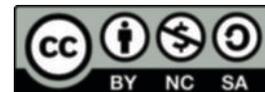
Note from the Executive Director

Land and land resources play a fundamental role delivering the economic growth targets of many emerging economies and have close links to issues such as job creation, poverty alleviation, and food security. Although land is a valuable asset that produces social, environmental, and economic benefits, economic benefits are the most readily recognized. Social and environmental impacts are important - but are often unpriced and undervalued.

The rapid expansion of agricultural and industrial production onto high value ecosystems in many developing countries testifies to this undervaluation. In Indonesia, for example, this expansion is a major driver of deforestation and degradation — which accounts for a significant amount of Indonesia's greenhouse gas emissions, fuels social conflict, and results in other economic and environmental losses. Demands on Indonesia's land resources are expected to continue to increase in the coming years.

Improved capacity to value the benefits associated with land and to integrate this information into land allocation decisions could support efforts to achieve both development and environmental goals. For example, overlaying available data on community locations, agronomic potential, and environmental quality can help decision-makers consciously address competition between short- and longer-term social, economic, and environmental concerns. Though this approach goes by various names, this brief refers to it as 'natural capital assessment.'

Within Indonesia, natural capital assessment could complement existing spatial planning efforts to identify areas best suited to meet development goals *while reducing — or eliminating — risks of new forest conversion and community conflict*. While the idea behind natural capital assessment is not new, new financial and technical resources along with growing interest among some local and national policy-makers, may now present a window of opportunity to pursue this approach in Indonesia.

This brief distills the elements of natural capital assessment process, highlights a few cases of existing, related experience and tools; and situates the discussion in the context of Indonesia's development goals and pressures. As such, it will inform further CPI analysis, which will consider options to help Indonesian technical experts and decision-makers consciously acknowledge and weigh the benefits from land resources to inform land allocation decisions.

At the same time, although we characterize the natural capital assessment opportunity and the tools in this brief, we also recognize that the commitment and capacity of decision-makers are the single most important ingredients to ensuring that information from an NCA process translates into changed practices on the ground. Credible, legitimate, and relevant assessments take time to do well. With this brief, we hope to kick start better analytical work that, if done well, has the potential to help Indonesia to use its land resources wisely, now, and in the future.

Tom Heller, Executive Director

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1.　Introduction - The Increasing Pressures on Land Resources in Indonesia

From agriculture to water purification, and from cultural heritage to carbon storage, land resources can provide the basis for many social, environmental, and economic benefits. At the same time, the pursuit of short-term economic benefits has often placed social and environmental concerns at risk. Particularly within Indonesia, pursuit of short-term gains has resulted in community conflicts, reduced air and water quality, decreased carbon storage, and decreased future economic development potential.[1]

Already significant demands on Indonesian land and resources are almost certain to increase even further in the years to come. Significant sources for growing demand include Indonesia's nationally-articulated development plans, and population and economic growth in among close trading partners:

- Development plans articulated in the *Economic Masterplan for the Acceleration and Expansion of Economic growth (MP3EI)* crisscross wide swathes of the Indonesian landscape. The plan outlines a vision to support USD 450bn of investment over the next 15 years towards competing land uses throughout the country.[2]

- The Ministry of Agriculture aims to nearly double crude palm oil production by 2020.[3] While oil palm can support economic development ambitions,[4] increasing production through adding more acreage has increased ecosystem degradation and fuelled community conflict. Alternatives exist that could generate increased incomes without adding much new acreage.

- Population and economic growth in Asian-Pacific countries — some of Indonesia's closest trading partners — will likely increase demand for Indonesian products, thereby adding strain.

The pressures on Indonesia's land and the resources connected to it call into question whether opportunities may exist now to minimize the social and economic trade-offs among land use options.

This paper reviews the elements of a process to help decision-makers in Indonesia consciously address the tensions among short and longer-term social, economic, and environmental concerns. This process — called a natural capital assessment approach — involves overlaying available data on community locations, agronomic potential, and environmental quality; and integrating this data into socio-economic planning processes.

