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Shifting Cultivation and Deforestation in Indonesia: Steps Toward Overcoming Confusion in the Debate

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Summary

The role of shifting cultivation in deforestation in Indonesia has been an area of great debate. Some claim this farming system is the main cause of forest cover loss. Others claim that – far from being damaging – it is a key means for the conservation and sustainable management of remaining forests. The two sides of the debate are talking past each other, because each refers to different farming systems at opposite ends of what might be called the ‘forest farming continuum’. Recently, there has been progress in clarifying the meaning of certain terms but the debate remains confused. In order to better understand the causes and extent of forest cover change in Indonesia, it is necessary to clearly identify the different forms of agency affecting forests and also to define key terms and concepts such as ‘forest’, ‘deforestation’, ‘degradation’, and ‘causation’. Based on these definitions an analysis of forest cover change over time can then be carried out.

Introduction

Indonesia has one of the largest areas of humid tropical forests in the world (ranking third behind Brazil and Zaire) and has 10% of what remains of this resource. The most influential studies on deforestation in Indonesia have assumed that about one million ha of the country’s approximately 100 million ha of remaining forest are lost each year (World Bank 1990; FAO 1990).

¹ This is a modified and abridged version of a paper titled ‘Rates and Causes of Deforestation in Indonesia: Towards a resolution of the ambiguities’, by William D. Sunderlin and Ida Aju Pradnja Resosudarmo, CIFOR Occasional Paper No. 9, Center for International Forestry Research, Bogor, Indonesia.

There are essentially two poles in the ongoing debate over the causes of deforestation in Indonesia. Some authors argue that smallholder production and the growing number of such producers – notably shifting cultivators – is the main cause of deforestation (FAO 1990; World Bank 1990; Barbier *et al.* 1993; Fraser 1996). Other authors, while acknowledging the significant role of smallholder production in deforestation, give greater emphasis to the role of government and its development projects, and to the timber sector (Dick 1991; WALHI 1992; Ascher 1993; Dauvergne 1994; Porter 1994; Thiele 1994; World Bank 1994; Angelsen 1995; Dove 1996; Ross 1996). Observers in this latter group tend to argue that the effects of shifting cultivation on forest cover have been overstated in past studies. Some claim that traditional shifting cultivation – far from being a danger to forests – is important for the future conservation and management of Indonesia's remaining forests (Zerner 1992; Colfer with Dudley 1993; Hasanuddin 1996; de Jong 1997).

This paper examines the confusion surrounding this debate and proposes steps necessary for understanding the role of shifting cultivation and other factors in forest cover change in Indonesia. The first section explores the different ways in which the term 'shifting cultivation' has been used. This is followed by a discussion of recent developments in the debate and in research on shifting cultivation. The next section argues that the role of shifting cultivation must be examined within the context of all relevant influences on forest cover change, and that major terms and concepts must be clearly defined. The paper concludes with ideas on key questions that need to be addressed in further research.

The Forest Farming Continuum

How is it that the views on the role of shifting cultivation with respect to forests in Indonesia can be so sharply polarised? How can some people insist that shifting cultivation is the fundamental cause explaining forest cover loss, while others consider it a minor problem, and still others maintain it is essential to future efforts to protect remaining forests?

The answer is that the various proponents in the debate are referring to entirely different kinds of farming systems (see Figure 1). While some authors specify the kind of shifting cultivation they are referring to, many do not – a tendency that has introduced considerable confusion into the debate.

Long fallow shifting cultivation

- long fallow rotation
- traditional
- mainly subsistence crops
- mainly self-generated capital
- far from urban area

Short fallow shifting cultivation

- short fallow rotation
- semi-traditional
- mixed subsistence & cash crops
- mixed capital sources
- intermediate distance to urban area

Forest pioneer farming

- no rotation
- modern
- mainly cash crops
- mainly outside capital
- close to urban area



Figure 1 Idealised typology of farming systems on the forest farming continuum.
Adapted from Sunderlin, 1997

