

The impact of trade and macroeconomic policies on frontier deforestation

Sven Wunder and Bruno Verbist

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Towards integrated natural resource management in forest margins of the humid tropics: local action and global concerns

Meine van Noordwijk, Sandy Williams and Bruno Verbist (Editors)

Humanity stands at a defining moment in history. We are confronted with a perpetuation of disparities between and within nations, a worsening of poverty, hunger, ill health and illiteracy, and the continuing deterioration of the ecosystems on which we depend for our well-being. However, integration of environment and development concerns and greater attention to them will lead to the fulfilment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future. No nation can achieve this on its own; but together we can - in a global partnership for sustainable development. (Preamble to the United Nations' Agenda21 on Sustainable Development; <http://www.un.org/esa/sustdev/agenda21chapter1.htm>).

Background to this series of lecture notes

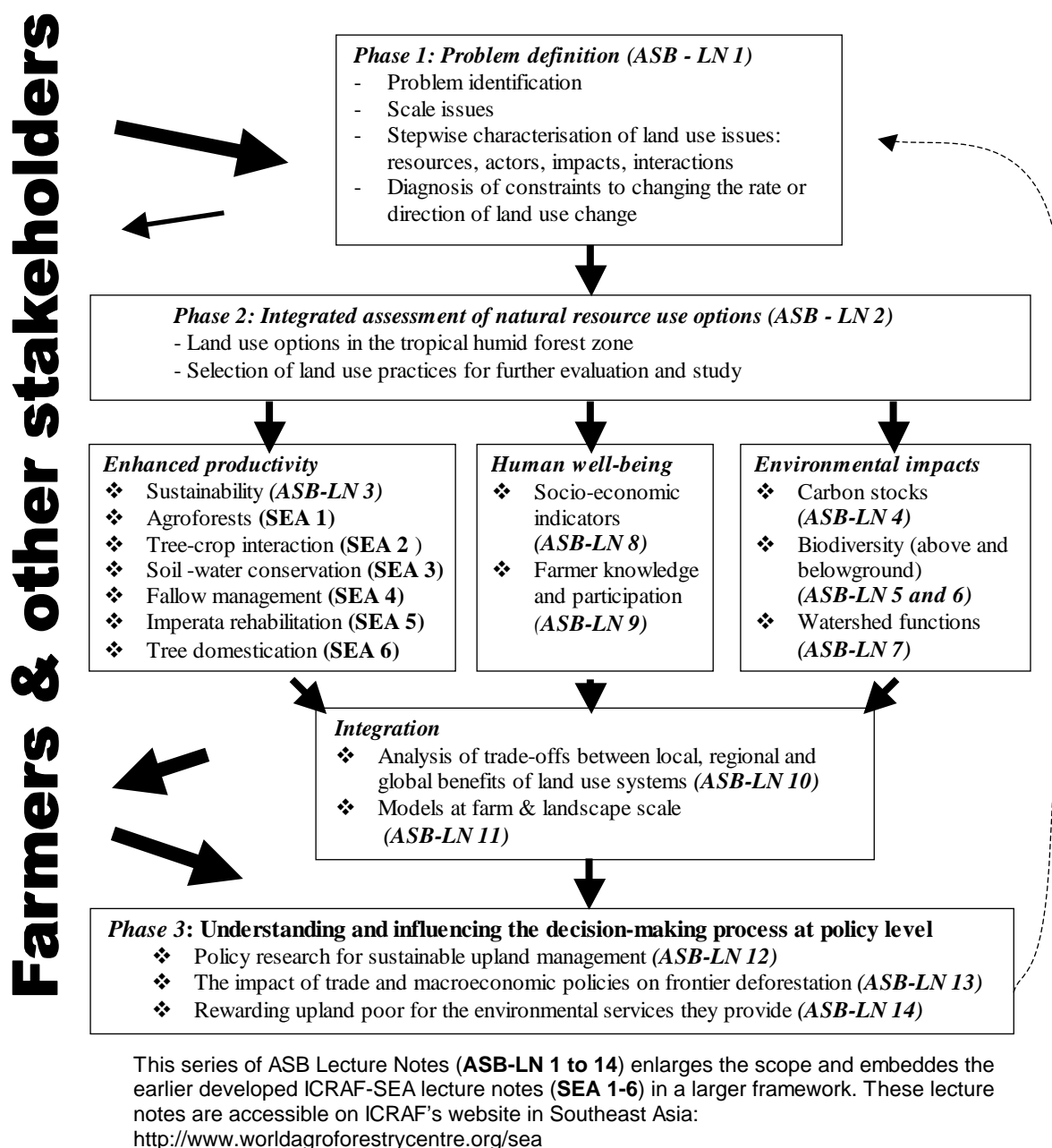
Much of the international debate on natural resource management in the humid tropics revolves around forests, deforestation or forest conversion, the consequences it has and the way the process of change can be managed. These issues involve many actors and aspects, and thus can benefit from many disciplinary perspectives. Yet, no single discipline can provide all the insights necessary to fully understand the problem as a first step towards finding solutions that can work in the real world. Professional and academic education is still largely based on disciplines – and a solid background in the intellectual capital accumulated in any of the disciplines is of great value. If one wants to make a real contribution to natural resource management issues, however, one should at least have some basic understanding of the contributions other disciplines can make as well. Increasingly, universities are recognising the need for the next generation of scientists and policymakers to be prepared for interdisciplinary approaches. Thus, this series of lecture notes on integrated natural resource management in the humid tropics was developed.

The lecture notes were developed on the basis of the experiences of the Alternatives to Slash and Burn (ASB) consortium. This consortium was set up to gain a better understanding of the current land use decisions that lead to *rapid* conversion of tropical forests, shifting the forest margin, and of the *slow* process of rehabilitation and development of sustainable land use practices on lands deforested in the past. The consortium aims to relate local activities as they currently exist to the global concerns that they raise, and to explore ways by which these global concerns can be more effectively reflected in attempts to modify local activities that stabilise forest margins.

The Rio de Janeiro Environment Conference of 1992 identified deforestation, desertification, ozone depletion, atmospheric CO₂ emissions and biodiversity as the major global environmental issues of concern. In response to these concerns, the ASB consortium was formed as a system-wide initiative of the Consultative Group on International Agricultural Research (CGIAR), involving national and international research institutes. ASB's objectives are the development of improved land-use systems and policy recommendations capable of alleviating the pressures on forest resources that are associated with slash-and-burn agricultural techniques. Research has been mainly concentrated on the western Amazon (Brazil and Peru), the humid dipterocarp forests of Sumatra in Indonesia, the drier dipterocarp forests of northern

Thailand in mainland Southeast Asia, the formerly forested island of Mindanao (the Philippines) and the Atlantic Congolese forests of southern Cameroon.

The general structure of this series is



In this series of lecture notes we want to help young researchers and students, via the lecturers and professors that facilitate their education and training, to grasp natural resource management issues as complex as that of land use change in the margins of tropical forests. We believe that the issues, approaches, concepts and methods of the ASB program will be relevant to a wider audience. We have tried to repackage our research results in the form of these lecture notes, including non-ASB material where we thought this might be relevant. The series of lecture notes can be used as a basis for a full course, but the various parts can also 'stand alone' in the context of more specialised courses.

Acknowledgements

A range of investors (or ‘donors’) have made the work of the ASB consortium possible over the past years, some by supporting specific parts of the program, others by providing core support to the program as a whole. These lecture notes build on all these investments, but were specifically supported by the ASB Global Steering Group, with funds provided by the Asian Development Bank, the World Bank via the CGIAR, by ICRAF core funds, by the Netherlands' Government through the Direct Support to Training Institutions in Developing Countries Programme (DSO)-project and by the Flemish Office for Development Cooperation and Technical Assistance (VVOB). Both biophysical and policy research was supported by a Regional Technical Assistance Grant from the Asian Development Bank. Many researchers and organisations have contributed to the development of ideas, collection and synthesis of data, and otherwise making the program what it is today. A team at the International Centre for Research in Agroforestry (ICRAF), consisting of Kurniatun Hairiah, Pendo Maro Susswein, Sandy Williams, SM Sitompul, Marieke Kragten, Bruno Verbist and Meine van Noordwijk developed these lecture notes.

What is new in this particular lecture note?

This particular lecture note was developed as an add-on to the existing 12 ASB-lecture notes. For this lecture note we mainly draw on published and ongoing research carried out by the Center for International Forestry Research (CIFOR), which the principal author of this note is affiliated to. For most of a decade, CIFOR has carried out a tropics-wide research programme on the “underlying causes of deforestation”. The empirical results from this programme are the main source of knowledge for this note.

The authors appreciate comments on earlier draft of this lecture note received from Fiona Chandler, David Kaimowitz, Meine van Noordwijk and August Temu.

Overall responsibility for any shortcomings in this lecture note remains with the authors.

ASB-consortium members

Details of the ASB consortium members and partner organisations can be found at: <http://www.asb.cgiar.org/>

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Lecture Note 13

THE IMPACT OF TRADE AND MACROECONOMIC POLICIES ON FRONTIER DEFORESTATION

By Sven Wunder and Bruno Verbist

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I. Objectives

- To learn how different changes related to trade and macroeconomic policies affect the loss of frontier forests, i.e. to understand both the likely direction and weight of these factors in influencing the speed of forest conversion;
- To comprehend trade-offs and synergies between policies for natural-forest conservation and those designed to promote economic development;
- To appreciate these linkages in the light of a few micro- and macro-level examples.

II. Lecture

1. Introduction

The purpose of this lecture note is to summarise different research results about the impact of macro-level factors and “extra-sectoral” policies on tropical forest cover. Specifically, we are interested in the forest margins – i.e. the spatial transition zone between tropical forests and converted land uses. What are the policy factors that accelerate frontier expansion, and which ones tend to slow it down?

The term “extra-sectoral” refers to all the things that happen outside of forests and forestry, but have a significant effect on forests. For instance, how do changes in international trade and a country’s balance of payment affect deforestation? What impact is a drastic currency devaluation likely to have on forests? What is the role of population growth? How is globalisation and import liberalisation likely to affect forests?

This lecture note is an attempt to respond to some of these questions, some of which were brought forward in the first lecture note of this series. In answering these and other questions, we will mainly draw on published and ongoing research carried out by the Center for International Forestry Research (CIFOR), which the principal author of this note is affiliated to. For most of a decade, CIFOR has carried out a tropics-wide research programme on the “underlying causes of deforestation”. The empirical results from this programme are the main source of knowledge for this note. We will supplement with other selected empirical studies that demonstrate how these macro factors and policies eventually “trickle down” to the forest. But the main objective is to synthesise the “big picture”. Readers interested in the specific case studies that shape this “big picture” are referred to publications describing the underlying studies.

A key hypothesis is that what happens to tropical forests is more determined by events outside the forest arena than by what happens inside the forest sector. In other words, the extra-sectoral impacts will often be more important than, for instance, the new forest law, the participatory tree-planting project or the environmental education programme that is implemented at the forest margins. That does not necessarily mean that forestry interventions are not effective. What it does mean is that some macroeconomic and extra-forestry factors tend to set the scene for success or failure of the projects and strategies of forest-margin stabilisation, so that the promoters of these strategies need to have a realistic vision about the direction and proportions of impacts. In some cases, the macro-decision makers should also explicitly take into account how forests are affected before they make their “extra-sectoral”, macro-level choices.

2. Definitions: Deforestation and forest degradation

2.1 Deforestation

Before we define deforestation it is good to define first what a forest is. As was already illustrated in the former lecture notes many different definitions coexist (differences in between countries and within a country often between organisations) and they cover a whole continuum (Figure. 1).