1　Wicke et al 2010, Obidzinksi 2012
2　OECD Reviews of Regulatory Reform 2012

3　When tabulated, local government (Kabuputen) and provincial goals often goals exceed this amount (Daemeter 2011)
4　Sheil et al 2009.

2. The Current Window of Opportunity to Change Land Use Practices in Indonesia, While Meeting Growth Goals

At the same time that demands for land and resources are increasing, several new developments in Indonesia have converged to open a window to change land use patterns. These include:

Legal and policy developments

- The *Indonesian Law No. 32/2009* introduces the concept of conducting strategic environmental assessments[5] prior to making medium-long term development planning decisions. This law captures the spirit of natural capital assessment within an existing Indonesian legal framework,[6] though implementation of the law has been limited to date.

- The *Constitutional Court ruling No. 45/PUU-IX/2011 (MK45)* requires that local authorities work with the Ministry of Forestry to decide which lands are available for local development, and which fall under Ministry of Forestry authority by the end of 2014.[7] This provides a critical opportunity to engage local and central government authorities on spatial planning and land allocation decisions for large swaths of land.

- The BAPPENAS-led effort to identify and support low carbon development activities through the *RAN-GRK and RAD-GRK*[8] are underway. This process intends to guide and establish medium-long term planning and budgeting decisions in support of climate-friendly development. As most Indonesian emissions come from land use,[9] this effort provides additional impetus to re-align land use policy and practice, and development goals, towards a low-carbon pathway.

Increasing financial incentives and political will to resolve social pressures

- New funding sources, including but not limited to the fund for REDD in Indonesia, may start to disburse funds within 2013-2014. Some allocations could be applied to help local governments conduct natural capital assessments within the context of their existing spatial and climate-planning mandates.

- Land tenure conflicts have been increasing; local government policy makers have begun to prioritize efforts to resolve these tensions.[10]

- If land tenure can be equitably resolved and land thus made available, private actors have indicated interest in helping develop public-private partnerships to establish agricultural production on suitable lands.

It is possible for Indonesia to shift toward a land use paradigm that achieves development targets by optimizing opportunities for highly productive agriculture and forest protection. This would help drive behavioral and investment changes, building a strong foundation of future economic development and forest conservation. Brazil is already experimenting with policies which would support this development model by, for example, limiting credit to producers who do not comply with environmental regulations.[11]

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5   The Indonesian translation for Strategic Environmental Assessment is KLHS, or Kajian Lingkungan Hidup Strategis.

6   Dusik, J. and Kappiantari, Z. 2011.

7   Constitutional Court decision No. 45/PUU-IX/2011 (MK45). For more background on the ruling, see Wells et al 2012.

8   BAPPENAS stands for Badan Perencanaan dan Pembangunan Nasional. In English, this is the State Ministry of National Development Planning. RAN-GRK stands for Rencana Nasional Penurunan Emisi Gas Rumah Kaca "RAN-GRK". In English, this means National Action Plan For Reducing Greenhouse Gas Emissions.

9   Most estimates of Indonesia's land-related emissions (including peatland degradation) range from 60-85% of the nation's total.

10   Jakarta Post (2011). In-person communication with Central Kalimantan Governor Teras Narang 2012.

11   Assunção, Gandour, Rocha, and Rocha (2013).

3. Natural Capital Assessment Can Link Development and Conservation Goals

Within this context, changes in Indonesia's resource use patterns become a matter of 'how,' not 'if.'

One pathway, which could help minimize the social, environmental, and economic trade-offs, is based on a 'production and protection' concept. It suggests that

(a) improving productivity of existing agriculture

(b) supporting highly productive agriculture on already degraded lands, and

(c) developing protection mechanisms for critical environmental areas

can deliver and distribute revenues that meet or exceed economic growth targets while limiting the social, environmental, and future economic development losses of new forest conversion.

It is possible to move towards this pathway by using social and biophysical data to help determine where and how to locate (a) agricultural production and (b) areas critical to maintain and promote social, environmental, and long-term economic health. The process of natural capital assessment (NCA)[12] does precisely this by drawing upon data to help decision-makers understand where nature provides benefits to support human needs, now and in the future.

