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PUTTING "SLASH-AND-BURN" IN CONTEXT:

SOCIOECONOMIC AND POLICY ISSUES

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To set the stage for this workshop on research methodology, this paper provides a sketch of the relationships among biophysical, socioeconomic, and policy issues in the Global Initiative on Alternatives to Slash-and-Burn (ASB) and the working hypotheses to be refined and explored through research in Indonesia. The paper is a sketch for two reasons. First, time for presentation is short. To alleviate this constraint, a form is attached for participants to request additional material relevant to ASB. Second, and more fundamentally, all of us will be working together to fill in the details of this picture as we collaborate on ASB research.

1. WHAT IS THIS ALL ABOUT?

ASB is a global research initiative to investigate three interlinked problems:

- **global climate change**, specifically the prospect of global warming from the emission of carbon dioxide and other 'greenhouse gases.'
- **loss of biological diversity**
- **mass poverty** in developing countries

Rapid deforestation in the humid tropics is the link among these problems. Perhaps a quarter of the hypothesized "global warming effect" results from tropical deforestation. These tropical rain forests represent the world's greatest stock of biological diversity. Part of the global problem of tropical deforestation is the result of "slash-and-burn" agriculture, practiced by impoverished smallholders who lack viable alternatives for their livelihood.[1] A **goal** of the

[1]. See ASB 1994a; Bandy, Garrity, and Sanchez 1993; Sanchez and van Houten 1994.

ASB initiative, which is central to ICRAF's mandate in agroforestry,[2] is to improve the well-being of these farmers. Providing them with sustainable land use practices that are viable alternatives to "slash-and-burn" should reduce the global rate of deforestation.

Indonesia's share of global problems from "slash-and-burn" remains to be seen. As discussed below, answering that question is a key objective of ASB characterization. Aside from potential links to global problems, a workable strategy for sustainable smallholder development also could serve the three pillars of economic development in Indonesia: growth, equity, and stability. Despite rapid growth in other sectors, sustainable increases in productivity of upland farming systems still can be an important engine of economic development and poverty alleviation, especially in Indonesia's Outer Islands. The supply of workers continues to grow there, while new land is getting scarce in many regions. Under these conditions, farmers will be eager to raise productivity if they have profitable options. If such intensification is achieved, the resulting expansion of income and employment would, among other benefits, help inhibit migration to Java.

Agroforestry, which already is widely practiced by Indonesian smallholders, is one land use which holds special potential for sustainable productivity growth in Indonesia's uplands and for local (as well as global) environmental benefits through conservation of Indonesia's soil and water resources. Agroforestry also may provide a means of rehabilitating degraded forest land and, thereby, help reverse deforestation.

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[2]. "ICRAF defines agroforestry systems and practices as those where woody perennials are deliberately integrated with crops or animals on the same land-management unit, either at the same time or in sequence with each other" (ICRAF 1994, p. 2).

2. ALTERNATIVES TO WHAT . . ?

We might avoid a lot of confusion if we always referred to our research project as "alternatives to unsustainable slash-and-burn agriculture." Since that is a lot to say, it is convenient to use the nickname "slash-and-burn" as a kind of shorthand.

For the purposes of ASB characterization in Indonesia, it is helpful to distinguish "slash-and-burn" (*tebang bakar* or *tebas bakar*), which is an agricultural technique, from "shifting cultivation" (*ladang berpindah*), a land use system often associated with slash-and-burn. Moreover, it can be misleading to equate the use of the "slash-and-burn" technique with unsustainable land use. In fact, "slash-and-burn" is practiced in a number of land uses.

Some land uses associated with slash-and-burn are agronomically sustainable under certain socioeconomic conditions. Traditional shifting cultivation of foodcrops (*ladang berpindah*), as practiced for generations by local people in Sumatra and Kalimantan, obviously is sustainable, at least as long as population densities are low. Some other land uses involving slash-and-burn, such as continuous growing of foodcrops on fragile upland soils, probably are not sustainable.

Today it may be easy to reach consensus that "sustainable" things are good and "unsustainable" things are bad. But "sustainability" has so many meanings in current discourse that it has become almost meaningless. One important contribution from ASB research could be to identify a more precise (and more useful) meaning for "sustainable land use."

ASB research includes biophysical, socioeconomic, and policy studies because all of these factors influence the sustainability of alternative land uses. Furthermore, each of these perspectives is important in diagnosing problems and pointing the way to developing techniques that can lead to sustainable productivity increases in the future. Work on

biophysical determinants of sustainability by ASB-Indonesia colleagues already shows promise of advancing knowledge of the effect of soil carbon on long-run productivity and on greenhouse gas emissions (Murdiyarso and others, 1994).