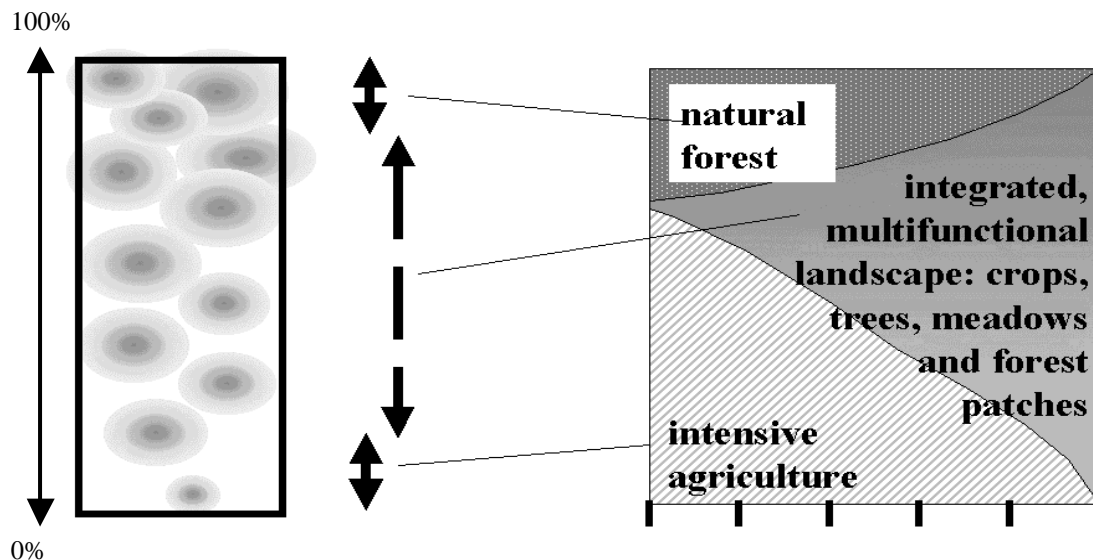


Figure. 1 On the left: a continuum of tree cover (0 – 100%) and the range of thresholds that is used across the globe in defining 'forest' on the basis of tree cover. Current definitions vary between 20% and 80 % tree cover. On the right: Choices among combinations of three major types of land uses in a landscape, aiming to serve both agricultural production functions and to maintain environmental goods and services that forests provide.

In this specific lecture note, we employ the terminology used by the United Nations Food and Agricultural Organization (FAO 2000a), since many data and reports to which this lecture note refers to are based on this. According to FAO, a forest is an area of a minimum 0.5 ha, covered by a tree canopy of at least 10%, with trees that can reach more than 5m height, and subject to the constraint that the area should not be under an alternative (e.g. agricultural or urban) use. Note that in this terminology, both natural forests and forestry plantations are counted as "forests" (as long as they satisfy the quantitative criteria), whereas agroforestry counts as a non-forest system when it mainly produces agricultural outputs.

Deforestation is thus defined by any change in conditions so that an area *no longer* qualifies as a forest. In the majority of cases, deforestation occurs because the area's tree canopy-cover is reduced to less than 10% by means of converted land uses. This conversion can be permanent (e.g. urban expansion) or temporary (e.g. shifting cultivation). This means that we identify deforestation with a radical removal of tree cover - in most cases a conversion to other land uses.

Note that this definition does not say anything normative about whether deforestation is good or bad. Although much deforestation research is driven by a legitimate concern about the rapid loss of tropical forests, the desirability of these land-use change processes has to be assessed separately, based on a subsequent analysis of the costs and benefits of forest loss to different stakeholders at variable levels of aggregation.

2.2 Frontier deforestation

There are different means and ways to get rid of a forest. In this lecture note, we will focus mainly on frontier deforestation - the process of moving into large blocks of previously continuous forest. This transition zone is also often referred to as “forest margins”. The process of frontier deforestation and advancing forest margins has to be distinguished from the clearing of forest remnants in pre-established agricultural or in peri-urban areas. Both types of forest loss have important implications, but for two reasons we have a special interest in the forest-frontier margins. First, frontier forests have been claimed to be particularly important for the conservation of pristine habitats and biodiversity (Bryant, D.Nielsen et al. 1997). Second, there is evidence that once forests are fragmented, they disappear more rapidly in incremental processes that are harder to stop (Rudel and Horowitz 1993; Mertens and Lambin 1997). In terms of addressing root causes of tropical forest loss, it thus makes sense to have a special interest in forest frontiers and rainforest margins.

What does frontier deforestation look like in spatial terms? The top row of Figure 2 shows three different forms of frontier deforestation. First, large clearing for commercial purposes can appear as a geometric shape, for instance in the case of the expansion of soybean production in lowland Bolivia and Brazil (Kaimowitz and Smith 2001). A second type is the corridor shape, which is often found from settlement and agricultural activities around new roads, such as the logging roads being built into the humid forest zone of Cameroon (Mertens and Lambin 2000). Finally, a third frontier-clearing prototype is the fishbone pattern, known from directed settlement programmes (such as Indonesia's *Transmigrasi*), where land is allocated to settlers in strips along a road or a settlement nucleus.

For comparison, the lower row in Figure 2 shows spatial interactions that we do *not* associate with frontier deforestation, since they occur in more forest-scarce areas and/or areas of pre-established human settlement. The three examples show subsistence agriculture (including shifting cultivation), forest-remnant clearing and peri-urban deforestation.

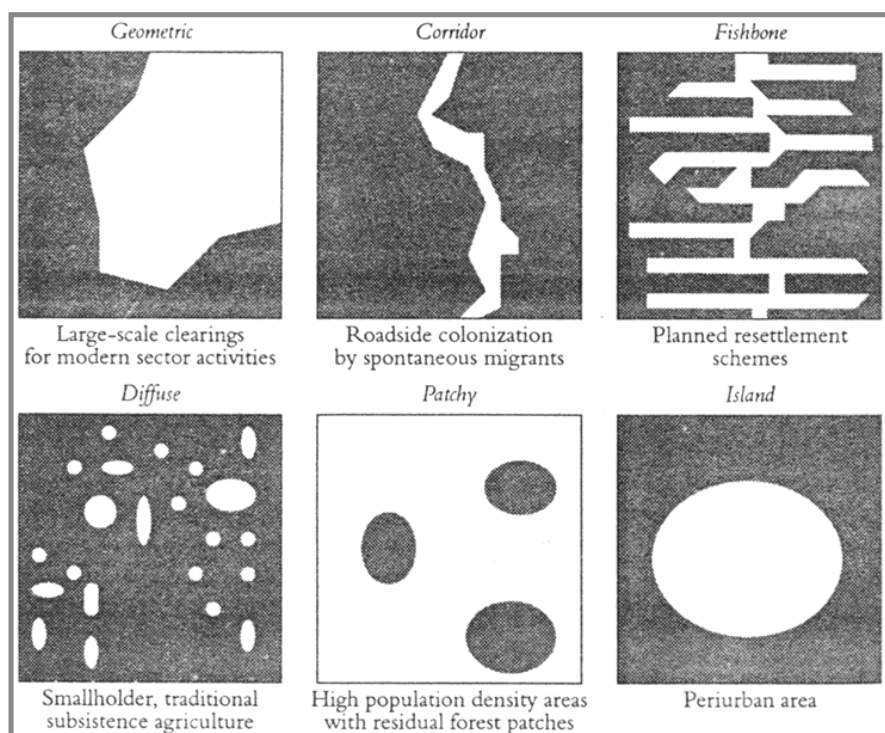


Figure 2.
Six spatial
forest--non-
forest
patterns
(Mertens and
Lambin 1997)

2.3 Forest degradation

Besides deforestation, there are also numerous forest degradation processes – a residual category of interventions that significantly alter forest quality, structure and functions, but do not deprive an area its status as a forest according to FAO's criteria. Notably, this includes selective logging, which reduces forest canopy-cover, but normally not below the 10% minimum threshold. On the other hand, clear-cut harvesting for pulp harvesting would usually be seen as deforestation, to the extent that they fully eliminate the canopy cover.¹ Other examples of forest degradation include repeated exposure to fire, over-extraction of firewood or over-grazing (both mostly in dry forests), or over-harvesting of bush meat -- also called *defaunation*, and especially important in Central Africa.

Deforestation and forest degradation not only differ in their physical impact on forests; they also tend to be dissimilar processes in economic terms. Deforestation is often an investment in future uses of the converted land, since there usually is a non-trivial cost of preparing the land for alternative uses before the benefits from conversion can be reaped. On the other hand, the forest-degradation processes described above often tend to be more associated with a "cashing in" of rents through the over-harvesting of various forest products – i.e. producing an economic benefit here and now, but probably less in the future.

3. Theoretical framework

Browsing through the literature on deforestation, one can discriminate between three main prototypes of, or approaches to, the phenomenon of deforestation: 1. The impoverishment approach; 2. The neo-classical approach, and 3. The political ecology approach (see Wunder 2000: chapter 2 for further discussion). These approaches differ substantially as to what they identify as the main drivers, agents and mechanisms behind forest loss, as shown in Table 1.

Table 1. Three Deforestation Approaches

Questions	Impoverishment Approach	Neo-classical Approach	Political Ecology Approach
What main, single factor is responsible for deforestation?	The growing number of poor	Open-access property rights	Capitalist investors crowd out peasants
Who is the principal deforestation agent?	Smallholders	Various agents – small or big	Capitalist entrepreneurs
What is driving the dynamics of deforestation?	A gradual push with deterministic, vicious circles	Optimising agents react to pull incentives	Capitalist pull, land expulsion and smallholder push
What impact have demographics and labour absorption	Labour absorption is low. Labour abundance boosts deforestation	Labour mobility is high and labour supply very elastic	General labour scarcity at frontier causes deforestation
What effect has a rise in the peasant's farm output prices?	It causes lower farm production and less deforestation	It causes higher farm production and more deforestation	It causes lower farm production and less deforestation

Source: (Wunder 2000)

¹ In FAO's use of the terms, that would only hold if the area is not *intended* to be reforested after the clear cut. In a critique of the FAO concept, it is argued that intentions and predictions about post-clearing land uses in the tropics are extremely uncertain, making the FAO definition highly speculative Wunder, S. (2003). *Oil wealth and the fate of the forest. A comparative study of eight tropical developing countries*. London, Routledge (in press).

The impoverishment approach points to a combination of poverty and demographics as the main mechanism responsible for forest loss, creating a vicious circle of environmental degradation driven by the growing number of smallholders. Obviously, population growth plays a prominent role here; low labour absorption at the frontier and a low pace of technological innovation mean that Malthusian scenarios dominate: more and more (poor) people have to live off a finite resource base, leaving them no other alternative than to convert more forestland in order to survive. Shifting cultivation for subsistence under growing population pressure is an applied scenario of this type, leading to both reduced fallow periods and dwindling forest resources.

Neo-classical analysts rather see the ill-defined forest property rights as the main factor responsible for deforestation: an open or quasi-open access to forestland at the frontier encourages smallholders and large investors alike to open up the forest and claim land rights afterwards. Agents are not so much forced by deterministic and vicious circles; they rather react to opportunities in a rational and optimising way, even when they happen to be poor. Labour supply tends to be flexible; if there are good rewards to forest colonisation and conversion, people will have more children and, notably, migrants will come in from outside to fill job opportunities.

The political ecology approach points specifically to externally driven processes, e.g. large capitalist farmers or ranchers, as the main agents of deforestation. This can either be directly through their additional land demand, or by disrupting local land-use systems and by crowding out small farmers, who hence are pushed further into the forest. While the large farmers tend to maximise profits, smallholders try to maintain their predominantly subsistence-based livelihoods. In other words, according to this approaches, the rich deforest due to greed while the poor mostly do so because of need. Normally, population growth is a subordinate factor in this picture.

Obviously, the three approaches have competing attitudes to the explanation of deforestation, but this does not necessarily mean that any one of them is universally more correct than the others. Forest-loss processes differ across the tropics, and one will find examples from different parts of the world that fit any of the three approaches, as we will see below: different deforestation prototypes dominate in different places. On the other hand, as shown in the last row of Table 1, some of the predictions by the three approaches are directly opposed, allowing us to test their relevance directly.

Consider that a small forest-margin farmer producing cocoa as his main cash crop is suddenly facing higher cocoa prices that substantially increase his revenues. What would be the impact on deforestation? In the political ecology and especially the impoverishment approach, people that are better off would need to produce *less* cocoa to earn the same money - or they would be able to feed more mouths without having to push into new forest areas for cultivation. The assumption is that they only produce a certain "target revenue", which is sometimes also called a "full belly" economy – so to say, you only work until your stomach can be filled up with food. The opposite reaction occurs under the neo-classical standard economic assumptions of profit maximisation. Farmers faced with a higher profitability in cocoa will allocate more labour, capital and land to take maximum advantage of the price boom by producing *more* cocoa. This also means normally that they will deforest more, rather than less.