In brief, natural capital assessment describes a macro-scale (or landscape-scale) exercise to identify and weigh the benefits across different land use options. Natural capital practitioners first map the location of key benefits across a region and, second, generate locally-relevant alternative development scenarios. The results are used to build legal and spatial planning processes that define zones for protection or production. In this way, NCA can direct business and government decisions for development and conservation towards their most suitable region, wherein local stakeholders establish the process to determine what uses are most suitable.

The following section provides further information on mechanics and principles of a typical NCA process.

Box 1 - Characteristics of Natural Capital Assessment

- **Draws more empirical information into spatial planning decisions: It is not necessarily a new process**

- **Landscape-focused:** seeks to generate suitable land use zones

- **Spatially explicit:** results in discrete recommendations for a defined land area (e.g., suited for development, not suited for development), based on weighing multiple possible uses and benefits

- **Participatory:** weights for each potential use are determined by local values and needs

- **Integrated into socio-economic and spatial planning processes at relevant geographic units**

- **Dynamic:** can be updated with new information as data becomes available

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12   Natural Capital Assessment describes the process of identifying and weighing the values of different land resources and benefits.

There are different approaches to NCA, which often differ according to the needs of the implementers and users. Therefore, NCA goes my many different names. Examples include natural ecosystem assessment, ecosystem assessment, natural capital analysis, systematic conservation planning, suitability mapping and strategic environmental assessment. Each of these names still captures the fundamental elements of NCA — using locally-relevant data to choose sites for protection and/or production activities in ways consistent with relevant planning and development goals.

4. Conducting Natural Capital Assessments: Principles, Process, and Skill Sets

4.1 Learning from Regional Millennium Ecosystem Assessments

One foundational resource which can help a new natural capital assessment process may be found in the experiences of Millennium Ecosystem Assessment (MEA) practitioners.

In 2000, United Nations Secretary General Kofi Annan requested an assessment of the consequences of ecosystem change around the globe on human well-being, which would also provide a scientific basis for future policy and management actions. In 2005, the Millennium Ecosystem Assessment (MEA) was released. The MEA is the most extensive assessment of the Earth's ecosystems to date and includes the work of over 1,300 experts worldwide in over five technical volumes and six synthesis reports.[13]

Five years after the MEA's release, in 2010, several practitioners published a manual to inform future ecosystem assessment practitioners based on their experiences in reviewing and conducting assessments.[14] The following section distills and builds on this work.

4.2 Principles

According to MEA practitioners, three principles help ensure assessments link to real (i.e. broadly accepted and realizable) decision making and resource management changes. Assessments must be relevant, credible, and legitimate:

1. **Relevant**

    a. They must answer questions that fit within decision maker priorities

    b. They must fit within timeframes needed to make a decision

2. **Credible**

    a. Data and processes must meet standards of scientific rigor and technical adequacy

    b. Assessments must include local knowledge that has been validated and reviewed in ways that stakeholders agree is credible

3. **Legitimate**

    a. The process must be transparent

    b. Users ideally 'own' the process, or are otherwise invested and engaged

While the MEA guide recognizes that not all principles may be met at all times, incorporating them can help ensure that NCA (or similar) efforts are more likely to result in sustained changes to land use planning and practice.

4.3 Process

The MEA practitioner guide outlines what a natural capital assessment may look like in practice. Noting that assessments which align with the above principles generally require three months to several years — depending on scale, budget, data availability, technical competency, process, and specific needs of the decision to be made — NCA usually involves several sequential activities:

1. **Establish need** for and scope of assessment (e.g. objectives, rationale, spatial scale, user needs for information)

2. **Create proponent work team**, preferably that includes competence with spatial analysis, conflict negotiation, scientific assessment, ability to engage relevant policy-makers and local populations

3. **Convene assessment participants** to decide on goals, approach, and rules for process and review

4. **Create governance structure** to ensure credibility and legitimacy of results