Biophysical determinants of sustainability interact with socioeconomic determinants: the opportunities and constraints that affect land use choices of households and communities. Consider shifting cultivation (*ladang berpindah*). Sustainable shifting cultivation is an example of what Schultz (1964) called "traditional agriculture," a particular type of economic equilibrium. Economically-efficient resource allocation in traditional agriculture derives from local people's long experience with a stable natural resource base. In other words, they already have worked out all the answers and the questions are not changing.

It is widely recognized that abundant land is a key requirement for sustainability of traditional shifting cultivation. When population density becomes too high, the fallow period may become too short for sustainable foodcrop production. Boserup (1965) hypothesized that population pressure spurred agricultural growth by inducing a shift to more intensive techniques along with local institutions to support intensive land use, such as private property in land.

Farming system transformations are summarized in a schematic form in Figure 1, with population pressure increasing from left to right across the columns. (Note that all these examples involve slash-and-burn. Shifting cultivation of foodcrops, initially sustained through long fallows (Column A), becomes unsustainable (Column B) as rotations shorten. The result

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[3]. The decision to stratify the household survey in three groups (local people, government-sponsored transmigrants, and spontaneous migrants) is based, in part, on the theory that learning-by-doing is important in land use management. The underlying hypothesis is that local people have the technical knowledge, gained over generations, and the institutional base for sustainable land use. However, as discussed below, there is a question about how much time is required to adjust to rising population pressure. When conditions are changing, especially if that change is rapid and adverse, even local people may not have ready solutions to pressing resource management problems.

is soil degradation leading, for example, to *alang-alang* infestation. **Agroforests** (Column C of Figure 1) are managed, multistrata, agroforestry systems with forest-like architecture (Michon and de Foresta 1990). These complex agroforestry systems (including, for example, the 'jungle rubber' agroforests of Sumatra and Kalimantan) are a prevalent indigenous alternative to shifting cultivation of foodcrops in Indonesia.

Do appropriate innovations (like agroforests) emerge fast enough within local communities in order to avert severe resource degradation when population pressure forces intensification in upland agriculture? Fieldwork by the ASB teams working on land use and socioeconomic characterization should help us to understand where local communities already have (or are developing) sustainable land use strategies and also where population and other pressures are running ahead of local capacities to respond.

Although the literature gives a mixed picture on the rate and biases of indigenous institutional innovation, the verdict on the rate of indigenous technological innovation through trial and error is clear: it is slow. This is why Hayami and Ruttan (1985) emphasize the importance of scientific research institutions that develop profitable new techniques for use by smallholders as an crucial ingredient for successful agricultural development. Hayami (1994) recently identified opportunities for contributions from research on agroforestry systems in an analysis of prospects for sustainable upland development in Indonesia.

One thrust of agroforestry research seeks ways to raise productivity within agroforests (hypothetical agroforestry systems AF1 and AF2, Columns D and E, respectively, in Figure 1). Adapting existing higher yielding rubber planting material in order to raise productivity of 'jungle rubber' agroforests is but one specific example where agroforestry research offers potential for economic and environmental benefits (Budiman and others 1994). If sustainable

productivity increases prove feasible, such agroforestry innovations might eliminate slash-and-burn or lengthen the period between slashing and burning.

Raising smallholders' incomes is an indispensable objective of research to increase productivity of agroforestry systems. Perhaps this higher income from land already in use would reduce pressure to clear forest for new land.[4] Trees planted in agroforestry systems also may help alleviate global climate change stemming from "the greenhouse effect," but similar benefits from trees also can be achieved through development of large-scale plantations of forest species or estate crops, like oil palm. Among these tree-planting options, however, only **agroforests** appear to compare to natural forests regarding conservation of biodiversity (Michon and de Foresta 1990).

The vital role of public research institutions in generating techniques that smallholders can adopt to raise productivity and deal with mounting pressure on natural resources is only one link between socioeconomic determinants of sustainable land use at the local level and national policy. Land use choices by households and communities can be affected (directly and indirectly) by a host of government policies, including trade policies for forest and agricultural products, agricultural price policies, land use policies in forestry and agriculture, legal institutions that enforce property rights, infrastructure investments, and many other possible candidates. Sorting out this web of interactions to identify the key policy links is a major challenge for the ASB policy characterization team.

[4]. On the other hand, increasing profitability of cleared land could simply increase deforestation. The results depend on the institutional and legal context of land use.