4. Economic models of tropical deforestation

The book "Economic Models of Tropical Deforestation – A Review" (Kaimowitz and Angelsen 1998) was a state-of-the-art review of a range of different types of models explaining forest loss in the tropics. Deforestation literature had soared in the 1990s, and the 133 models reviewed included a wide range of economic models. We can use

this synthesis to get a global snapshot of "what matters" in terms of economic incentives for land-use change and deforestation.

The countries under analysis ranged from the larger forest countries to some with limited forest coverage. Most frequently represented were Brazil (12), Indonesia (7), Costa Rica (6), Ecuador (5), Mexico (5), Thailand (5), Philippines (4), Tanzania (4) and Cameroon (3). In general, the quality of data is lower the larger the scale of analysis. Household models tend to have good-quality data as the scientist is in control of the data collected, just like spatial regression models where data often comes from regional remote-sensing imagery. On the other hand, global regression models used national deforestation estimates, generally based on FAO forest assessment or yearbook data that exhibit a number of insecurities and serious problems (Grainger 1996; Rudel and Roper 1997; Matthews 2001).

In analytical terms, we should make conceptual distinctions between:

- *Agents* of deforestation (e.g. smallholders vs large farmers)
- *Sources* of deforestation (what deforested land uses, e.g. crops or pasture)
- *Immediate causes* of deforestation (agents' direct decision parameters – e.g. higher crop prices, or a new road reducing transport costs)
- *Underlying causes* of deforestation (broader contextual impacts and enabling factors – e.g. population growth, currency devaluation or new land-tenure legislation).

4.1 Effects of price changes

As a main result, the synthesis by Kaimowitz and Angelsen (1998) showed that higher agricultural prices in by far the most cases stimulate more forest clearing. Farmers react to the opportunity of more profitable cultivation by expanding it. Hence, they *increase* their income by cultivating more land themselves, or newcomers will be attracted. This picture thus favours the neo-classical approach, at the expense of the political-ecology and impoverishment school, which predicted a *decline* in cultivated area (see Section 4).

Second, according to the model results, changes in relative prices between agricultural products can also alter the balance between land uses, which affects deforestation. In particular, if farmers produce both *land-extensive*² food crops and *land-intensive* cash crops, and choose mainly between these two land-use options, than a rising relative price of food crops over cash crops will tend to cause higher deforestation.

Third, higher timber prices can also stimulate deforestation, although the evidence is weaker than for agriculture commodities. This happens because better prices tend to stimulate a more rapid harvesting rate, which indirectly opens up forested areas for conversion, mainly through road building (see Box 1).

4.2 Factors affecting costs

Policies and other interventions that favour agriculture will in most cases cause higher deforestation. Higher agricultural productivity, lower input prices, lower land prices, and lower transport costs are among the most important factors identified (Kaimowitz and Angelsen 1998). In most places, deforestation is thus fairly well explained by expanding agriculture (Barbier 2001; Andersen, J. et al. forthcoming).

Road building near or into forest areas is the single most important factor causing deforestation. It lowers transport costs for extracting both timber and agricultural products, so that these commodities can "pay their way out" to the marketplace. By making viable a series of economic activities and enabling more intensive human

² "Land-extensive" here means a *high* input of land per output unit, "land-intensive" the reverse.

settlement, roads are often the first but decisive step towards forest conversion. As such, roads are often a very important tool for rural development. Improvement of existing roads can have a similar effect of lowering transport costs and thus enlarging the spatial "band" around the road where forest conversion becomes worthwhile. Even road planning - i.e. private agents' anticipation of a future new road - can cause deforestation (see Box 1).

Effects of changes in costs and benefits are also mentioned in lecture note 11A (p 15). In the mid 19th century, von Thünen was the first to analyse the relative profitability of a range extensive-to-intensive land use systems as a function of distance, often along roads or rivers. Slightly simplified, one can say that farmers will expand their farms until the returns are equal to the costs, but transport costs rise the farther you get from the road and the worse the roads are. Hence, when roads improve, costs go down and farmers even farther away can still make a profit by converting forests to farmland.

Box 1. Sangay National Park in Ecuador: a planned road to deforestation

When Ecuador in the mid-1970s became an oil-rich country, the military government started an ambitious plan of national integration. Highland and lowland regions would be connected by various new strategic roads, which would facilitate the exchange of goods and production factors. For some years, almost half of the state's investment budget was spent on road building. This was probably a success in terms of promoting rural development. The highland region was able to specialise more on cattle ranching, while the lowlands now produced staple crops (especially rice) that were much cheaper than those previously produced in the highlands. There was also a higher mobility of migrant labour from the highlands to work seasonally in lowland export crops. Roads promoted trade and development, but they also stimulated a wasteful use of land resources – in particular, highly land-extensive cattle ranching that caused massive deforestation.

An applied case study can help to illustrate the powerful land-use impact of roads. Sangay National Park, a UNESCO World Heritage Site since 1983, is an area of unique biodiversity, stretching from the highlands to the Amazon lowlands. The main natural protection for this area has been its rugged topography and difficult access. However, over the last forty years there have been local ambitions to link the highland town of Macas to Guamote in the lowlands by building a 70-km new road through the heart of the Park. Additionally, because of its strategic access to the Peruvian border, the military has geopolitical motives to promote such a road. This stop-and-go project, initiated a decade ago but frequently interrupted due to financial shortages, faces many problems. Because of the steep slopes and high rainfall, the road construction has been extremely difficult and has had high environmental costs. Even before its completion, it has produced multiple landslides. Hence, the direct deforestation impact of its incipient construction has already been considerable, because earth, rocks and stones loosened by explosives have poured down the steep hillsides, with devastating effects. However, the potential indirect impacts have been much more powerful. Rumours of alternately halting and restarting the road project have over the years been followed by the consecutive abandonment and reclaiming, respectively, of land tenure along the proposed road. Small farmers and a couple of urban entrepreneurs speculate actively in the completion of the project, which would enable commercial farm production and increased land prices around the track. Hence, they have in some places started to clear land not because alternative land use pay off here and now, but because securing tenure through "active" occupation may do so in the future. Plans and preparations have also been made on how selectively to extract fine timber species. A number of sporadic colonisation efforts in this still isolated region have failed in the past; only one settlement remains today. However, these settlers too are struggling to acquire formal land titles and are eager to see the road project completed, because the transport access it will provide them with new production opportunities and an economic rent from higher land prices. Only the future will tell whether their speculation will be successful, in the sense that the road will be completed in a way that provides permanent transport access for their products to the marketplace.

Source: Wunder (2000)

Higher rural wages, or higher labour opportunity costs in term of new employment options, will reduce deforestation. This is because forest clearing is a particularly labour-intensive activity. The effect will be particularly strong when forest-based options constitute an "employment of last resort", which people turn to in periods of economic crisis when alternative, better - remunerated employment options become scarce (Angelsen and Wunder 2003: Section 4).

Fertiliser subsidies that make purchased fertilisers cheaper can in some cases reduce deforestation, and their withdrawal can increase it. When fertiliser prices are low, farmers apply them more, cropping on more permanent plots. When fertiliser prices are high, they turn more to shifting cultivation, saving on fertiliser costs but clearing much more land. This is an exception to the general pattern of agricultural subsidies promoting forest loss. It applies especially in contexts where slash-and-burn is a prime cause of deforestation, and where forests' main local importance is as a source of nutrient inputs into agriculture, e.g. in Central Africa. Subsidies making fertilisers cheaper will then tend to reduce forest conversion for that purpose.

4.3 Land tenure

We remember from the last section that the neo-classical approach pointed to insecure land tenure as a key factor behind deforestation. But Kaimowitz and Angelsen (1998), as well as other empirical studies (e.g. Wunder 2000), find land-tenure security to be an ambiguous factor vis-à-vis the determination of forest loss. This is a controversial issue, where more research is still needed. People that have insecure tenure and access rights can only plan for limited time periods; the more long-term the benefits, the less secure is it that the land user with insecure rights can reap them, hence the less (s)he will be inclined to invest in the land.

In general, (more) secure tenure will help the land user adopt long-term profitable solutions. In some circumstances, that will favour forest management, but in many cases it will not. This will depend on whether forestry and tree-based systems are actually the most profitable option in the long term compared to cattle ranching, oil-palm estates, soybean fields - or even selling the land to other parties. Depending on the socio-economic context, secure tenure seems to have a more positive effect on tree planting and agro-forestry than on natural forest management. Trees take time to grow, so the decision to allocate land almost by definition requires control over the land until harvest. But there is nothing in and off itself ensuring that more secure tenure leads to more forests in the landscape. Examples from Latin America show the opposite, as pastures for cattle ranching often is more rewarding than forestry and less risky than cropping, seen from a long-term perspective.

One factor to consider is thus what land uses are favoured by secure tenure. Another one is the process by which this secure tenure is established in the first place. Forest clearing is often seen as a sign of active occupation - "the land is being worked" - that discourages others from taking possession. Conversely, forests are often seen as "idle" territory inviting invasion. This means that deforestation *per se* often helps establish property rights ("homesteading") – whether by informal tenure recognition among a group of land-colonising settlers, or by the process of obtaining formally recognised land tenure through the responsible state agency. Homesteading thus promotes "excessive", speculative deforestation – beyond what can be explained by a pure economic rationale. If deforestation is rewarded with "homesteading", people may clear forests simply to gain control over the land, regardless of what is the most profitable land-use option.

A similar line of thought was also developed on p19 in lecture note 11A with a modified von Thünen model applied in Indonesia by Timothy Brown, Mubariq Ahmad and William Hyde, which explicitly incorporated costs of securing tenure as a function

of distance. Their assumption was that forestry can be competitive in situation where tenure is assured.

As mentioned above, whether or not forestry is actually the most profitable option varies over time and space.

4.4 The role of agricultural technology

Forests and agriculture are generally the most extensive land uses in the tropics. Agriculture tends to compete for land with forestry. Hence, higher agricultural land demand becomes the main source of forest loss, and many changes in agricultural profitability become the main drivers for deforestation. Nonetheless, the balance between recipient sub-sectors of new agricultural land is quite different between tropical continents:

- Cattle-ranching heavily dominates land-use change in Latin America: most deforested land ends up as pastures in land-extensive ranching systems.
- In Central Africa and in South Asia, extensive swidden systems for food crops (plantains, tubers, etc.) require large land areas for crops and fallows.
- In Southeast Asia and West Africa, logging of highly priced timbers has played a larger role in opening up forest frontiers. In Southeast Asia, much land has been converted to cash and estate crops (oil palm, cocoa, coffee, etc.).

Conversion from forests to agriculture is not always linear or permanent; over time it can involve cyclical processes. Figure 3 gives an example from Ecuador on how the stocks of forests and of agricultural area may dynamically interact, with changes in the latter driving adjustments to the former. The figure also makes it clear that the production technology used in agriculture is crucial for how much forest remains.

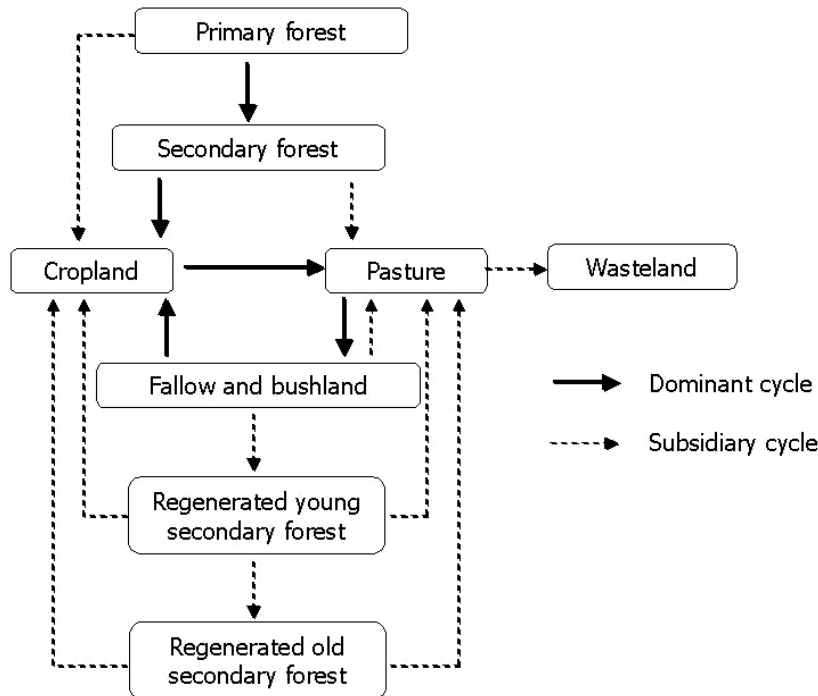


Figure 3. Example of a deforestation cycle. Source: Wunder (2000: 148).