5. **Conduct assessment** ensuring key variables are included and monitored

6. **Develop scenarios** for credible development alternatives

7. **Decide** on response options

8. **Implement decisions** – provide the regulatory environment, staff and resources, and engagement avenues with relevant local actors to translate decisions into a framework of incentives and disincentives to promote changed land use practices

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13   MEA 2005

14   MEA 2010 'Ecosystem and Human Well-being: A Manual for Assessment Practitioners.'

4.4 Skill Sets

Where the diverse skills required to conduct NCA do not exist within one organization, a coalition of actors and stakeholders can help ensure the process is relevant, legitimate, and credible. Other characteristics MEA practitioners noted as useful include:

- Buy-in from local and national agencies – needs to meet decision-maker needs and time frames

- Strong project management – ability to engage multiple stakeholders, reach consensus, deliver interim products that demonstrate progress, and implement resulting decisions

- Validated data – on the key natural and social resources of interest

- Technical experts – who can help put together the relevant plans and build local capacity

Private firms who are willing to invest in land if the social and legal issues permit them to may also help animate processes and provide the testing grounds for whether incentives and disincentives are sufficiently aligned to meet short- and long-term social, economic, and environmental goals.

Table 1 below provides another way of conceptualizing which activities a few key actors can lend to the natural capital assessment project process.

By participating in previous assessments, Indonesia has shown some capacity to host and manage several sub-global assessments. Indeed, as part of the MEA process, the Indonesian Ministry of Environment coordinated the 'Jakarta Bay and Bunaken Ecosystems Sub-Global Assessment' to assess and better manage its marine and fishery resources. For its forestry resources, Indonesian researchers participated in the cross-cutting sub-global assessment on Forest and Agro-ecosystem Tradeoffs in the Humid Tropics (Tropical Forest Margins). Since the publication of these assessments, other researchers have continued to develop the analytical tools and generate further examples of ecosystem assessment in Indonesia. The following sections refer to additional resources and examples of ecosystem service assessment tools, attempts, and results.

Table 1: Potential contributions to enhance usability of a natural capital assessment process, by actor

TECHNICAL EXPERTS	USERS - DECISION MAKERS	DONOR AGENCIES	PRIVATE ORGANIZATIONS
Ability to balance and manage • Credible scientific research process AND • Complex multi-stakeholder engagement process	Ability to enhance usefulness of NCA by: • Demonstrating commitment in NCA process, as exhibited by contributing staff, resources, and including NCA into organizational priorities • Using analytical outputs in spatial planning decisions	Ability to facilitate • Pre-existing relationships with government actors and technical experts • Financial or in-kind support for civil society actors, researchers, and experienced facilitators	Ability to catalyze activity by • Investing in areas designated for production • Respecting and supporting areas and laws designated for protection

5. Technical advances in mapping social, environmental, and economic data

In recent years, several new tools have become available which can draw upon social, biophysical, and economic data to aid development and conservation planning efforts. These tools can help model different development pathways so that decision-makers can choose the most relevant inputs and outcomes. The following examples describe some of these tools and, where available, illustrate where they have already been applied.

- The 'Suitability Mapper' is a data analysis tool created by the World Resources Institute (WRI), in coordination with the Indonesian organization Sekala, to help locate suitable areas for future oil palm development. The tool maps biophysical and legal characteristics in Kalimantan, and its supporting documentation provide a useful framework for identifying the social and economic criteria relevant for locating sustainable oil palm development. See case one for further details.

- InVEST stands for Integrated Valuation of Ecosystem Services and Trade-offs. The Natural Capital Project consortium created this tool to 'map and value the goods and services from nature which are essential for sustaining and fulfilling human life.' It has been applied in Indonesia twice: in Kalimantan, and, separately, in central Sumatra. Key features analyzed in Indonesia include: biodiversity, carbon storage and sequestration, sediment retention, nutrient retention, and water yield.[15]

- MarXAN with Zones is a decision support tool created by the University of Queensland and applied in the Berau district of East Kalimantan in partnership with The Nature Conservancy. It offers 'a systematic planning framework to evaluate the consequences and trade-offs of alternative zoning configurations.' Key features from the East Kalimantan example are species-specific conservation targets matched against the land requirements within the studied range needed to meet each target.[16]