3. CHARACTERIZATION OF WHAT ... ?

ASB characterization comprises a set of parallel activities at different levels:

global

agroecosystem

- benchmark site
- community
- household

Unsustainable slash-and-burn agriculture is **not** the sole subject of the ASB characterization activities at benchmark sites; it is not even the main focus. Characterization activities at benchmark sites should develop as complete a picture as possible of prevailing land use patterns, including forest concessionaires (HPH), industrial forest plantations (HTI), treecrop estates, and large-scale absentee owners as well as smallholders.

Similarly, community and household-level characterization covers the range of smallholder farming systems, not just shifting cultivation. (See ASB 1993, Annex E, p. 5). This is why the household-level questionnaire for Indonesia (ASB-Indonesia/ICRAF 1994) is built around sets of systematic questions for each of eight different land use categories

- wet rice (*sawah*)
- fish ponds (*kolam ikan*)
- home gardens (*pekarangan*)
- upland fields (*ladang*)
- perennial plots, including agroforests (*kebun*)
- bush fallow (*belukar*)
- grasslands (*padang pengembalaan*)

forests (*hutan*)

Key **objectives** of land use characterization activities are to:

Identify the dominant land uses within benchmark sites for major agroecological zones.

Quantify the extent of these land uses, including (but not limited to) the extent of unsustainable slash-and-burn agriculture.

Understand the biophysical, socioeconomic, and policy determinants of changing land uses within benchmark sites.

Exchange information across benchmark sites to obtain a global picture of land use patterns at the forest margins.

Synthesize information in order to quantify the contribution of different land uses to deforestation and environmental changes at the global level.

4. WHERE DOES POLICY RESEARCH FIT?

Global synthesis is one step in an ongoing process of refining hypotheses that link the global problems (global warming, biodiversity conservation, and human welfare) to biophysical and socioeconomic determinants of land use choices at the local level. As a starting point for discussion, it is useful to review the hypotheses in their current stage of development and to discuss how they can be refined, focused, and further adapted for ASB-Indonesia.[5]

Global Warming Hypothesis

H.1. *Agroforestry (and tree monoculture) systems that accumulate biomass quickly and produce greater reservoirs of soil carbon will increase carbon sequestration, thereby decreasing net CO_2 emissions, compared to foodcrop systems and grasslands.*

[5]. Some of these hypothesis are adapted or taken directly from Garrity 1993, p. 6, and ASB 1994b, pp. 6-.

Biodiversity Hypotheses

Compared to continuous foodcrop systems and tree monoculture, agroforestry systems maintain soil fertility and diminish weed invasion, prolonging the productivity of recently-cleared land at forest margins and thereby reducing forest encroachment.

Complex agroforestry systems ('agroforests') conserve higher levels of biodiversity at the forest margins compared to either continuous foodcrop systems or to monoculture plantations of perennials.

Human Welfare Hypotheses

On the forest margins, complex agroforestry systems or 'agroforests' provide a superior alternative for small-scale farmers to either continuous foodcrop systems or to monoculture tree plantations. Compared to continuous foodcrops or monoculture plantations, agroforests provide:

H.4. * *higher total factor productivity,*
H.5. * *greater household food security,*
H.6. * *improved individual nutritional status, and*
H.7. * *reduced production and price risks.*

Hypotheses 1-3 have a clear biophysical slant as presently stated, while Hypotheses 4-7 have a socioeconomic orientation. Suppose these hypotheses stand up to empirical tests and, for the sake of argument, agroforests turn out to have many advantages compared to other land uses regarding carbon sequestration, biodiversity, and human welfare.

This brings us to questions for policy research. At a basic level, one might wonder why are things the way they are? For example, why aren't there more agroforests in Indonesia? Or, assuming the comparison makes agronomic sense, why is there so much agroforest in Indonesia and almost none in Brazil and the Cameroon? From a policy perspective, two other types of questions are even more important: Do these differences matter? If so, is there anything constructive that can be done to change things?

One place to start policy analysis is to estimate magnitudes in terms of **policy objectives**. How much deforestation is caused by slash-and-burn? How does that add up regarding global warming and loss of biodiversity? What is Indonesia's share? As already noted, the global synthesis of ASB characterization work will attempt to answer questions like these. If the magnitudes are big enough for Indonesia (or the world) to care about, the next task is to identify **policy instruments**. When we know important policy objectives are not being met and policy instruments exist (or can be created) to address those objectives economically, then we have defined a **policy problem**.

What is to be done in the meantime, before global policy problems are fully defined as an outcome of the global synthesis? The best place to start is to look for policy problems at the national (and regional) level. The initial policy research hypotheses come from two questions: Are there important **policy failures** that affect land use at the forest margins? Are there important **market failures** that affect land use at the forest margins?