It has been argued that the Green Revolution, with its drastic increase in the productivity of staple crop production, has saved a lot of forests. Further yield rises would be necessary if the remaining wildlands in the tropics are not to be sacrificed

entirely (Borlaug 2002). The logic of the Borlaug hypothesis would at first sight seem similar to that of the impoverishment approach: if prime agricultural areas can produce higher yields, then production need not expand into marginal lands. But what is the relationship between technological innovation and forest loss at different scales and under variable scenarios? A workshop held in Costa Rica in 1999 brought together a range of case studies around this topic, published later in a book (Angelsen and Kaimowitz 2001; Jayasurya 2001). This section will present some main results, and compare them to the model outputs from last section.

As a general observation, technological advances in agriculture, as well as the introduction of new profitable crops, will tend to make agriculture more profitable. So, in a given location, region or country, technological progress will usually cause higher deforestation – just as higher output prices do. This is what one would expect from neo-classical reasoning, with upward sloping producer supply curves (see above). However, several specific scenarios can change the picture, depending on factors such as farmers' type of production and of output markets (see Angelsen and Kaimowitz 2001 for technical details). Let us look broadly at the factors separating the two cases:

Q.1. Under what circumstances do new technologies or products *reduce* forest clearing?

1. **When labour-intensive techniques/ products are being introduced in forest-scarce regions.** In these cases, some labour that might otherwise have cleared forest fragments will be absorbed using new techniques that are applied to relatively large cultivated areas.
2. **Shifts in dual systems towards the sedentary, more land-intensive type.** Imagine a dual production system – on the one hand productive, fertile, irrigated prime agricultural areas in the lowlands, and on the other marginal, rainfed uplands with low yields. If new technologies are only applicable to the prime areas with best conditions, this will reduce output prices and diminish forest pressures in marginal zones (Jayasurya 2001). This process has driven forest regrowth in many marginal zones of developed countries.³
3. **Introduction of high yield varieties (HYVs) of cereals and other basic staples,** which have an inelastic demand (when prices go down, demanded quantities will rise little), will lower food prices. So, if the output market is limited and/or demand is price-inelastic, then an increased production will lower agricultural prices. This tends to reduce incentives for the expansion of production, and thus reduces deforestation.

The second and third case represent versions of the Borlaug hypothesis, and they underline the role of scale in scrutinising technology impacts on forest loss. Let us return for a moment to our cocoa farmer in Section 3, and assume that (s)he successfully introduces a new high-yield variety, which has been developed in that particular region. Consider three scenarios:

- A. The farmer sells the cocoa to the world market, and no other producer region adopts similar yield-improving techniques. Hence, our farmer and colleague innovators can sell unlimited additional cocoa at the same price. That provides farmers with good extra earnings, and they would be inclined to clear forest to plant more of the new variety.

³ See e.g. Mather, A. and C. L. Needle (1998). Trends in global forest cover: issues in explanation and modelling. Information bases for land use/cover change research. Proceedings of IGU-LUCC'97. Y. Himiyama and L. Crissman. Brisbane: 84-91, and Rudel, T. K. (2001). Did a Green Revolution restore the forests of the American South? Agricultural technologies and tropical deforestation. A. Angelsen and D. Kaimowitz. Wallingford, CABI: 53-68.

- B. Assume now, alternatively, that sales go via middlemen with large pre-accumulated stocks, so that the latter would only be willing to buy the additional cocoa production at a reduced unit price. In that case, producer incentives for new cocoa-led deforestation would be lower than under scenario A.
- C. Finally, suppose that all cocoa farmers in the world adopt the new yield-enhancing technique at the same time. That would flood the market with cocoa supplies and, depending on the demand elasticity of chocolate consumers, lead to a fall in world-market cocoa prices. This price fall would ultimately also reduce the incentives to expand cocoa production into the forest margins, compared to scenarios A and B.

In other words, the Borlaug hypothesis remains valid at the aggregate world-market level - or when markets are restricted by policy or by transport costs. Yet, when innovations occur at a lower scale, with access to external markets and fixed output prices, then it is likely that technological progress raises local land demand and increases local pressures on forests. In a way you could also put above scenario's A, B and C on a time line, whereby scenario A often happens at the beginning of a process of technological innovation, but where scenarios B and C come to dominate over the years.

Q.2. In which cases would new technologies or products *accelerate* forest clearing?

The first general answer is that, more often than not, new technologies will increase deforestation. The second is that this is more likely to happen specifically when one finds:

1. Labour-saving or -displacing products or techniques (e.g. mechanisation of crop cultivation, ranching, soybean introduction), combined with a flexible supply of capital. Part of the redundant labour will here be "set free" to expand into the forest margins;
2. Eradication of plant and animal diseases is a powerful tool to make production across-the-board more profitable (just like a price increase does), and thus also stimulates land demand and forest conversion;
3. Export booms with products that demand large initial immigration of labour, which subsequently is "set free" under bust periods to expand into the forest;
4. Forest margins with a high population density, high population growth and/or flexible immigration of labour.

Note that in all the cases illustrated above, forestland is mainly to be considered as an available reservoir of land, which will accommodate fluctuations in the demand for new agricultural lands. Perhaps the strongest result is the fourth observation. It implies that if one has an agricultural frontier with a flexible labour supply - probably a condition valid for most tropical frontiers - almost no matter what type of technologies you introduce and safeguards you take, higher profitability will go hand-in-hand with higher deforestation. That is a somewhat uneasy message to send to the managers of Integrated Conservation and Development Projects (ICDPs) that aim to make both the environment and local people better off simultaneously by means of improved agricultural systems. Yet, this picture is consistent with the problematic outcomes of most ICDPs (Gilmour 1994), and hence a revision of the overly optimistic Brundtland-report view on "win-win" options related to commodity production in tropical forests (Angelsen 1997; Fisher 2001; Wunder 2001a).

5. Comparing macro-economic links

After a short general introduction, this section will highlight how factors and policies at the national level "trickle down" to the forest level. The section will draw mainly on CIFOR country-comparative work specifically on long-run land-use changes in eight tropical oil countries (Wunder 2003). The primary cases here were Cameroon, Venezuela, Gabon, Ecuador and Papua New Guinea, with secondary studies on Indonesia, Nigeria and Mexico. We will also draw on comparative CIFOR research about the forest implications of policy responses to macroeconomic crisis and to structural adjustment in Indonesia, Bolivia and Cameroon (Kaimowitz, Erwidodo et al. 1998; Ndoye and Kaimowitz 2000; Sunderlin, Resosudarmo et al. 2001).

5.1 The general picture: forest impacts of economic growth, poverty, and population growth

In 1950, Simon Kuznets found that income inequality was rising in the early stages of an economic development process, while being reduced again in the later stages (Kuznets 1955). This pattern of an inverted U-curve over development phases has come to be known as the Kuznets curve. More recently, scholars have also looked out for an Environmental Kuznets Curve (EKC), testing whether also the environment "has to get worse before it can get better" by means of economic development. For forests, that would mean that the original or "pre-development" forest cover is first reduced over time and growing income, while in later stages it recovers somewhat (see Figure 4). There are mainly two factors that would cause a forest transition, i.e. a turnaround in forest-cover reduction. On the one hand, the greater concentration of intensified agricultural production on high-productive soils allows forests to come back on marginal soils where agriculture is abandoned. Second, more affluent societies may demand more forest products and services – and develop the institutions to effectively manage these forests (Mather and Needle 1998) and (Rudel 2001).

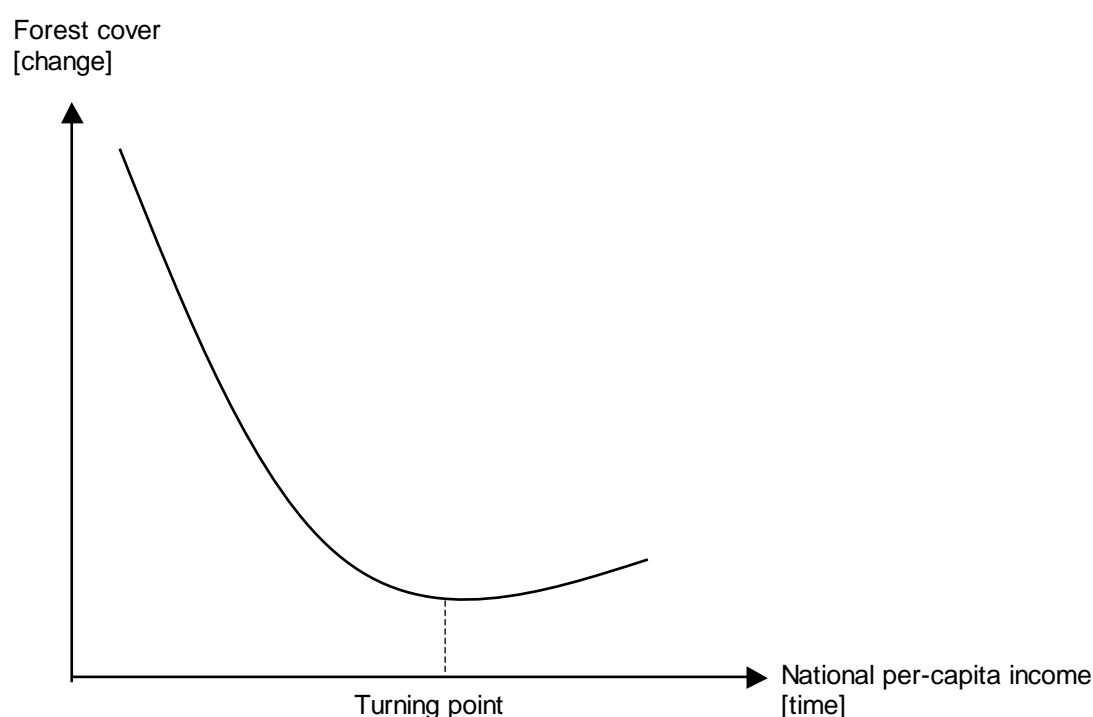


Figure 4. An Environmental Kuznets Curve (EKC) for forests?

While the pattern seems to fit some "brown" environmental problems (such as industrial emissions) fairly well, there has empirically been mixed support for an EKC on deforestation. In developing countries, economic growth is correlated with multiple sources of absolutely higher land demand, and even the *rate of* deforestation among developing countries does not always seem to go down systematically in later stages of economic development (Culas and Dutta 2002). It may be unlikely that tropical countries can economically 'grow their way out' of high deforestation scenarios - except in particular cases where urban sectors and the service economy have a very dynamic role (see below). In this special case, they come to resemble more the case of developed economies at very high income levels – countries that grow crops in specialised high-yield systems and can afford to import the bulk of the most land-demanding commodities from other countries. If a forest transition actually occurs, it may at very high income levels, the forest-coverage recovery may be modest compared to the original loss, and it may be a much less biologically diverse forest that 'comes back' (plantations, regrowth), compared to the natural forest that was lost in the first place.

By the same token, poverty and its reduction over time have an ambiguous effect on deforestation (Reardon and Vosti 1995; T. Reardon and S.A. Vosti 1995; Angelsen 1997). On one hand, poverty alleviation typically is associated with higher labour (opportunity) costs, which tends to reduce both forest clearing and degradation. On the other hand, when people become less poor they also start to consume more protein-rich foodstuff like meat and dairy products, which demands more land that can come from cleared forests. They may also save more money, which alleviates their capital constraints vis-à-vis investments associated with forest clearing. There are thus ambiguous effects. As we will see below, the net impact of poverty alleviation on forests depends on the relative weight of these different factors.

What is the role of demographic factors? There is no doubt that population growth generally tends to accelerate forest loss, since more people need more land to satisfy their needs – whether these needs are constant (Malthusian impoverishment scenario) or growing over time in response to economic opportunities (neo-classical scenario). The effect is most direct and powerful when people live in rural areas and depend on land-extensive swidden cultivation methods for their growing subsistence needs. It is more indirect when production is traded across regions and countries, so that trade integration and globalisation can displace demographic effects across space. In statistical tests of the relationship between forest cover/loss and population density/growth, the positive correlation has been found to be more significant at aggregated scales, in early stages of economic development and more in humid, forest-abundant than in dry, forest-scarce environments (Palo 1994; Uusivuori, Lehto et al. 2002). Population growth is thus a "slow driver", working mostly indirectly, and sometimes with a time lag. Rural population growth often does not open up forest margins on its own, but works in "tandem" with other factors (Geist and Lambin 2001). It seldom constitutes the "first impact", but rather it is key as a "fuel" to empower and upscale deforestation triggers in areas that have already been opened up (Rudel with Horowitz 1993).