- LUWES, which stands for Land Use Planning for Low Emission Development Strategy, offers 'principles, steps, and tools (including software) to help multiple stakeholders negotiate the development of land use plans.' Developed primarily by the World AgroForestry Center, it suggests a process for rural land use planning in tropical countries and focuses primarily on integrating greenhouse gas reducing land use activities into economic development plans.[17]

- The Exploring Multiple Benefits Tool was developed by the UN-REDD program to identify and map the biodiversity and ecosystem benefits of different land use decisions. It offers a series of mapping tools to help identify and understand the spatial relationship between ecosystem carbon stocks, other ecosystem services, biodiversity, land use, and pressures on natural resources.[18]

Ultimately, a natural capital assessment is about bringing in different forms of data to inform a decision about resource use. Many tools may help reach that end, and the choice of which to use depends upon the needs of decision-makers and the capacity of their staff to use them. The above list includes some of the most prominent; one is elaborated in further detail in the next section. We note that each tool was developed to meet specific decision-maker needs. An in-depth analysis of how they compare and contrast is beyond the scope of this brief. Indeed, such an in-depth analysis is generally best done to suit a specific decision-making need and timeframe.

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15   See McKenzie et al 2012 for Sumatra and Dean et al 2012 for Kalimantan.
16   See Wilson et al 2010

17   See Dewi et al 2012
18   See UN-REDD 2011

Case 1 – WRI's Kalimantan Oil Palm Suitability Mapper

Problem Indonesia's ambitious oil palm development goals place many millions of hectares of Kalimantan forest at risk. At the same time, there are many millions of hectares of 'degraded lands' that could provide an outlet for this growth. However, access to degraded land has been constrained by varying definitions of 'degraded'; lack of information on where appropriate degraded lands are located; and social and legal barriers preventing responsible development on them.

Objectives Recognizing these challenges, WRI has worked closely with the Indonesia-based organization Sekala to develop an Oil Palm 'Suitability Mapper.'[19] This publicly-accessible tool seeks to identify potentially suitable areas for sustainable oil palm plantation, in ways that avoid degrading carbon-rich and high-conservation value areas. It draws upon existing data to provide a range of different variables to allow users to decide which kinds of 'degraded' lands may be potentially suitable sites for oil palm expansion.

Design The online suitability mapper features a series of default data values to account for the characteristics of degraded lands in accordance with a working paper by WRI and Sekala on how to find suitable degraded land for sustainable palm oil development,[20] though users can adjust the range of these values to reflect local priorities and needs.

While WRI notes that all identified sites warrant field inspection as part of social and legal due diligence processes, applying this tool using WRI's default settings has enabled identification of a potential 3.3 million hectares of degraded[21] lands which may be legally and ecologically suitable for new sustainable oil palm production in Central Kalimantan.[22] Central Kalimantan could use a portion of these lands to meet its provincial development goals — which call for an additional 2.5 million hectares of oil palm production — without needing to clear new forestland.

WRI used relevant indicator values in four layers — the first two of which are summarized below — to calculate the potential 3.3 million hectare figure. The criteria were selected to encompass a range of definitions of degraded lands.[23]

WRI identifies two additional categories which determine a site's suitability: legal and social. An appropriate assessment of these would include a review of existing concession status, legal classification, active plantations, community claims, land history, political interests, accessibility to market, and plot size. Field visits are essential to assess many of these characteristics.

Suitability mapper results for Kalimantan, using default values, are featured below.

Lessons WRI has expended significant efforts in assembling data that previously existed only in a patchwork across Indonesia. This tool provides even greater value to land use managers given its ease of use, customizability, and data transparency. While this tool holds great promise for resource managers throughout Indonesia, decision-maker usage remains a critical factor in ensuring the tool translates into changed land use practices.