The ‘forest farming continuum’ presented in Figure 1 is based on the conceptual separation of ‘shifting cultivation’ (sometimes referred to as ‘swidden cultivation’ or ‘slash-and-burn agriculture’) and ‘forest pioneer’ farming systems (also known as ‘truck farming’) suggested by Weinstock & Sunito (1989). Weinstock & Sunito (1989:20-21) define ‘shifting cultivators’ as people “who practice a form of rotational agriculture with a fallow period longer than the period of cultivation... Unless faced with population pressure or other constraints, land is used only one to three years and fallowed for a relatively long period (up to 20 or more years)”. ‘Forest pioneers’ are defined as people “who may utilise slashing and burning of the existing vegetation but with the primary intention of establishing permanent or semi-permanent agricultural production. Although some subsistence food crops may be planted, the planting of cash crops (most often perennials) is the primary focus of attention. Land is usually not fallowed but is used continuously and is abandoned only after total or near total exhaustion of the native fertility of the soil since there is no long term plan to again return to the same site”.

Implicit in the concept of the ‘forest farming continuum’ is the view that cultivation practices become less sustainable as: (i) rotation of fallow plots is shortened or eliminated; (ii) tradition gives way to modernity; (iii) subsistence crops are replaced by cash crops; (iv) family capital is replaced by external funding; and (v) farms are close to urban areas. In the real world, there are, of course, many deviations from the idealised ‘forest farming continuum’. Thus, ‘traditional’ shifting cultivation may include cash crops, just as some forms of forest pioneer farming may rely heavily on subsistence crops. The intent of the concept is not so much to record or predict actual tendencies, but rather to summarise the principal arguments made with respect to various forest farming systems.

Those who argue that shifting cultivation is essential for the long term conservation and management of remaining forests have tended to restrict their argument to the traditional, long-fallow shifting cultivation at the left end of the continuum. In contrast, those who argue that shifting cultivation is a threat to forests are actually referring to the short-fallow shifting cultivation described in the middle column of Figure 1, and the ‘forest pioneer’ farming on the right-hand side of the continuum. In fact, ‘forest pioneer’ farming systems have often been included in the term ‘shifting cultivation’ even though they involve no cyclic rotation of lands.

Why have the various parties to the debate tended to ignore the great diversity of farming systems, and assumed instead that there was a common understanding of the term ‘shifting cultivation’? Partly it is because each side has tended to assume that ‘shifting cultivation’ as they view it (whether long-fallow, on the one hand, or

short or no rotation, on the other) is the dominant form and that other farming systems are relatively insignificant.

In fact, there are no data that clearly demonstrate the relative proportions of households in each of the three broad categories of farming systems illustrated in the forest farming continuum. This lack of information facilitates selective and questionable interpretations of the process of forest cover change. To combat this problem, Weinstock & Sunito (1989) called for a survey of the many farming systems operating under the term 'shifting cultivation'. Unfortunately, no such survey has been carried out.

Instead, there have been widely diverging informal assessments of the relative 'weights' of the various farming systems. The World Bank (1994:19), for example, claims that "traditional communities may be much larger than previously thought". Other observers, however, state that traditional shifting cultivators are few in number and are undergoing rapid transformation of their farming systems. Tomich and van Noordwijk (1995) say that traditional shifting cultivation has 'virtually disappeared' in Sumatra. Potter (1993) refers to a WWF study showing that 'traditional' systems have been modernising, for example with the use of chainsaws. Kartawinata *et al.* (1989) observe that in some areas nominally under shifting cultivation in East Kalimantan, producers established perennial crops that were maintained for ten or more years. Other recent research describes regional and local instances of shifting cultivation and forest pioneer agriculture (e.g. BAPPEDA & PPKD 1995; DepHut 1995; DepTrans & YDWL 1996; Endogeotec Visicon 1996). All this research, however, falls far short of the survey called for by Weinstock & Sunito (1989), which remains a requirement for understanding the effects of various farming systems on forest cover change in Indonesia.

Recent Developments in the Debate

In recent years there have been four major developments in the debate on the role of shifting cultivation in deforestation in Indonesia. The first concerns a fundamental shift in the perception of the importance of shifting cultivation in forest cover loss. The second involves greater precision in the use of 'shifting cultivation' terminology. The third concerns the effects on forest cover of smallholder tree crops, which are often associated with shifting cultivation. And

lastly, new insights have been gained into the reasons for shortened fallows.