5.2 The role of trade and foreign-exchange inflows

A recent case-study book on eight specialised oil and mineral exporters (Wunder 2003) and aggregate-level statistical comparisons of this group with tropical non-mineral exporters (Mainardi 1998; Sunderlin and Wunder 2000) jointly confirm three basic notions. First, oil- and mineral-rich countries in the tropics on average retain a greater share of forest cover than other tropical countries. Second, they also tend to lose their remaining forests at a slower pace than the other countries. Third, when they lose forests this happens much quicker during oil bust periods than during boom periods.

Somewhat surprisingly, the findings thus indicate that oil and mining revenues often come to protect forests.

The core reason is that an abundant inflow of foreign exchange from mineral exports allows for higher government spending levels that attracts people to the cities. At the same time, an appreciated real exchange rate makes both agriculture and timber extraction less competitive than in non-mineral exporting countries. In other words, these countries become very expensive and highly urbanised. They under-develop agriculture and forestry, which has a protective impact on forests, unless in special cases where the accompanying policies aggressively promote land occupation (see below). In most oil countries, however, road building into forested areas and other rural development policies become widely neglected. The urban population still consumes resources that indirectly leaves an "ecological footprint" on forests, but supplies come from either imports or peri-urban cultivation systems that tend to be more land-intensive than those practised by a rural-based population. In by far the most cases, urbanisation is thus, in net terms, good for forest conservation.

Conversely, from the research on crisis and structural adjustment we know that the opposite scenarios of foreign-exchange scarcity and currency devaluation often lead to an increased emphasis on land- and forest-based resources and a "re-ruralisation" of the economy, which eventually also increase pressures on the forest margins (see Box 2). One factor is that changes in relative prices make farming and logging more profitable, hence land users expand these activities to additional land. Another is that urban employment declines, making low-remunerative, rural-based activities the default option to secure livelihoods. Finally, there is a general pattern that crisis and sharp price fluctuations induce risk-reducing diversification strategies, e.g. in rural areas a larger portfolio of crops is grown by farmers so as to be prepared for unexpected income shortfalls. All these three effects increase pressures on forests.

Box 2. Cameroon: Forests between boom and bust

Few countries in the world have over the last three decades experienced such marked macroeconomic cycles as Cameroon. In the 1970s, the country was a showcase of stable agro-export led growth and economic development. Towards the end of that decade, and for the first half of the 1980s, world-market prices for main products like coffee and cocoa were very favourable. At the same time, recently discovered petroleum produced large additional revenues. As a result, Cameroon experienced a boom period with remarkable economic growth. Employment in the formal economy also rose, especially in the public sector (70% increase in six years) and in parastatals. Most of these state investments and expenses occurred in the urban economy, which was stimulated as a result.

But this all changed in the mid-1980s, when the country's good fortune turned around. World-market oil prices plunged, and so did other key export-crop prices, leading to a sharp terms-of-trade deterioration for Cameroon. Rising real interest rates made it more expensive to service the country's foreign debt. The public sector eventually had to be cut back drastically, and urban employment options dried up. Adjustment was made more difficult by the fact that Cameroon could not independently devalue the *CFA franc*, a currency tied to the French *franc* and shared with numerous other countries in Central and West Africa. As a result, Cameroon went into a deep, sustained recession that actually halved real per-capita incomes over the next seven years.

What was the impact of these accentuated economic cycles on forests? CIFOR research attempted to measure the impacts by collecting primary data on both land use and the economy of households, combining satellite imagery with socio-economic surveys in the same sites, and juxtapose this picture to the major macroeconomic trends. Only the southern, humid part of the country is forest-covered, so the survey of about 5,000 households in 125 villages and the time-series remote-sensing analyses concentrated on this area. In Ndélélé in East Province, yearly deforestation quadrupled in the 1986-91 period (594 ha) compared to 1973-86 (144 ha), rising further in 1991-96 (631 ha). Similarly, for the Bertoua area (also East Province), deforestation almost tripled from 1973-86 to

1986-91. In the peri-urban area near the capital, Yaoundé, deforestation doubled from 1987-95, compared to the previous period (1973-88). Household survey data from villages in all three provinces of the humid forest zone confirm that clearing of forests increased markedly after the onset of the crisis, because farmers enlarged cultivation for food crops (plantains and food crops). In other words, forest conversion rose substantially across the humid forest zone.

What was the reason for the drastic rise in deforestation rates after the 1986 onset of the economic crisis? Demographic surveys carried in a subset of the above villages showed that annual rural population growth exploded from 0.75% in 1976-1986 to 4.6% in 1987-97. During the boom, the expanding urban economy had absorbed most of the rural population surplus. Immediately after 1986, this trend stopped and the demographic surplus had to be absorbed in the rural areas. Yet, as the crisis continued (after 1992), there was even a net return of migration from urban areas back to the countryside. This caused a massive increase in the area of food crops, mostly for subsistence uses, which in shifting cultivation requires extensive fallows. Hence, households tended to clear more forests. Another crisis factor was that cocoa, the main cash crop, was thrown into a particular crisis due to the deteriorating competitiveness (only in 1994 was the *CFA franc* devalued), fluctuating world-market prices and the withdrawal of fertiliser subsidies and of public technical assistance. This reinforced a shift from land-intensive cocoa to land-extensive food crops. But farmers did not directly replace cocoa plantations with food crops; rather they would neglect the former and open up new fields for the latter, leaving them with maximum flexibility to respond to future changes in market conditions by returning to the semi-abandoned cocoa fields. Finally, logging also expanded, in particular after the currency devaluation in 1994, which helped to provide access for conversion of new frontier areas, especially in the East province. In combination, these changes triggered a massive increase in land demand in the humid forest zone, which was accommodated by a decrease in forest area.

Sources: (Mertens and Lambin 1997; Kaimowitz, Erwudodo et al. 1998; Ndoye 1998; Mertens 2000; Mertens and Lambin 2000; Ndoye and Kaimowitz 2000; Sunderlin 2001; Sunderlin, Resosudarmo et al. 2001; Wunder 2003).

5.3 What policies hurt forests?

Not only the external conditions created by trade and foreign exchange inflows have an impact; the domestic policy responses are also crucial in determining the net deforestation outcome. The book on tropical oil countries (Wunder 2003) identified the following ten major fields where national policies *de facto* came to *accelerate* deforestation.

1. Rural road building (or improvement) through/ near forests

First and foremost, those countries that had strong rural road-building programmes (e.g. Ecuador and Indonesia) also had high deforestation, confirming the micro impact of roads from above. Correspondingly, those that had not (Gabon, Papua New Guinea, Venezuela prior to World War II) also had very low deforestation.

2. Large gasoline subsidies

Not only roads reduce transport costs; cheap fuel has similar (though reversible and non-spatial) effects of reducing transport costs, thus enabling agriculture or timber harvesting from remote areas. Fuel subsidies thus accelerated forest clearing, as happened e.g. in Ecuador and Venezuela.

3. Large government spending at the frontier

Providing social infrastructure (schools, health services) in frontier areas helps to attract migrants and strengthens colonisation, and is thus conducive to deforestation. Conversely, neglecting rural development (as occurred, for instance, in Gabon) induces people to move out, agricultural areas to be abandoned and forests to grow back.

4. Currency devaluation

In the macroeconomic sphere, devaluation is a powerful tool to change relative prices and production incentives. If agriculture and timber harvesting are a tropical country's

main non-oil trade-exposed sectors, then making them more competitive through sharp and repeated devaluation will expand production, which tends to accelerate deforestation. Indonesia was a country that during the oil boom followed a strategy of frequent devaluations.

5. *Generous forest concessions*

A government that generously allocates land to concessionaires on favourable terms in an aggressive attempt to attract investors (e.g. Indonesia) will tend to face more rapid extraction rates. Thus, forest areas are also being opened up more rapidly for conversion. On the contrary, countries that raised timber taxation significantly also experienced some slow-down in extraction speed, as happened in Papua New Guinea in the last half of the 1990s.

6. *Import protection of land-extensive sectors*

Generally, protectionism has ambiguous impacts on deforestation. Yet, we can safely say that import protection of certain land-extensive sectors like cattle ranching in parts of Latin America or slash-and-burn produced food crops in Central Africa is detrimental to forests. These protected sectors then over-expand into marginal soils with very low returns. Protected domestic timber sectors can also be highly wasteful in their use of wood resources when lack of import competition induces them to become inefficient.

7. *Subsidised credits for these land-extensive sectors*

If the government provides specific subsidised credits for these land-extensive sectors, this will further result in over expansion, at the expense of forests. For instance, in Latin America a lot of subsidised rural credit is earmarked to cattle ranching, thus assisting the expansion of a sector responsible for the bulk of deforested lands.

8. *Resettlement into forested areas*

'Transmigration'-type programmes (like in Indonesia) where people are resettled from densely populated areas out into the forest, under the slogan of "bringing people with no land to a land with no people", will accelerate deforestation.

9. *"Homesteading" land-tenure rules*

Land-tenure agencies often allocate property rights to settlers only if they can prove that they continuously open up and convert 'unproductive' forestland, a practice one can find in all three tropical continents. As explained above, this fosters speculative forest clearing beyond of what is mandated by production motives.

10. *Abandon all family-planning programmes in favour of a pro-natalist strategy*

As explained above, high population growth has an indirect yet powerful effect on forest loss, so policies that encourage this will also accelerate deforestation. This is an underlying cause in all three tropical continents, but its strength depends on its interaction with other causes.

5.4 What policies protect forests?

Conversely, what policy package has *de facto* worked in the eight tropical oil countries as an effective protection of the forest margins? Most of the points listed here are a direct reversal of the above-mentioned factors that accelerate forest loss. The macroeconomic policies these countries followed were on average not particularly good development policies, but the following components happened unintentionally to be very effective in conserving forests:

Box 3. Unintentional forest conservation policies in tropical oil countries

1. Neglect the rural road network
2. Spend all the oil money in the cities
3. **Sell gasoline at its 'normal' price**
4. Keep over-valued exchange rates
5. **Tax logging companies heavily**
6. Heavily tax export agriculture
7. **Liberalise food imports**
8. Resettle people out of the forest to near roads
9. Waste budgets on agro-industrial 'white elephants' and ignore rural smallholders
10. Create a business environment where few people find it worthwhile to produce

Source: Wunder (2003: Chapter 10).

Compared to the above "reverse" list, some factors in Box 3 merit additional explanation. Regarding (5), the implication is that if governments are able to capture the bulk of stumpage values, the rate of timber extraction will be slower, which will also reduce some of the conversion that is enabled by logging roads and other "opening-up" effects. For (7), more food imports will reduce the size of domestic land-extensive cultivation, and possibly increase overall efficiency in the use of resources. (8) indicates that some resettlement programmes, notably in Central Africa, have actually curbed deforestation, because they have moved people *out of* remote forested areas and into roadside settlements with typically more land-intensive agricultural production. (9) refers to the fact that an inefficient use of public funds in agricultural parastatals and misguided mega-projects has come to benefit forests because these activities never accomplished to clear the land they originally had planned to. Likewise, (10) notes that if a general rent-seeking mentality surges, as occurred in the oil countries, then the lack of entrepreneurial spirit will become a serious obstacle to any type of commodity production, which obviously also relieves pressures on forests.

We should note that of these *de facto* effective conservation policies, only one - taxation of logging operations (5) - originates in the forestry sector itself, whereas another one - resettlement (8) - affects forested area directly. All the other measures are "extra-sectoral" - they are "blind" strategies of "conservation by chance", with measures originally designed to achieve completely different purposes.

We could also ask the question how this ten-point set of policies would likely be received by development decision-makers - say, the Minister of Planning or a World-Bank team helping to design a structural adjustment programme and a poverty-reduction strategy. Probably, only three out of the ten components (the ones in **bold** in the Box) would have a chance to earn positive marks vis-à-vis a list of "good development policies". These would be the elimination of gasoline subsidies (3), an effective taxation of logging rents (5) and a more liberal food-import regime (7). All the other measures, from urban policy biases to semi-corruptive practices and excessive interventions, would be perceived as having negative impact on economic development and poverty alleviation - some of them in a decisive way. This indicates that the hard trade-offs between tropical forest conservation and economic development do not only occur at the micro-intervention level (see above), but also when we look at the big policy decisions at the macro level.