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19   Available online at http://www.wri.org/project/potico/about-suitability-mapper

20   Gingold et al 2012.

21   As many have commented that the term 'degraded' lands does not have a consistent definition, WRI explains their definition as 'Degraded" ... does not mean "poor soil quality," but rather that the area has low carbon stocks, little biodiversity, and is not currently used for productive agriculture or human habitation. Alang-alang grasslands are an example of such areas in Indonesia." For further discussion of the varying descriptions and estimates of the term degraded, see McLeish et al 2011.

22   3.3 million hectares of potentially suitable land for oil palm from Gingold et al 2012, table 9, page 20.

23   See Gingold et al 2012 for detailed descriptions of methodology and layers used in the Suitability Analysis.

CATEGORY	INDICATORS	DESCRIPTION
ENVIRONMENTAL		
CARBON AND BIODIVERSITY	LAND COVER	Development should favor grass and shrub-lands (pre-developed areas) and avoid natural primary and secondary forests. Natural primary and secondary forests sequester carbon, provide habitat for animals, and regulate local air and water quality.
	PEAT	Peat of any depth is to be avoided. When drained, peat is highly susceptible to dangerous and smoky fires. Peat also sequesters significant amounts of carbon.
	CONSERVATION AREAS AND BUFFER ZONES	Areas designated as conservation areas (Hutan Lindung; Hutan Konservasi), along with 500-1000m buffer around them, are not suitable.
SOIL AND WATER PROTECTION	EROSION RISK	Areas with high erosion risk are to be avoided. Erosion decreases water quality, soil quality, and fertility, and increases costs of resource management
	GROUNDWATER RECHARGE POTENTIAL	Areas with high recharge potential are to be avoided. These areas are critical to replenishing groundwater supplies, and fertilizer, pesticides, and herbicide can contaminate them.
	WATER RESOURCE BUFFERS	Buffer areas around water — lakes, streams, rivers, springs, and coastlines — should be avoided. They are crucial to maintaining healthy water supplies; and this aligns with existing Indonesian law.[a]
ECONOMIC		
CROP PRODUCTIVITY	TOPOGRAPHY (ELEVATION; SLOPE)	Each of these indicators should be assessed to suit site needs. Each reflects biophysical characteristics relevant to oil palm cultivation. These indicators impact crop yields, the amount of management input required (i.e. fertilizer, specialized crop strains, irrigation, terracing), and the long-term profitability of a plantation. For these indicators, appropriate suitability classes may vary according to individual company or project-specific requirements. Suitability classes could also be adjusted to identify potentially suitable sites for other crops, including timber plantations.
	CLIMATE (RAINFALL)	
	SOIL (DEPTH, TYPE, DRAINAGE, ACIDITY, COLOR)	
FINANCIAL VIABILITY	SIZE	The contiguous area of a site matters for plantation and mill management decisions. Larger, contiguous areas can support larger, more profitable mills.
	ACCESSIBILITY (ROADS/RIVERS)	Indicates how much infrastructure investment may be required and the feasibility of conducting field surveys.

[a]　Indonesian Government Regulation No. 47/1997 and Presidential Decree No. 32/1990.