Sea change in perception of shifting cultivation

In 1990 both the FAO and the World Bank published major studies claiming that the rate of deforestation in Indonesia was approximately one million ha per year. Both argued that shifting cultivation explained the majority of forest cover loss. This was based on the calculation that the 27 million ha of land assumed to be under shifting cultivation in the three main provinces of Sumatra, Kalimantan and Irian Jaya (RePPProT 1990, cited in World Bank 1990) was expanding at a rate of 2% or 500,000 ha per year, making it the single largest cause of deforestation in Indonesia (World Bank 1990:3).

Subsequent studies have tended to de-emphasise the role of shifting cultivation (often claiming that the effect of shifting cultivation has been overstated in the past) and give greater emphasis to other agents such as the timber industry, and to underlying causes such as the nature of government, politics and economic development in Indonesia (see Table 1).

A study by Dick (1991) was particularly influential in promoting a sea change of perception of the role of shifting cultivation in deforestation in Indonesia. Dick criticised the underlying assumptions of the World Bank (1990) and FAO (1990) studies, pointing out that they use the terms ‘smallholder conversion’ or ‘shifting cultivation’ to include both ‘traditional shifting cultivation’, which he views as relatively benign, and ‘spontaneous transmigration’, which he views as having unsustainable practices and accounting for the largest share of deforestation. Dick also contests the validity of the World Bank and FAO deforestation estimates because he claims that the 27 million ha they took to be under shifting cultivation include many natural and long-standing grasslands and shrublands, as well as areas that have been farmed for a long time. In his opinion, traditional shifting cultivators account for only 21% of total deforestation, and even this may be an overstatement as many of the forests they clear are part of a long-standing rotation on clan lands. He points out, moreover, that traditional shifting cultivators “lack the tools necessary to convert all but the most open primary forests” (Dick 1991).

Table 1: Change over time in views on causes of deforestation in Indonesia

SOURCE	TYPE OF CAUSE						
	AGENT				UNDERLYING		
	smallholder			plantations & tree crops	timber industry	government/ politics	economic development
	shifting cultivation	spontaneous transmigrants	regular transmigrants				
World Bank 1990	*	*					
FAO 1990	*	*					
Dick 1991		*				*	
WALHI 1992	effects overstated				*		
Barbier <i>et al.</i> 1993	*growing population density most important						
Ascher 1993						*Government - MOF alliance	*economic di- versification
Porter 1994					*		
Dauvergne 1994					effects understated	*	
Thiele 1994	effects overstated				effects understated		
World Bank 1994	effects overstated				effects understated		
Angelsen 1995	effects overstated					*government land claims	*exogenous price effects
MOF 1995	effects overstated			*			
Ross 1996					*	*ruling coalition	
Fraser 1996	*population density			effects overstated			
Hasanuddin 1996	smallholders blameless				*		
Dove 1996	effects overstated					*national political economics	

* Form of agency assumed to have the largest role in deforestation.

A major positive development in the recent debate on the role of shifting cultivation has been that influential analysts of the forest situation are no longer willing to accept at face value the claim that shifting cultivation is uniformly bad for forest conservation and management. There is increasing recognition of the wide diversity of farming systems that were previously subsumed under the term 'shifting cultivation'. Unfortunately, there are still no convincing data on the extent and rate of deforestation, and of the relative importance of different actors in the process of forest cover loss. This lack of data has not, however, prevented some observers from making strongly-worded pronouncements on the role of shifting cultivation in relation to forest cover at the national level.

Changing use of terminology

In recent years, the two sides of the debate on shifting cultivation have refined their terminology and focused their attention on the polar extremes of the continuum of forest farming systems.

Environmental NGOs have, for example, decided to use the term 'rotational agriculture' (*perladangan gilir-balik*) instead of 'shifting cultivation'. In this way they intend to emphasise the positive resource management aspects of traditional, long-fallow shifting cultivation. They argue that the word 'shifting' gives the false impression that traditional long-fallow agriculture is unbounded in space, nomadic, and invasive. The word 'rotational' is preferred, therefore, because it conveys the fact that traditional long-fallow agriculture tends to occur in a clearly-delimited area, and that ecological regeneration of resources through the rotational cycle assures that farmers will not need to go beyond their traditional fallow grounds.