A study from the Philippines confirms that some of these tools interact (Araño, R.R. and Persoon, G.A., 1998). As little natural forest is remaining in the Philippines, it is often seen as an example what could happen in neighbouring, still forest-rich countries. One successful move to preserve pristine forest was the cancellation and non-renewal of logging concessions around the Sierra Madre Natural Park in the northeastern Philippines. As no more logging roads are being constructed and old

logging roads are deteriorating, forest protection increased markedly. So, in this case action (5) was implemented drastically (a complete closure instead of a taxation), which resulted in a degraded road network (1).

Exercise:

The following questions could be discussed in small groups:

1. For the forest area where you work (or which is closest to where you live) make a list of conditions and factors that stimulate deforestation.
2. What above mentioned deforestation approach would explain best the deforestation, which has been going on so far?
3. Why? What reasons or observations support your choice?
4. What would be the most suitable policies to protect that particular forest?
5. Would these policies stimulate economic development? If not, which groups will be most disadvantaged by implementing them?
6. Should these groups be compensated? And if so, how could that be done?

6. What does this mean for Indonesia?

6.1 Screening the main deforestation drivers

We will now turn to a brief examination of policies and deforestation causes in a single country, Indonesia. We will do that by comparing the pattern of policies and macroeconomic development over the last decades with that of land-use change and forest loss.

Initially, as mentioned above the model synthesis by Kaimowitz and Angelsen (1998) also included seven models for Indonesia. By looking at the main deforestation factors identified in these models, we can obtain at least a preliminary idea about what factors have driven forest loss in Indonesia. The main factors found to cause higher forest loss over time or space in these models fall into the three domains of agriculture, logging and infrastructure:

Box 4: Deforestation drivers identified in economic models of Indonesian deforestation

Agriculture

- high output prices and/or low input costs
- high productivity and/or good soil quality

Logging

- high timber prices and/or low timber extraction costs
- the type (and terms of operation) of logging concessions

Infrastructure

- low transport costs (e.g. rural road density, type, maintenance)

From the set of factors in Box 4, we can already make some observations vis-à-vis the three approaches of deforestation from Section 3, Table 1:

- Commercial incentives have been the dominant drivers. Although some factors (such as soil quality) can also be subsistence-driven, most relate to markets.
- “Neo-classical” (and possibly “political ecology”) explanations are more relevant than “impoverishment”. The deforestation-accelerating effect of higher productivity/ output prices/ lower input costs clearly shows that farmers react to “pull” incentives.
- The impoverishment mechanism of a vicious circle whereby a poor and increasing population is pushed to convert new forests to grow food crops is less

relevant for the last three decades in Indonesia. If one increases agricultural profitability at the forest margin, one should expect forest loss to go up in Indonesia, not down.

- Logging has had a larger deforestation role in Indonesia than in most other countries. It has helped to open up forest frontiers. The sector has often provided the basic capital for alternative land uses, e.g. oil-palm companies that have depended on harvesting timber profits first to then finance investments in the estate crops.
- Box 5 provides by means of an example from Lampung (Sumatra) some additional insights into how trade, macroeconomics, demographics and government policies can interact in a way that is highly conducive to deforestation. The example illustrates further that “neoclassical”, market-oriented motives of deforestation are prevailing in the Indonesian context, even in the case of smallholders. It also shows that forest loss can seldom be explained by single factors, since “deforestation tandems” or multiple causes at different levels are jointly enabling the process of forest clearing.

Box 5. Underlying causes of deforestation in Lampung, Sumatra (Indonesia)

Sumberjaya, a watershed of about 730 km² in West Lampung, Sumatra, experienced a loss in forest cover from 60% in 1970 to 12 % in 2000. Correspondingly, smallholder coffee systems increased their share from 7% to 70 %. About two-thirds of this area had been classified as ‘protection forest’ to preserve watershed functions, so forest conversion to coffee triggered (often violent) reactions from state forest guardians. From 1991 till 1996 thousands of people were evicted and relocated and houses and coffee harvests put on fire.

Since 1951 the Biro Rekonstruksi Nasional (BRN), a transmigration program under the coordination of the army, had stimulated the local resettlement of Javanese veterans from the independence war (Kusworo 2000). Good soils, construction of roads and attractive coffee prices also attracted spontaneous migrants from Java to Sumberjaya, especially during 1975-1985. The yearly population growth of 7.5 % during 1978-1984, doubled the population from 40.000 to 79.000 and was thus heavily driven by immigration, triggered by high coffee prices (see below). After 1976 many Javanese, who had come as seasonal labourers for the coffee harvest, set up their own farms and actively opened large tracts of forest.

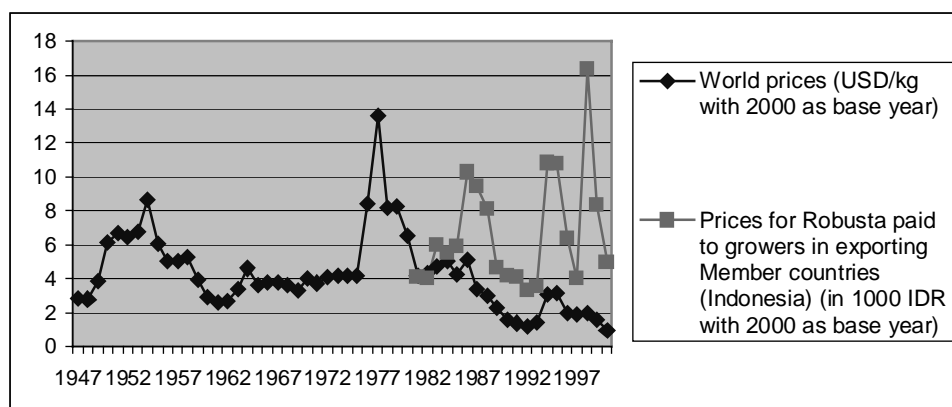


Figure 5. Indicator prices for Robusta (USD/lb) on the world market compiled from International Coffee Organization (ICO) reports at <http://www.ico.org> and Karanja, 2002 were deflated to real prices (USD/kg) using the United States Consumer Price Index (CPI) with reference year 2000. Real average annual coffee prices paid to Robusta growers in Indonesia (source ICO), were deflated using the general Consumer Price. This Rupiah price series is based on ICO-data. Due to market deficiencies these prices tend to be higher than what farmers really get.

But favourable conditions and a stream of both directed and spontaneous migrants were not the only underlying deforestation drivers.

From figure 5 it becomes clear that after the coffee price surge in 1975 and 1976 due to frost damages on the coffee harvest in 1975 in Brazil, which by then had a market share of 35 %, real global prices have been in an almost continuous downward spiral interrupted by only a few (and small!) upward periods!

However this downward trend is not apparent for Indonesian growers. Regular devaluations of the *rupiah*, dramatically increased prices paid at farm gate during subperiods and gave a more 'spiky' pattern to local prices for growers. During and after the oil-price boom in the 1970s, which Indonesia as an oil producer also benefited from, the country did not like other oil exporters let the currency appreciate to uncompetitive levels. On the contrary, economic policy emphasized currency devaluation as a tool to actively protect export farmers' interest. Devaluation was also strong following the economic crisis in 1997. In 1998 the average price per kg at farmgate rose to 12.000 Rp compared to Rp 4.000 a year earlier.

In other words, deforestation in Sumberjaya was driven by a combination of policies and market factors, specifically favourable export-crop prices, currency devaluation, transmigration measures and spontaneous migration.

6.2 New Order policies and development strategies

In spite of the financial crisis and political turmoil accompanying President Suharto's downfall, for his three decades of "New Order" period as a whole, Indonesia's economic-development record has been quite impressive. Policies have been characterised by:

1. Macroeconomic policies widely praised for their prudence, continuity and timeliness (Gelb and Glassburner 1988; Bevan, Collier et al. 1999b).
2. An economic strategy of openness to 'mobile' capital both of foreign and Chinese-Indonesian origin. Relatively liberal capital movements and other measures to attract investment (Winters 1996).
3. A competitive real exchange rate-including the active use of currency devaluations (Warr 2000), favouring the exports of urban labour-intensive industries (textiles, electronics, etc.), cash and estate crops, and forest-based industries-with the consecutive rise of timber in the 1970s, plywood in the 1980s, and pulp & paper in the 1990s (Barr 2001): Chapter 2).
4. As a result of 1, 2 and 3, a remarkably high per-capita growth in national income and private consumption, turning Indonesia from an extremely poor country in the late 1960s to a middle-income economy in the 1990s.
5. Significant policy attention to rural development, agriculture and food security-including massive increases in rice productivity (Scherr 1989).
6. As a result of 4 and 5, major long-run progress in rural and urban poverty alleviation and in non-income welfare (higher life expectancy and primary education enrolment, reduced child mortality, etc.)(Hill 1992; Sunderlin 1993; World Bank 1999b).
7. Aggressive land-use policies opening up forest margins through generous timber concessions, transmigration programmes and rural road construction.

6.3 Forest lost and converted

Turning now to the forest sphere, Indonesian deforestation figures are notoriously uncertain (Sunderlin and Resosudarmo 1996). A handful of remote-sensing based studies exist, but variable forest definitions and coverage make the estimates very difficult to compare. Nonetheless, in Box 6, some rough numbers on both measured forest loss and its converted uses over the last two decades are given. These are based on estimates from Forest Watch Indonesia/ Global Forest Watch (FWI/GFW 2002), a consultancy report comparing a variety of sources (Muhamad 2002) and a synthesis of additional statistics on cropped areas.

Box 6. Indonesian deforestation – measurement and proximate causes

Measured deforestation between 1980-2000:	about 30 million ha	
Conversion 1980-2000 (proximate causes):		
Estate-crop and perennials expansion	12+	million ha
Forestry expansion (pulp harvest and plantations)	3÷	million ha
Food-crop expansion (incl. swidden)	7-8	million ha
Total converted uses 1980-2000:	about 22-23	million ha

Source: Wunder (2003: Chapter 9)

As indicated by the ranges and \pm signs in Box 3, these figures are subject to great uncertainties. Deforestation figures depend on the assumption regarding the differences in definitions and coverage (see above). The expansion of estate and cash crops is underestimated, as some of the minor crops are not accounted for. Forestry expansion is probably over-estimated, as some of the areas harvested by clear cuts have been put into cash and estate crops, and thus are double-counted. In addition, both natural forests and forestry plantations are “forests” in FAO terms, so converting one to the other should not count as deforestation.

Still, it seems worthwhile to get the guesstimates down on paper, and allow for an explicit discussion of the proportions. Even the rough figures show that perennial and estate crops make up more than half of converted land use. They also seem to indicate an inconsistency between deforestation and alternative uses. As by far most of Indonesia's "default" vegetation cover is tropical forest, we would expect deforestation and converted land use to approximately match. But the total conversion of about 22-23 million ha falls about 25% short of the alleged deforestation figure. The numbers don't add up in Indonesia!

One possible explanation is that forest clearing ‘runs ahead’ of conversion because of the economic attraction to harvest timber and pulp resources, combined with a lack of capital to put the cleared land under alternative uses. An example is what happened with the oil palm plantation sector. In 1999 the area planted with oil palm was 2,957,079 ha (Casson 2000: Appendix 2), but after the 1997 economic crisis and a partial palm-oil export ban, the poor financial condition of most of these conglomerates made them focus on gaining profit through logging, with less investment in new plantations. They chose to hold about one third of the concession area as a land bank, where timbers were extracted but no oil palms planted so far (A.Casson, e-communication, 15 July 2003).

Part of the data discrepancy could also be explained by outright errors in land classification leading to overestimated deforestation figures. In the official figures, a total forest area of 143 million ha is often cited. Comparison of a few case studies, where official maps were compared with Remote Sensing imagery indicates that a lot of forest conversion on the ground was never considered in the statistics. The discrepancies seemed to be larger in the late 1980s and 1990s.