Figure 1 - Combined Suitability Map for Kalimantan (WRI 2012)
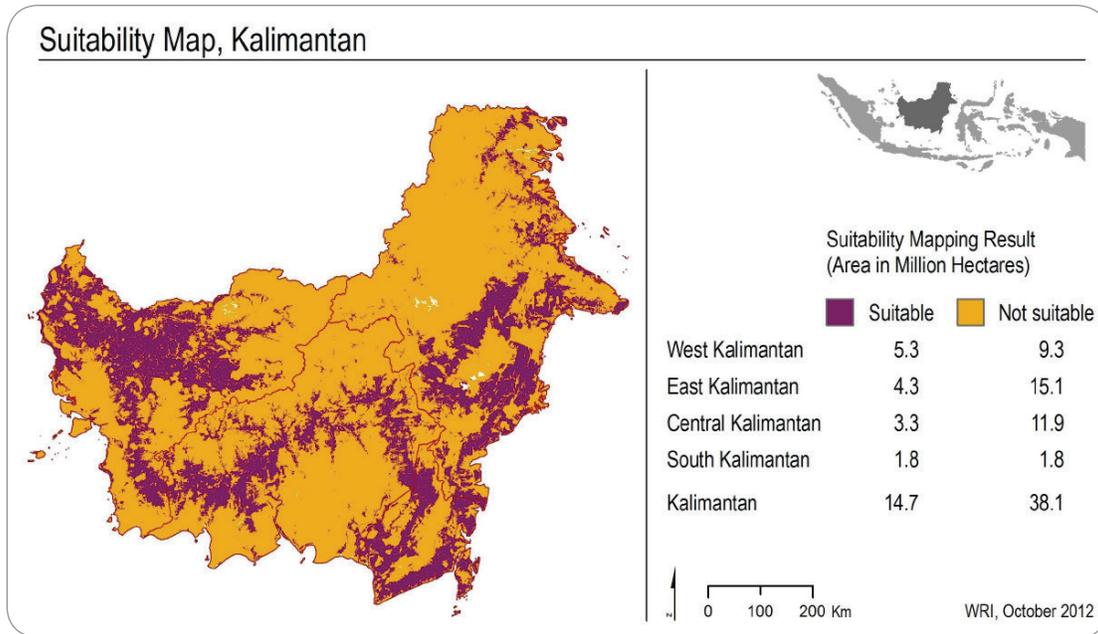

Table 2: POTICO Suitability Mapping Results for Central Kalimantan, by layer (Gingold et al. 2012).
Area in Million Hectares. Total Acreage in Central Kalimantan is 15.3 Million hectares.

LAYER	POTENTIALLY SUITABLE		NOT SUITABLE
	HIGH POTENTIAL	POTENTIAL	
CARBON & BIODIVERSITY	1.7	3.2	10.3
SOIL AND WATER PROTECTION	7.8	2.3	5
CROP PRODUCTIVITY	3.1	5.4	6.8
COMBINED SUITABILITY	0.5	2.8	11.8

Case 2 – Lessons from Spatial Planning Experiments in East Kalimantan

Context In the years following decentralization, the research and development organization Center for International Forestry Research (CIFOR) signed an agreement with the Government of Indonesia to conduct long-term research on sustainable land use management, environmental change, and local livelihoods in Malinau, East Kalimantan. This followed off of some years of previous research in the area as part of the Bulungan Model Forest Project.[24]

Problem At the time of CIFOR's agreement, Malinau possessed one of the largest contiguous tracts of dipterocarp forests in the world, which had a recognized global conservation value. Yet significant development impacts over a short period were anticipated, as the area stood at the edge of the forest frontier and was populated largely by poor, forest dependent people targeted by official development programs.[25] Spatial planning in the area erred towards resource extraction rather than the integrated conservation and development paradigm.

Objectives As part of its long-term research efforts in the area, in 1998, CIFOR launched a multi-stakeholder land-use planning process with the Ministry of Forestry and district of Malinau. Six researchers led the effort to facilitate an alternative approach to land-use planning. This approach drew upon adaptive management, systems theory, and multi-stakeholder principles to try and connect villager needs and biophysical data into a dynamic spatial planning practice.

Outcomes The project team was able to generate and provide the district with extensive, rigorously-collected ecological, forest, and social data. However, the district ultimately commissioned its own land use plan in 2002 which showed little evidence of incorporating this new data — and even neglected data from previous spatial planning processes in the same area.

The Jakarta-based consultant who prepared the new plan did so with little or no public participation, and with no known field visits. Finally, though the consultant presented the report to a small closed group — to which CIFOR researchers, but not local community representatives, were invited — the district never made the final plan public, even upon request. In short, despite state-of-the-art efforts to provide new social and biophysical data into spatial planning, the local spatial planning processes ignored the new information and made subsequent land-use decisions (namely, large oil palm developments atop ecologically sensitive areas) removed from a strategy based on best-available local and scientific information.[26]

Lessons This work highlights that effective NCA processes depend upon a pairing of technical expertise and political will. Greater data availability will only translate into changed practices if local decision-makers decide to participate in its development and dedicate sufficient resources to contribute towards and use its outputs.