In making this terminological change, environmental activists have become more conscious of the conceptual 'space' they occupy at the left end of the forest farming continuum. Unfortunately, they tend to describe all small-scale farming in the outer islands as 'rotational agriculture' (see for example Hasanuddin 1996), rather than also paying attention to the other farming systems on the forest farming continuum (see Figure 1). Environmental activists appear to fear that admitting the existence of unsustainable smallholder farming systems will undermine their claim that people at the forest margin possess wisdom (*kearifan*) in forest management. Acknowledgement of the full continuum of farming systems would, however, strengthen rather than weaken the NGO position, for two reasons. First, it would demonstrate recognition of the complexity of rural social change. Second, it would demonstrate concern for forest pioneers, who are as much victims in the process of

rapid social change as are shifting cultivators.

A terminological shift has also occurred among representatives of the government 'anti-shifting cultivation' position. The term 'forest pioneer farming' (*perambahan hutan*) is now more frequently used than 'shifting cultivation' (*perladangan berpindah-pindah*), indicating a tendency to focus more explicitly on the right-hand portion of the forest farming continuum. A tendency persists, however, to denounce both forest pioneer farming and shifting cultivation, and to minimise or ignore distinctions between the two.

It is regrettable that proponents of the government position have failed to acknowledge the positive environmental features of traditional long-fallow agriculture. This failure is partly explained by the government's relationship to timber concessionaires, who often occupy the same area as traditional shifting cultivators and are given preferential access to forest resources and the land beneath them.

Smallholder tree crops

Smallholder tree crop production is often understood to be included within the general term 'shifting cultivation', because many shifting cultivators produce tree crops. It should, however, be seen as a distinct category because, although it is strongly associated with shifting cultivation, it tends to be carried out on different kinds of lands and follows an entirely different logic of production (Dove 1993).

There may, in fact, be a strong association between smallholder tree crop production and deforestation. Chomitz and Griffiths (1996) found that tree crops, and rubber in particular, may play a more important role in deforestation in Indonesia than subsistence-oriented shifting cultivation. Rubber is the country's largest single earner of agricultural income (US\$ 1.5 billion in 1994-95), and output value almost doubled in the 1984-1995 period (World Bank 1996). Between 1982 and 1994, production of tree crops increased by 66% for rubber, 60% for coconut, and 55% for coffee, and for all three crops smallholders are the principal source of production (Economist Intelligence Unit 1995, World Bank 1996).

In brief, the significance of the Chomitz and Griffiths' (1996) finding in the context of this discussion is that the effects of shifting cultivators on forest cover may be less a result of their fallow fields than of the tree crops they plant.

Reasons for shorter fallows

It has long been noted that the main indicator of decreasing sustainability in shifting cultivation is the decrease in the fallow period. (This can be described as a shift to the right on the 'forest farming continuum' shown in Figure 1). Most accounts assume that growing population density is the main (or only) cause of shortened fallow periods.

Fraser (1996), for example, contends that growing population density and the resulting pressure exerted by shifting cultivation explain the annual forest cover loss of 900,000 to 1 million ha observed by FAO. It is not clear, however, to what extent the high correlation between increased population density and decreased forest cover is *causal*, and to what extent it is *incidental*. It is possible that there are other variables, not taken into account by Fraser, that may contribute to the high correlation. These include various independent variables (technological change, distribution of wealth and income, demand for agricultural products, growth of infrastructure, level of women's education and participation in the labour market, etc.) which may all modify the influence of population on forest cover. If these variables are taken into account, the apparently fundamental role of population growth in the loss of forest cover is less obvious.