Returning to the policy aspects, the tentative figures confirm the suspicion from above that commercial "neo-classical" motives have clearly dominated in the Indonesian deforestation case: cash- and estate-crop expansion has been much more important in quantitative terms than the increase in food-crop areas.⁴

What role have macroeconomic policies played for the outcome of accelerated forest loss? Did forest loss contribute to economic development – or was it even a necessary

⁴ Even many so-called "food crops" can actually be major cash generators for their producers, due to the growing importance of national markets. This further reinforces the role of commercial processes.

condition? These complex questions are not analysed in detail here. One can cast doubt on whether the policies of generous large-scale timber concessions contributed much to the positive macroeconomic outcome. The wood-based industries generated much foreign exchange and accumulated capital for reinvestments in other sectors, but the direct employment effects were limited and often local people in rural areas were expelled from their land, in the way it is described in the "political ecology" literature. On the other hand, much of the expanding cash and food crops were owned by smallholders, helping to appreciably consolidate the rural economy and alleviate poverty – much more than in countries with marked urban policy biases (see above). The development of labour-intensive agriculture was an effective motor for poverty alleviation, but it had a deforestation cost. Many of the policy measures were good for the macro-economy, and even for the majority of poor Indonesian people, but most elements were also bad news for forest conservation. This underscores the notion from last section of important policy trade-offs at the macroeconomic level.

7. Conclusion and policy recommendations

Tropical agriculture is the great land-use competitor of tropical forests, and by far most deforestation occurs in order to increase farmlands. Hence, most policies and interventions that favour the expansion of agricultural production also come to decrease forest area – at least that is true for the type of forest-abundant agricultural frontier areas and forest margins that we have been concerned with in this paper. In some cases, agricultural expansion is driven by a growing poor population growing food crops with land-extensive swidden cultivation (impoverishment approach). In others, it is the emergence of new market opportunities that drives the process (neoclassical approach). In a third set of cases, it is the clashes between these two processes that provide the main impetus (political ecology approach). Independent of what the dynamics are, there are normally strong underlying factors, most of them outside the forest sector, that enable and empower the conversion of forests to alternative uses.

Notably, even agricultural ‘intensification’ that increases per-hectare yields can accelerate forest loss. Intensification is often seen as an area- and forest-saving factor, but that effect is highly context- and scale-dependent. It certainly holds for widely adopted intensifying innovations that reduce the total market price through their strong supply-boosting effect. Yet, where adoption is limited, innovators increase production but prices remain high, so they will, in most cases, scale-up their now more profitable production. Hence, they will tend to deforest more, rather than less. Almost any agricultural investment in frontier areas with flexible labour supply promotes deforestation. Hence, it is hard to design agricultural programmes in these regions without a negative effect on the remaining forest.

Let us evaluate policy responses observed in the set of eight oil countries, as to what can be done *strictly with the aim to stabilise the forest margins*, i.e. disregarding for a moment the people living in and around forests and their development aspirations. We should distinguish between those factors that directly affect land extensification through a spatial effect, and those that work through the society-wide, macro-level context.

I. Reduce land extensification:

- Stop building or improving roads in remote rural areas near tropical forests
- Don’t give subsidised credits and inputs to “land-hungry” production sectors
- Don’t give out overly generous forest concessions to the timber companies
- Stop rewarding deforesting squatters with secure land rights
- Stop moving and/or directing people into forests

- Stop financing development projects in the forest margins
- Use instead resources and incentives in favour of other areas (e.g. pre-established “prime” agricultural zones, urban areas, peri-urban agricultural systems)

The last two recommendations will be controversial, and need qualification. They do not imply that it is *impossible* to design forest-margin projects that through institutional fine-tuning and micro-adjustment of interventions will be successful in stabilising land demand at the forest margin. However, it is difficult to do so, and among the many projects that have tried to achieve it, the majority has failed. It is easy to predict that when money is spent in the forest margins – be it on health, education, R&D, value added activities and especially on agriculture – in the medium term these investments will have spin-offs that tend to attract more people and foster economic development. But more people and more development both mean, in most cases, more local land demand. That land is usually made available by converting forests. This is a serious risk that even the most well-intentioned forest-margin project will face.

II. Create a conservation-conducive macro-level context

- Promote high urban labour absorption to keep people from migrating to the frontier
- Avoid excessive economic fluctuations through careful adjustment policies
- Avoid currency devaluation making agriculture and logging overly attractive
- Don’t provide subsidies to make fuel cheaper
- Liberalise food and timber imports
- Reduce population growth as an important long-term driver

As for the spatially explicit recommendations above, many of these economy-wide proposals are deeply problematic from a development perspective. Unfortunately, many ‘good’ development policies (for economic growth and poverty reduction) are bad for forest conservation. Conversely, some ‘bad’ development policies come to protect forests. These *de facto* conservation successes are the result of ‘blind’ strategies and unintentional side-effects from macro policies. In particular, non-forestry (extra-sectoral) policies prove to be much more important for forest cover than forest policies proper. This part of the picture is not very encouraging.

Among the mentioned policy tools and interventions, there are some ‘win-win’ options that are promising for both forest conservation and economic development. Generally, the removal of subsidies with ‘perverse’ forest impacts (fuel, cheap agricultural inputs) has such potential. Forestry sector reform in developing countries can potentially help to capture (and distribute more fairly) timber stumpage values while also slowing down the “opening up” of forest frontiers. Speculative land tenure arrangements caused by “homesteading” rules could be eliminated, and provide some social benefits at the same time. Import liberalisation in the timber and food sectors could reduce forest loss while increasing economic efficiency and (arguably) fostering national development in the long run.

Yet, it becomes clear from the above (as well as from the ASB Lecture Note #10) that the interface between forest conservation and (local or national) development in the tropics exhibits more trade-offs than synergies. A logical consequence from this diagnosis is that direct compensations for environmental services, i.e. rewarding local land users for forest conservation yielding benefits to outsiders (related to watershed, tourism, carbon-storage and biodiversity) should be explored. Only if they are compensated in a *quid pro quo* for their opportunity costs of conserving the forest will they take these external benefits into account in their land-use decisions. Although experiences in the tropics with these schemes are incipient, they are certainly

expanding (Landell-Mills and Porras 2002; Pagiola, J. et al. 2002)— and they are badly needed as applied conservation tools in a world where tropical forests continue to recede.

8. The micro-macro paradox – reactions to the Oil Wealth book

Some publications start to live the most interesting part of their life only after having been introduced into the public domain. The aforementioned book on oil countries (Wunder 2003), with its controversial conclusion that oil through macroeconomic effects can come to protect tropical forests, is one such example. We reproduce here, with permission from the authors, first the harsh criticism from two of those environmental NGOs that have been working particularly on topics related to oil and mining, the Ecuador-based Oilwatch and the World Rainforest Movement (WRM). Their Open Letter to CIFOR (July 2003) was e-distributed on “WRM friends” to reach thousands of recipients. It focuses on the importance of direct effects of oil operations in the tropics, and also profoundly questions the scientific value of the CIFOR study.

Box 7. Open letter to CIFOR (Center for International Forestry Research)

From: Oilwatch and World Rainforest Movement
To: CIFOR Director David Kaimowitz
Re: CIFOR study strengthens oil exploitation and mining

The Oilwatch Network and the World Rainforest Movement are deeply surprised and shocked by a CIFOR study which appears to give green credentials to two activities that are at the core of deforestation and forest degradation: oil and mining. The study ("Oil, Macroeconomics and Forests: Assessing the Linkages", by Sven Wunder and William D. Sunderlin), constitutes one of the worst examples of a biased, simplistic and unscientific study.

The authors show a total lack of understanding about forest ecosystems and on how oil and mining impact on them and on their inhabitants. The authors fail to understand that a forest is not simply an area covered by trees and that the presence or absence of tree cover is but part of the equation. A forest is an entire ecosystem, including people, fauna, flora, water, air and soils. All these components are severely degraded by oil activities (people are killed, repressed or expelled; local animal and plant species are severely impacted and some driven to extinction; water courses suffer pollution, siltation and alteration; the air becomes poisoned and so on). However, the authors of the study only look at questionable data about forest cover to "prove" that oil and mining serve to conserve forests.

The authors also fail to identify oil activities as a major direct and underlying cause of deforestation and forest degradation. They don't mention that even before a single barrel of oil is produced, prospection activities result in extensive deforestation and in the violation of local peoples' rights. It also results in facilitating access to forests by other actors through the opening of roads, a process which accelerates as oil production increases. The major underlying causes of deforestation and forest degradation (land tenure issues, macroeconomic policies, sectoral policies, external debt servicing, among many other) are either ignored or diluted, putting most of the blame of deforestation on agriculture and livestock production carried out by local dwellers.

The study's conclusions constitute a show case of unscientific manipulation of information. In spite of the fact that the findings in the five countries analysed do not support the authors' hypothesis, they "adjust" them to achieve their aim. They are even forced to divide Venezuela into two different countries --pre and post World War II Venezuela—simply because the latter proved their hypothesis wrong. Using their same information, anyone can reach exactly the opposite (equally biased, simplistic and unscientific) conclusion. Were the hypothesis to be that oil and mining in no way help to conserve forests, the "conclusions" would be (using the same wording as the authors) that Ecuador (and post World War II Venezuela) are "confirmative cases in absolute terms", that Papua New Guinea is a case of "relative confirmation" as well as Cameroon, "though a more hesitant one",

while Gabon and pre World War II Venezuela "were the only cases outright rejecting the core hypothesis."

The authors' solution to the forest crisis is in line with their analytical approach: take people out and let oil and mining companies take care of the forests. The absurdity of this approach is best visualized in their "ten-component so-called 'Improved Gabonese Recipe' for achieving maximum forest conservation". In that respect, it is more than sufficient to mention --with no need to comment-- their point 8 ("Force rural people to settle in concentrated roadside agglomerations"), point 9 ("Waste your agricultural budget on agro-industrial 'white elephants' and ignore smallholders") and point 10 ("Nourish a rent-seeking environment in which few people find it worth while to produce") to declare this study a demerital approach to forest conservation.

Within that framework, the authors are finally able to prove that reality does not really exist, by concluding that "Oil production in itself is a negligible direct source of deforestation, compared to national land use. Its direct degradation impacts are variable, and have in many cases declined over time through better practices. The same is true of mining [which is not even addressed in the study] though its effects can be more significant: there are some examples of severe forest loss caused by mining."

For people subjected to oil and mining this study is not only science fiction; it is a mockery of science. We deeply regret that what many people have until now considered a serious research institution such as CIFOR is giving this study its institutional backing. The oil and mining industries will be extremely happy, but this is a very sad day for forests and particularly for forest peoples struggling against what the authors have never had to live with: the social and environmental destruction that these activities entail.

Further strengthening the oil and mining companies, CIFOR is now publicizing another publication (not available through its web page) obviously in line with the one we comment above and written by one of its authors (Sven Wunder). Both CIFOR and the author of "Oil Wealth and the Fate of the Forest: A Comparison of Eight Tropical Countries" perceive the implications of the study. While CIFOR feels obliged to state that it "does not receive funding from oil or mining companies", the author says that "environmentalists should not misinterpret this report". However, if this book reflects the same findings as the one we comment (and the CIFOR news release on this publication show that this assumption is correct), then it will not be a question of "misinterpreting" anything, but of making CIFOR and the author responsible for providing the already extremely powerful oil and mining companies with a very useful tool for greening their image while destroying forests and forest peoples' lives.

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Ricardo Carrere
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David Kaimowitz, the Director-General of the publishing institution (CIFOR), react to this letter in a way that defends the scientific value of the study, that stresses the broader context of other negative impacts from oil and mining, and warns against misinterpretations of the results.

Box 8. REPLY from David Kaimowitz, Director General of CIFOR:

Dear friends from Oilwatch and the World Rainforest Movement,

We can appreciate your concern about CIFOR's recent study on "Oil Wealth and the Fate of the Forest: A Comparison of Eight Tropical Countries". We are aware that both of your organizations have been doing excellent work exposing the negative direct impacts of oil and mining activities on tropical forests and forest dwellers, and feel that this study could undermine your work.

Our study in no way discounts nor minimizes the negative direct consequences of oil and mineral activities for forests and we certainly do not support either the oil and mining industries large

contribution to global warming or their frequent role in promoting corruption and undermining the rule of law.

