

Response to Sandker *et al.* 2007. “Will Forests Remain in the Face of Oil Palm Expansion? Simulating Change in Malinau, Indonesia”

Simulating Oil Palm Expansion Requires Credible Approaches that Address Real Issues

*Richard G. Dudley*¹, *Douglas Sheil*², and *Carol Colfer*²

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THE VALUE OF MODELING IN STIMULATING DEBATE

Although we approve of their goals, we have significant concerns about both the technical accuracy and local understanding revealed in Sandker *et al.* (2007). One value of modeling, as the authors indicate, is to help stimulate debate about important, complex issues. Debate is enhanced because a well-structured model explicitly states the assumptions concerning causal relationships among its components. Genuine participation by domain experts and stakeholders helps ensure that these relationships reflect an accepted, although simplified, reality. If model structure is unduly complicated, unclear, or inaccessible, such debate will be limited. One advantage of system dynamics modeling is that, over the past 50 years, a fairly standardized approach has evolved that, if used, encourages effective communication regarding model structure, assumptions, and outcomes. For a complete treatment of this approach, see Sterman (2000).

In addition to using a standardized approach and software (e.g., Stella[®], Vensim[®], PowerSim[®], and similar packages, some with free versions), the system dynamics paradigm also provides model evaluation tools and verification protocols (e.g., Barlas 1996, Sterman 2000, Chapter 21). These help ensure the overall value and utility of a model. This matters because the desired end product is not the model, but improved scientific understanding and policy formulation.

Ecology and Society, as a leader in open-access publishing, should continue to encourage authors to make their models available online. Often the full reasoning embedded in a complex model cannot be compressed into a paper of reasonable length, yet that reasoning is the basis for claims made in such papers. *Ecology and Society* can further improve debate regarding model-based assertions about key issues, such as the expansion of oil palm (*Elaeis guineensis*) plantations, by requesting that models be sufficiently transparent and fully annotated to permit useful commentary. Sandker *et al.* (2007) have made a reasonable effort at such model availability and transparency (see <http://www.cifor.cgiar.org/conservation/ref/research/research.2.5.htm>). This allows us to identify some errors, omissions, and improbable assumptions.

THE ROLE OF PARTICIPATORY MODELING

As Sandker *et al.* (2007) are certainly aware, participatory modeling can help ensure that views of domain experts and stakeholders are adequately addressed. Ideally, these efforts employ a team of modelers and facilitators trained in these protocols. Considerable research on this topic has resulted in detailed guidance for participatory modeling (e.g., Vennix 1996, Andersen 1997, van den Belt 2004).

One rationale for using participatory modeling is that dynamic coupled human natural resource systems, such as that considered in Sandker *et al.* (2007), are simply too complex for a small team to

¹Independent Researcher, ²CIFOR (Center for International Forestry Research)

fully understand. The elicitation of information from domain experts and stakeholders during the modeling process is essential for building a model that includes key factors influencing the problem under discussion.

Another rationale for participatory modeling is stakeholder ownership. If participants agree on model structure, they are more willing to consider and agree on model implications. This can reduce disagreement when later formulating policy, by focusing discussions on real, rather than perceived, differences. As we explain below, Sandker et al.'s model has not yet reached this stage.

COMMENTS ABOUT THE MODEL

Our interest in oil palm in Kalimantan stems from its rapid expansion in the region, the controversies surrounding its benefits as a biofuel source, and its various environmental and social impacts. Upon reading Sandker et al. (2007), we found ourselves questioning some assumptions and findings. We examined the model within the Stella software. Although we cannot provide a detailed analysis of the model—clearly the result of considerable work—we identify some concerns that undermine our confidence in the model and its outcomes.

IMMIGRATION AND RELATED ISSUES

Sandker et al.'s (2007) conclusions discuss the impact of in-migration from other parts of Indonesia and the fact that labor for clearing land and working within oil palm plantations would be largely provided by these migrants. As presented, it appears that such movements are a major conclusion drawn from the model. We find, however, that these are "assumptions" built into specified relationships restricting the number of local people who might participate in land clearing and oil palm jobs. No transfer of local workers from existing jobs can occur within the model, and only 30% of "available" local workers are considered available for this work. In addition, regardless of the number of local workers available, only 10% of the plantation jobs would ever be open to them. The model assumes that 2% of immigrants will leave only after unemployment exceeds 35%, a rather high threshold. Apparent model results showing high immigration are thus the result of several underlying assumptions. High immigration may or may not

occur, but this model does not help us understand why.