Some of these variables have been examined by Angelsen (1995), whose case study data from Sumatra suggests that increasing population is not necessarily the main cause of deforestation. Angelsen weights the factors causing annual forest clearing and finds the following: (1) the increasing *proportion* of households opening swidden lands accounts for 70% of the total; (2) the increasing *total population* of households accounts for 23% of the total; and (3) the increasing *average size of swiddens* accounts for 7% of the total. This kind of analysis suggests that population growth explains only about one-quarter of forest cover removal. An alternative view of the linkages among relevant variables could, however, produce a different conclusion from the same data. It could be, for example, that the increasing proportion of households clearing new swidden lands (said to be 70% of the explanation) is actually doing so in response to growing local population density and pressure. Interestingly, Angelsen's (1995) survey reveals that three-quarters of the farmer respondents believe that population growth explains shortages of land.

In the face of these potential contradictions, it is important that future research on the reasons for shortened fallow periods should avoid assumptions about the role of population density in forest cover change. It makes sense that a wide variety of factors might have an influence on this phenomenon – among them: (1) population density; (2) changing proportion of households involved in shifting cultivation; (3) changing area under production per household; and (4) constraints imposed on smallholders by competing land uses (for example, timber concessions, agricultural and forest plantations, and mining). The last of these topics is one that is greatly under-researched and of growing relevance in Indonesia.

Summary of developments in the debate

This section has described four potentially positive developments in the debate on the role of shifting cultivation in relation to forest cover in Indonesia. First, facile and unsophisticated assessments of the effects of shifting cultivation by influential international organisations have been criticised and subsequently revised. Second, there is now a tendency to use more precise terminology to differentiate between the widely varying farming systems that were formerly lumped together as ‘shifting cultivation’. Third, there is a growing recognition that the effects of tree crops on forest cover need to be considered separately from those of shifting cultivation. And fourth, there are some interesting preliminary insights into the reasons for shortened fallows.

Nonetheless, these positive developments are overshadowed by the persistence of unhelpful tendencies and by large information gaps. Statements about the national-level effects of various forest farming systems remain largely unsupported by empirical data. The more differentiated use of terminology is often motivated by partisan argumentation rather than by a more nuanced understanding of various forest farming systems. Research on the effects of tree crops and the reasons for shortened fallows is producing important new knowledge, but we are still far from achieving a satisfactory understanding of the phenomena being studied. There remains, therefore, a pressing need to raise the sophistication and the scope of research on the extent and causes of forest cover loss in Indonesia.

The Need for Conceptual and Methodological Clarity

In order to adequately address the problems posed by inappropriate forms of

deforestation in Indonesia, it is necessary to understand the extent and the causes of the problem. Research must pay attention to all kinds of forest farming systems, as well as to other factors that affect forest cover, such as regular and spontaneous transmigration, timber concessions, agricultural plantations (notably palm oil), forest plantations and the growing production of pulp and paper, and mining.

Table 2 summarises some of the numerous assessments of the extent and causes of the problem, and shows how radically their conclusions diverge. Thus the highest and the lowest estimates of annual deforestation differ by a factor of ten, while the highest and lowest estimates of the joint effect of traditional agriculture and spontaneous transmigration differ by more than 300,000 ha per year.

As pointed out by Dick (1991), these estimates of forest cover change are nothing more than ‘semi-educated guesses’ as none of the studies are based on rigorous comparison of satellite imagery data at two or more points in time. The FAO (1990) deforestation estimate, for example, relies on various forest cover assessments from different years; forest cover change was then extrapolated at the provincial level on the basis of population density data (Sutter 1989). For its part, the World Bank (1990) estimate relies on Bank calculations and on a survey of wood raw material supply.

Additional deficiencies are that the studies fail to define or define clearly key concepts and terms such as ‘forest’, ‘deforestation’, ‘degradation’, and what is meant by ‘agent of deforestation’. This failure to provide clear definitions facilitates selective interpretation of data and therefore severely distorts the results of such studies, as is illustrated by the six examples below.

(1) How does one define ‘forest cover’ in Indonesia? Official estimates of the area of forested land in Indonesia differ widely. The sixth Five-Year Development Plan (REPELITA VI) says there were 92.4 million ha of forest land in 1993 (RI 1994). The National Forest Inventory, based on 1986-91 satellite data, estimates there are 120.6 million ha of forested land covering 69% of the land area (excluding Java) (GOI/FAO 1996). The REPELITA VI and GOI/FAO estimates thus differ by almost *30 million ha* at roughly the same point in time.