The CIFOR study focuses on the macroeconomic effects of the revenues that oil and mining generates and how that affects forests indirectly through exchange rates and government budgets. It finds that when large amounts of money comes into countries from oil and mining revenues (or anything else) that tends to increase the value of national currencies and promote government spending in urban areas and that often reduces pressure on forests. The study also makes clear, however, that things do not always work this way because if governments use their new oil revenues to build roads, like they did in Ecuador, or finance transmigration programs, like that did in Indonesia, those negative effects can outweigh the positive effects. The same can happen if all the oil money goes to the rich who then go out and buy steaks and that encourages cattle ranching.

Why did CIFOR do this study? Our goal was definitely not to justify the oil and mining industry. It was to show that the macroeconomic policies typically associated with structural adjustment programs such as exchange rate devaluations can have very negative impacts on forests. This helps to strengthen the argument that the World Bank and national governments must do environmental impact assessments of their structural adjustment policies. The methodology used in the book also shows that it is in fact possible to do environmental impact assessments of structural adjustment policies.

We have been aware from the beginning of this research that the positive objective I just explained ran the risk of unwittingly justifying the actions of the oil and mineral companies. We have tried as much as possible both in the book and in our press release to make very clear that it is not oil and minerals per se that have positive impacts on forests - it is rather any large influx of money. That could come just as well from debt relief, remittances, and any other source. And given the negative direct impacts from oil and mining it would be much better if the money did come from these other things.

However, we chose oil and mining for the study for two main reasons. First, about half of all the tropical forests in the world are located in countries that rely heavily on oil and mining exports. Second because the booms and busts in the oil and mining industries provide a perfect opportunity to study the impact of the revenues that come in, by looking at pressure on forests before the oil booms, during, and after.

I can appreciate Oil Watch and WRM's belief that the negative consequences of saying anything positive about the oil and mining sectors outweighs the importance of demonstrating that Structural Adjustment Programs have major indirect impacts on forests than need to be monitored. That is a judgment call, and we may very well have been wrong.

I do not accept, however, the claim by Oil Watch and WRM that the CIFOR study was in any way unscientific. Moreover, I find it somewhat surprising that the claim was made apparently without ever reviewing the study itself or requesting a copy of the study itself from us. The study, which is an almost 500 page extremely detailed and well document book published by Routledge Press, is the result of almost three years of full-time research by one of our most serious and competent researchers. It carefully documents each of its conclusions and makes all of the study's caveats and limitations extremely clear.

I was also somewhat surprised by the quote from Ricardo Carrere in the New Scientist in which he implies that CIFOR would prefer to have oil companies managing forests than local people. I would certainly hope that he knows us well enough not to think that is the case. As a center committed to alleviating rural poverty and sustainable management of tropical forests, CIFOR places central importance on the role of local people in any decisions affecting forests.

CIFOR remains as willing and interested as ever in working closely with both WRM and Oil Watch on the very many issues where we strongly agree.

With very warm regards,

David Kaimowitz

Director General, CIFOR

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Finally, the author of the book (Wunder (2003) also responded the Open Letter. His response defends four scientific aspects vis-à-vis the criticism raised: site-specific oil effects, economy-wide effects, the effect of other financial transfers, and the general empirical underpinning of the work.

Box 9. REPLY from the Author

Dear Ricardo and Esperanza,

Thanks for the attention you have given to our Oil and Forests study.

David Kaimowitz' response to you reflects already quite well William Sunderlin's and my own queries vis-a-vis your Open Letter to CIFOR on our study. First, your review is based on a non-published, e-distributed summary draft that in no possible way can contain the full documentation for a multi-year study of this type. You simply haven't seen the full argument. This documentation (incl. data for three additional countries) is available in the book "Oil Wealth and the Fate of the Forest. A comparative study of Eight Developing Countries" (see publication information at the end of this e-mail).

Second, some quotes and references from the draft article are directly misleading, e.g. in regard to biased policies that we find to be de facto forest-protecting, but without in any way recommending them ourselves (as suggested by you): "Hence, this is not a list of our policy recommendations, but of policies that de facto have protected forests in our study countries" (p.18 in our paper). Unfortunately, your quotation is thus out of context.

This is not the place for a specialized discussion of technicalities, but let me just respond to four main points raised in your Open Letter:

1. SITE-SPECIFIC IMPACTS OF OIL PRODUCTION:

This study does not try to downplay unscientifically the damages from oil production. In the book, we quantify in detail the direct forest-cover area impacts in the five main study countries from both oil exploration and production, using a range of estimates. We do find these deforestation impacts to be very small - often by orders of magnitude lower than those from alternative sources of deforestation - proving some previous claims exaggerated. Indirect effects of opening up forests to other damaging activities, e.g. by road building, can cause more deforestation, though in most countries many roads are also being built into areas unaffected by extractive industries. The book makes it very clear that deforestation is not everything, since damage to forests can occur also through the severe environmental and cultural degradation effects, as documented for the particularly gloomy cases of Ecuador and Nigeria. Oilwatch's and other NGOs' valuable work is being widely cited in these sections. Unlike for oil, the site-specific effects of hard-rock mineral extraction are only partially documented in the book. In some of these cases, the effects have been in the same limited range as for oil, in others there have been huge deforestation effects, such as in some parts of Papua New Guinea where entire watersheds were affected. This leads to a much more differentiated message: good practices actually matter a lot for the site-specific effect of oil and mining.

2. ECONOMY-WIDE IMPACTS OF OIL REVENUES:

A general lesson from the book is that, if an oil or mining activity is being stopped for environmental reasons, this is normally not the end of the story. If poor developing countries do not make money from oil, economic mechanisms will induce them to make more money from other sources. Vice versa, if they are very oil-rich, they tend to widely ignore these other sources. Two main alternative income sources are agriculture and timber harvesting. Both of these, we found to be expanding significantly in periods of low oil incomes, responding to economic crisis and currency devaluation. Forest conversion to agriculture and cattle ranching constitute globally the main end use of deforested lands. In that sense, oil incomes and other financial transfers (see below) can ultimately reduce pressures on forests by reducing the foreign-exchange squeeze that plagues many countries that are indebted and have few options to participate in world markets. The pressures are alleviated because US\$1 million generated from oil extraction on average tends to require much less deforestation than US\$1 million earned from additionally exported cash crops or

from import-saving food crops. There are thus important economy-wide trade-offs involved, which we must not ignore by over-focusing on the site-specific impact of just one sector.

3. DEFORESTATION EFFECTS OF OTHER FACTORS:

This book is not only about oil. Other foreign-exchange transfers, like debt relief and remittances will in most cases have similar effects of discouraging land-extensive production that requires a lot of forest clearing. I am saying "in most cases" since domestic policies are extremely important in ultimately determining forest impacts. The lessons about macroeconomic policy impacts also have wide applicability for countries that are not endowed with oil. These are probably the most important points from our work, yet somehow they get lost in your Open Letter.

4. EMPIRICAL SUPPORT TO OUR MAIN HYPOTHESIS:

It is incorrect to say that, by reversing the main hypothesis of "oil revenues come to protect forest" to the opposite ("oil revenues accelerate forest pressures"), the conclusions would also reverse accordingly. First, chapter 2 in the book reviews different studies clearly indicating that tropical countries specialized on oil and mineral exports have more forest left than other countries, and that they lose these forests at a significantly lower rate than other countries. This finding is valid across the entire tropics, not only for the eight countries we selected for detailed study. In the study countries, there is a clear pattern that in times of oil booms, net deforestation either reverses to forest regrowth (absolute confirmation), or it reduces deforestation rates (relative confirmation). The reversed hypothesis only holds for one out of the eight countries (Ecuador), for reasons that have to do with the specific policy responses in that particular case.

In sum, this book does not provide a carte blanche to oil and mining companies to expel people and to manage forests for profits only at their own discretion. On the contrary, it strongly advocates companies' use of "best practices". It also points out that the "invisible effects" of oil-derived incomes on the economy tends to have unintentional side-effects of protecting forests, which in most cases are far more powerful than the direct deforestation. That can sometimes lead us to reevaluate whether these operations are environmentally desirable or undesirable: you may lose less forest than you win. In other cases, the quality and importance of a certain forest resource threatened by oil operations may be so important that it should not be carried out - even if, in the worst case, it means that the country's citizens eventually clear much more forest elsewhere than was originally saved. Finally, other international and national policies have similar effects - oil is not a necessary part of the equation.

Why don't you read, or at least skim the book, and then let us know if you are still skeptical about the findings? To do less than this would be unfair to the years of research that have been put into this work.

Research that treats important topics at the centre of heated global debates is bound to produce criticism. That is a good thing. However, in the spirit of promoting an open debate, I hope you will also make David's and my responses to the readership of your Newsletter. Only those readers who have had a chance to see both arguments can be fair judges.

Sven Wunder, CIFOR
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Both replies above triggered a second reaction from the authors of the Open Letter to CIFOR, in which they agree with the clarifications made, but disagree with the 'tactics'.

Box 10. Last reaction from Oilwatch and World Rainforest Movement

A POSITIVE REACTION FROM CIFOR

Two weeks ago, the WRM and Oilwatch disseminated an open letter to David Kaimowitz, Director of the Center for International Forestry Research (CIFOR), expressing our concern over a CIFOR research paper "which appears to give green credentials to two activities that are at the core of deforestation and forest degradation: oil and mining."

The resulting reactions have been very positive, particularly from CIFOR itself. In spite of the strong wording of our letter, both Kaimowitz and one of the authors of the paper (Sven Wunder) responded constructively to our concerns. At the same time, CIFOR posted in its web page our letter and their responses to it, thus enabling everyone to have a complete picture of the discussion. We greatly appreciate this open attitude and we have also linked the full responses to our web site (see "WRM News" section).

More importantly, our letter gave CIFOR the opportunity of clarifying its views on the oil and mining industry by stating that "Our study in no way discounts nor minimizes the negative direct consequences of oil and mineral activities for forests and we certainly do not support either the oil and mining industries large contribution to global warming or their frequent role in promoting corruption and undermining the rule of law."

Additionally, Kaimowitz's response further clarifies CIFOR's position by saying that "Our goal was definitely not to justify the oil and mining industry. It was to show that the macroeconomic policies typically associated with structural adjustment programs such as exchange rate devaluations can have very negative impacts on forests. This helps to strengthen the argument that the World Bank and national governments must do environmental impact assessments of their structural adjustment policies. The methodology used in the book also shows that it is in fact possible to do environmental impact assessments of structural adjustment policies."

By clarifying the above, CIFOR has now made it very difficult for the oil and mining industry to use its study as a greenwashing tool. We also appreciate this very much.

However, it might be very useful if CIFOR were to carry out a specific research on the social and environmental impacts of oil and mining activities in the same countries addressed in the study that motivated our reaction. To go beyond the mere "forest cover" issue and document the widespread impacts on people and the environment (human rights abuses, loss of livelihoods, cultural impacts, disempowerment, water and air pollution, biodiversity loss and so on), which can be described as forest degradation. We would certainly be willing to collaborate with CIFOR in this endeavour.

It is now perhaps necessary for us to clarify our position regarding CIFOR in general. Contrary to what our letter may have led people to believe, we have great respect towards both CIFOR and its Director. We reacted against a specific research paper and not against the institution. We would have probably not reacted at all if an oil industry consultant had produced the study. CIFOR holds a well-deserved credibility among forest activists and we would certainly not like it to lose it. Hence our strong and immediate reaction to what we considered --and still consider-- to be a huge mistake on its part.

We believe that our letter was necessary and that --fortunately-- the resulting discussion has been extremely useful. There has been only one loser: the oil and mining industry. David Kaimowitz ends his response saying that: "CIFOR remains as willing and interested as ever in working closely with both WRM and Oil Watch on the very many issues where we strongly agree." And so do we.

Ricardo Carrere (WRM) and Esperanza Martínez (Oilwatch)

Without taking side in the debate, one can say that Oilwatch/WRM's Open Letter focuses mostly on the site-specific, physical, visible damages of oil operations in tropical forests, while it is skeptical of the claims about economy-wide, invisible, positive effects from oil. CIFOR's analysis and two responses, in turn, claim that the visible damages are more than compensated for by the invisible, macroeconomic benefits to forests. There is a micro-macro mismatch, and the two groups look at it from different conceptual frameworks. The exchange of opinions, which was posted on CIFOR's website (<http://www.cifor.org/>) and on WRM's website (<http://www.wrm.org.uy/>), also shows that research-based messages taken to the media will often be remembered only for their main headlines, whereas the scientific caveats tend to get lost.

III. Reading Materials

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