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24   Bulungan was the previous name of the district. In 1999 the Bulungan district separated into three districts.
25   Boedhihartono, A.K. Gunarso, et al 2007
26   Wollenberg et al 2008.

Case 3 – Trinidad & Tobago EcoAgriculture "High Nature Value Index"

Problem The Northern Range ecosystem in Trinidad and Tobago offers several benefits to people through-out Trinidad, including significant clean, freshwater supplies, flood and erosion control, space for agriculture and housing, timber and non-timber forest product materials, and high biodiversity which holds significant values for ecotourism, recreation, education, and hunting activities. Around 2005, researchers conducted an ecosystem assessment which revealed that several inappropriate land uses threatened the ability of the Northern Range Ecosystem to provide these benefits – including unregulated mining, agriculture, forestry, fires, and housing developments.[27]

Objectives As part of the follow-up to its ecosystem assessment efforts, the Cropper Foundation sought to identify mechanisms to deliver greater economic gain to small-scale hillside farmers in environmentally sensitive areas of northern Trinidad while alleviating the environmental threats caused by existing farming practices.

Outcomes In 2009, the Cropper Foundation worked with the International Union for Conservation of Nature (IUCN) to develop a "High Nature Value Index (HNVI)." The index weaves together information on local small-scale farmer's agricultural practices, their concerns for land use options, and local land and soil fertility information. The index provides a score against which farmers can see and select alternative agricultural practices to generate higher yields and minimize their negative environmental impact.

The foundation then worked with farmers to develop land use plans that incorporated information from the HNVI. The plans identified resources that farmers could use to achieve greater environmental and social sustainability in Trinidad's northern hillside range — including new soil and water management practices.

The Inter-American Development Bank and the Cropper foundation supplied resources to the farmers in order to produce agricultural outputs with lower environmental impact, with a high degree of uptake.[28]

Lessons The EcoAgriculture Project provides an example of how NCA can provide local stakeholders with information to underpin strategic decisions about how to use land. It also suggests that better information can help international partners to respond more effectively to specific challenges facing local stakeholders, so as to encourage more economically and environmentally sustainable land uses in a developing region.

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27   Millennium Ecosystem Assessment 2005
28   Cropper Foundation (Williams) 2012

6. Conclusions, Outstanding Questions, and Next Steps

Even with an understanding of what a general NCA process entails, resource managers must make several important decisions in order to launch, implement, and sustain NCA in their specific circumstances. This includes answering questions such as:

- Which ecosystem services are of highest priority for my region?

- In which time frame do we need a decision?

- Does my organization have the capacity to conduct this analysis, or with which organizations can we partner to do so?

Each of these questions requires further analysis, much of which can only occur on-site and must be overseen by the government and non-government actors seeking a development pathway that better aligns their communities' economic, social, and environmental needs. Those who are seeking this transition should know that several significant resources already exist to support NCA, and, ultimately, changes in development plans and practice.

Among these, the Millennium Ecosystem Assessments 'Ecosystems & Human-Well Being' practitioner guide29 features many supplemental examples of previous assessments. Based upon the experience of practitioners who now form the Sub-Global Assessment Network, it also provides suggestions on each step of the assessment process, from determining needs, to developing proponent work teams, establishing governance groups for credibility, and translating analyses into action.

Secondly, there are several research organizations that can work with national, provincial, and district organizations to determine which technical and financial resources can help integrate the spirit of NCA into upcoming spatial planning decisions. This work can also entail conducting economic and spatial analyses related to making explicit and minimizing the tradeoffs among competing options for land use.

The single most significant ingredient to translating data into improved use of land resources, however, is the commitment of relevant decision-makers and champions to help motivate and sustain a natural capital process. NCA provides a way for local decision makers to acknowledge competing land uses and then transparently and consciously decide among them. Outside organizations can play a role in NCA through providing technical and/or financial resources. Ultimately, however, local decision-makers must drive the policy framework to ensure that communities can realize the short- and long-term social, economic, and environmental benefits associated with their land resources.

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29   Sub-Global Assessment Network 2010.

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