Table 2: Estimates of annual deforestation in Indonesia (thousands of ha)

SOURCE OF ESTIMATE	AGENT							
	Transmig. Dev't	Estate Crops	Swamp Dev't	Spontan. Transmig.	Trad'l Ag.	Forest Harvest	Fires	TOTAL
World Bank 1990	250			500		80	70	900
FAO 1990	300	274	85	461		80	113	1,315
TAG 1991	65	11.4	30.4	156.5		NE	NE	262.9
MOF 1992	300	160	NE	300		77	478	1,315
Dick 1991	78.4	11.4	30.4	178.5	135.5	120	70	623
Sukarjo 1996^a	NE	NE	NE	NE	NE	NE	NE	809
Hasanuddin 1996	NE	NE	NE	NE	NE	NE	NE	2,400

The top four rows of this table (World Bank 1990 through MOF 1992) are adapted from World Bank (1994: 52). The original was modified to reflect the fact that most sources did not separate the categories “spontaneous transmigration” and “traditional agriculture”. The World Bank (1994: 52) table falsely gives the impression this distinction was made. Dick (1991) makes a significant contribution by recognising the distinction. ‘NE’ signifies ‘no estimate.’

^a Reported in the *Jakarta Post*, May 29, 1996.

Assessments of forest cover loss which are calculated on the basis of different definitions of 'forest' at different points in time are likely to be utterly misleading, therefore, as they reflect not only real changes in forest cover, but also the differences in definitions of 'forest cover'. One example of such a case is Hasanuddin's 1996 study, with its estimate of two million ha forest cover loss per year, which relies entirely on government-supplied data on forest cover at two points in time.

(2) Does 'deforestation' refer to just *permanent*, or *both permanent and temporary* removal of forest cover? The FAO (1990) and World Bank (1990) studies implicitly assume that both permanent and temporary removal of forest cover constitute deforestation. In so doing, they include as 'deforestation' large areas of shifting cultivation that will eventually return to secondary forest status. This definition, therefore, greatly enlarges both the area assumed to be deforested and the role of shifting cultivation in overall deforestation.

(3) Does 'deforestation' refer to the loss of forest cover for *all kinds of uses*, or does it refer to the loss of forest cover that will never again regenerate for *timber production*? An implicit definition of deforestation in the World Bank (1990) study is based on the latter view.

(4) Does 'deforestation' refer to the *removal of forest cover alone*, or does it refer as well to the *loss of various kinds of forest attributes*, such as density, structure and species composition? Saharjo (1994) points out that the area deforested is smaller using the former definition, and larger in the latter case. Making a proper distinction between complete forest loss and forest degradation is an important issue with respect to assessing the comparative environmental effects of smallholder agriculture and logging. Under traditional shifting cultivation, for example, cultivated land is often said to be 'deforested' even though it may return to forest cover at a later date. Selectively logged forests, on the other hand, are often not considered 'deforested' even though various environmental functions may be seriously impaired.

(5) Is the 'agent of deforestation' the one that *removes the forest cover*, or the one that subsequently *prevents the regrowth of forest cover*? If one assumes the former, then logging companies are assigned a larger role in deforestation than might otherwise be the case. If one assumes the latter, however, then agricultural

smallholders, who sometimes colonise land that has been first opened up through logging, are assigned a larger role. Some observers have pointed out that it may be practically impossible to disaggregate the causal role of different agents operating in the same locality (e.g. World Bank 1990; Ahmad 1995).

(6) Is the ‘agent of deforestation’ most appropriately defined in terms of the ultimate designated use of cleared forest land, rather than by the actions and intentions of those who actually clear the forest? Barbier *et al.* (1993) suggest the former, arguing that because much deforestation in Indonesia occurs on land intended for conversion to agriculture, a causal role must be assigned to the growth of agriculture.