Preliminary hypotheses for policy research

H.8. *Inconsistent government land use policies, an ambiguous legal base for property rights, and a cumbersome land titling system contribute to insecurity in tenure, which, in turn, distorts household and community decisions in favor of forest conversion and unsustainable land use practices at forest margins.*

H.9. *Sustainable land use practices generate long-term regional and national benefits that exceed the benefits captured directly by local communities and households.*

These nine preliminary hypotheses span a number of disciplines. They have much more power when viewed together than each would in isolation. This is why ASB-Indonesia is a multi-disciplinary, multi-institution, multi-methodology consortium, an important achievement itself (see the ASB-Indonesia matrix).

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LITERATURE REQUEST FORM

Please fill in the blanks, mark the titles you need, and return to one of the ICRAF staff attending the workshop.

Name: _____

Organization: _____

Address: _____

_____

Telephone no: _____

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Figure Farming System Transformations

Increasing population density

Rotation (years)	A Sustainable shifting cultivation	B Unsustainable shifting cultivation	C Agroforests	D AF 1	E AF 2	F Tree Monoculture
0	Slash-and-burn	Slash-and-burn	Slash-and-burn	Slash-and-burn	Slash-and-burn	Slash-and-burn
1- 2	Food	Food	Food	Food	Food	Trees
3- 5	Fallow	Food	Trees	Trees	Trees	Trees
5-10	Fallow	Weeds	Trees	Trees	Trees	Trees
10-19	Fallow	Weeds	Trees	Trees	Trees	Trees
20	Slash-and-burn	Weeds	Trees	Trees	Trees	Slash-and-burn
21-22	Food	↓	↓	↓	Trees	Trees
23-24	Fallow	↓	↓	↓	Trees	Trees
25	Fallow	↓	↓	↓	Slash-and-burn	Trees
26-27	Fallow	↓	↓	↓	Food	Trees
28-39	Fallow	↓	↓	↓	Trees	Trees
40	Slash-and-burn	↓	↓	↓	Trees	Slash-and-burn
		↓	↓	↓	•	•
		↓	↓	↓	•	•
		Infinity?	Infinity?	Infinity?	•	

ASB-Indonesia: Phase I Benchmark Site Characterization Activities

Primary Phase I Sites Agro-ecological zone	N. Lampung Peneplains	Bungo Tebo Peneplains	Sitiung Peneplains / Piedmont	Rantaupandan Piedmont
Biophysical aspects (coord: Soleh Sukmana)				
1. Climate and soil maps for agroec. zones and benchmark sites	CSAR	CSAR	CSAR	CSAR
2. Vegetation maps for agroec. zones	BIOTROP	BIOTROP	BIOTROP	BIOTROP
3. Biomass measurements at benchmark sites				
a. above ground	UniLa-UniBraw	FRDC/UGM	CRIFC	FRDC
b. below ground	UniLa-UniBraw	UGM/UniBraw	CRIFC/UniBraw	FRDC/UniBraw
4. GHG emission measurement at benchmark sites	UniLa/IPB	IPB	IPB	IPB
Land use/socioeconomic aspects (coord: Made Oka)				
5. Land use systems description and quantification				
a. forests, treecrops, foodcrops at the sub-district level	FRDC/CRIFC	FRDC/UGM/CRIFC	FRDC/CRIFC	FRDC/CRIFC
b. land use changes in and around transmigration projects	TRANS	TRANS	TRANS	n.a.
6. Community-level appraisal (RRA)	CASER/TRANS/UniLa	CASER/TRANS/UGM		CASER/FRDC
7. Household-level survey				
a. local people *	CRIFC	CRIFC/FRDC	CRIFC	FRDC/CRIFC
b. transmigrants	TRANS	TRANS	TRANS	n.a.
c. spontaneous migrants	CRIFC	CRIFC/UGM	CRIFC	FRDC/CRIFC
Other site-based aspects (site coordinators)				
8. Site maping and gathering of site-specific secondary data	UniLa/UniBraw (Kurniatun)	UGM (Sambas)	CRIFC (Zulkifli)	FRDC (Gintings)
Policy aspects (coord: Husein Sawit)				
9. Identifying policy links from national and regional levels	CASER-CRIFC-TRANS			

- = "joint proposal"
/ = "cooperation needed"
n.a. = "not applicable"
* Kubu people are covered in the community-level appraisal, not in the household survey.
"Large-scale absentee" owners and operators are covered by CASER for Lampung, Bungo Tebo,
and Rantaupandan; but will not be covered in Sitiung