A related problem is the varied perspectives of observers on the principal value of forests, as in the case of substitution of natural forests by forest plantations. Commentators representing government or industry might view this trend favourably, inasmuch as timber yields from plantations can be greater per hectare than those from natural forests. Commentators representing environmental and forest community interests view the situation quite differently, since this process may harm biodiversity and the interests of forest communities. From the point of view of environmentalists, creation of plantations can be seen as ‘deforestation’, whereas from the point of view of government and industry it might be seen as ‘reforestation’. This concern is captured succinctly in the title of the WALHI/YLBH (1992) document *Mistaking Plantations for Indonesia’s Tropical Forests*. These interest-based positions with respect to different types of forests can lead to different interpretations of the same primary data.

It should be clear that more precise use of key terms and concepts is a pre-condition for raising the quality of research on forest cover change in Indonesia. Reliable estimates of forest cover change require comparison of matched satellite images from multiple years (Downton 1995). There should be close consultation of the methodology and technical specifications in FAO’s (1996) *Forest Resources Assessment 1990: Survey of Tropical Forest Cover and Study of Change Processes* for carrying out such a study on the extent of deforestation in Indonesia. The study offers rigorous definitions of ‘forest’, ‘deforestation’, and ‘degradation’ and represents a considerable improvement on past practices.

Analysis of the causes of forest cover change should: (1) specify three levels of explanation ('agent', 'immediate cause', and 'underlying cause'); (2) interpret the consequences of independence or interaction among agents of forest cover change; (3) rely on satellite imagery for interpreting causal sequences; and (4) give far more attention to macro-economic causation than has been the case to date (Sunderlin & Resosudarmo 1996).

Conclusion and Ideas for Future Research

Historically, the lion's share of blame for inappropriate deforestation in Indonesia has been placed on shifting cultivation. It has been relatively easy for the Indonesian government to blame shifting cultivators because they are among the most powerless of social groups in the country. There are deeply-rooted political and economic motivations for the Indonesian government's opposition to shifting cultivation (Dove 1985).

Studies by the World Bank (1990) and FAO (1990) echoed the government condemnation of shifting cultivation. Numerous subsequent studies have attempted to set the record straight by de-emphasising the role of shifting cultivation and by paying attention to other factors that have a role in forest cover change. Unfortunately, the quality of all studies on the extent and causes of deforestation in Indonesia is severely limited by a lack of national-level socio-economic and biophysical data, and by a failure to define key concepts and terms.

To promote the aim of achieving a better understanding of the role of shifting cultivation in forest cover change, this paper makes three points. First, the concept of 'shifting cultivation' must be disaggregated into at least three farming systems on a 'forest farming continuum'; these three farming systems have widely differing long-term implications for forest cover. Second, researchers must be aware that, although there have been significant strides in understanding the forest cover effects of forest farming systems, the biases and misunderstandings of the past persist and the information gaps remain large. Third, greater understanding of the varying effects of different forest farming systems requires that they be analysed in the context of all relevant forms of agency. A rigorous methodology must be applied to attain an adequate understanding of the extent and causes of forest cover change.

In carrying out further research on the impact of forest farming systems on forest cover in Indonesia, the following questions are important:

(1) What are the socio-economic characteristics and the ‘weight’ of various forest farming systems in relation to forest cover change – whether positive or negative? This is essentially the research proposed by Weinstock & Sunito (1989).

(2) If long-fallow shifting cultivation does in fact favour the long-term conservation and management of remaining forests, are there ways that this farming system can be supported and shielded from shifting towards the right of the forest farming continuum? Is it possible, as claimed by de Jong (1997) that modification and development of traditional shifting cultivation can help maintain its positive role in forest conservation and management? Research on this topic would respond to the challenging claim by Warner (1991:v) that, “Although successful in the past, swidden-based agroecosystems cannot serve as the model for the future of the tropics.”

(3) Are there socio-economic changes that are leading or might lead to a reversal of the process of shortening fallow period – for example, possible rural population stagnation or decline resulting from rapid urbanisation, or possible declining pressure from concessionaires resulting from the depletion of timber supplies?

(4) If forest pioneer farming is in fact destructive of forests designated for protection, are there alternative farming systems or non-farming income sources that might alleviate this pressure?

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