Another related issue is the assumption, within the model, that migration increases if local government has a lot of money—the implication being that local government somehow creates employment. This is modeled as a direct addition to immigration as local government gross revenues increase. Perhaps this approach is valid, but surely the assumption should be based on revenues per capita which, in the model, would drop as population increases. This matters because this assumption is largely responsible for the fact that modeled migration under the discussed PES scheme, based on carbon credits in lieu of oil palm, creates a migrant population eight times larger after 40 years than it would be without a PES scheme, reaching 30% of the total population. The authors state that a PES scheme is more acceptable to local leaders because of lower immigration compared with that under oil palm. But a reasonable alternative scenario would be oil palm plus a PES system to protect remaining forests and provide income to local people. This scenario would, under the model's assumptions, also cause significant increases in the immigrant population compared with an oil palm only scenario. Are these assumptions reasonable, and if so would such outcomes be acceptable to local leaders or to other stakeholders?

Important labor issues should certainly be included in the model, but we would prefer the logic to follow patterns of job availability and salaries vs. those in other sectors. For example, as land is converted to oil palm, will people who were formerly dependent on that land for subsistence, or for other jobs, be more likely, over time, to find and accept work in plantations or processing factories? There are also huge and negative implications for people's cultures and ways of life in moving from independent farmers to wage laborers on minimum salaries.

A SIMPLE TEST LIMITS CONFIDENCE IN THE MODEL

The authors report only 40 years of model output. This may appear sensible given the likelihood of other possible changes over a longer period, but the timeframe for plantation management would certainly cover a longer period. One simple test of model validity (in the sense of Barlas 1996) is to run the model for a longer period, 100 years, to see

if model results still make sense. This test reveals flaws. After 60 years, total area, which should be constant, rises exponentially. Somewhere there is an error. In the simulations, forest is constantly converted to agricultural land but amount of forest does not decline. Such problems lower our confidence in the model.

Over 100 years, we also see the area of productive oil palm become cyclical, peaking every 26 years near the planned 500 000 ha, but falling to half that between the peaks. In real oil palm plantations, such cycles can occur if large areas have been planted at a given time. If oil palm experts examined this output they would point out that an actual planting/replanting schedule might take place over a more extended period to avoid extended periods of low production. In Sandker et al.'s results (2007), these cycles have no visible impact on the different scenarios only because the simulations were terminated before the end of the first production cycle.

MISSING COMPONENTS?

The model emphasizes land use and economic outputs in terms of money and labor markets. Little effort is made regarding environmental and social factors. Although the authors report that local leaders are concerned about immigration, this concern is neither explained nor embedded in the model.

The failure to address environmental concerns is also troubling. The authors comment that, after the 40-year simulation period, much of the district will still remain under forest. Surely, evidence from elsewhere in Indonesia provides a strong counter example. Once oil palm plantations, and supporting infrastructure, are established will this not increase the likelihood of additional forest loss? The model says nothing about this type of feedback (we note the authors' disclaimer about the increased possibility of fire). The clearing of highly diverse rainforest to produce oil palm would seem to be an obvious detriment to biodiversity. Also, direct negative effects of oil palm on biodiversity are reported in the literature (e.g., see summary in Donald 2004). These issues are also important for many local stakeholders in Malinau who are dependent on the forest for essential goods and services (Sheil et al. 2006).

And what about conflict? Although the authors have included income to local people as a component in the model, even after 50 years, the fact that migrants' income is still over 50% higher than that of locals has no consequence, because there is no feedback to any possible consequences of such inequity. A recent history of ethnic strife in neighboring West Kalimantan might be a useful comparison as those problems were partly caused by the expansion of oil palm plantations (Colchester et al. 2006). Underlying causes of such conflicts are well described by Yasmi (2007).

Although there is no general consensus, local people in Malinau who had experience in plantation work elsewhere in Indonesia generally opposed such developments occurring locally (Padmanaba and Sheil 2007; and unpublished interviews). Sandker et al. (2007) sidestep these views while also neglecting concerns raised in publications of "advocacy groups" (e.g., Forest Peoples Programme 2005, Wakker 2006, Marti 2008). Ignoring all these concerns seems odd in a systems model designed to help stakeholders explore the consequences of different scenarios in meaningful terms. Indeed such neglect raises questions as to exactly which stakeholders were involved in developing the model and how their needs and concerns have been incorporated.

The authors state that they "... obviously expect that normal processes of civil society participation should underlie all decision making and that Indonesian laws regarding the changes in the status of land be respected." But the authors surely know that this not the case in Indonesia. Given the youth of decentralized democratic government in Indonesia, "normal processes" are neither expected nor indeed normal. This is well known: indeed various authors have explored the consequences of these failings in Malinau and Indonesia generally (e.g., Newman et al. 2000, Barr et al. 2001, 2006, McCarthy 2002, Obidzinski 2003).

CONCLUSIONS

For a model to be useful in the real world, it should reflect the real world. How much more interesting, and useful, this model could be if it addressed real-world problems, reflected the concerns of actual stakeholders, and stimulated their discussion on real solutions.

Perhaps a future model can go beyond simple scenarios and will be able to assist local governments in determining the best approach to developing oil palm plantations, or other appropriate developments, that would be most compatible with local conditions, cultures, and desires. Such a model might include components such as “likelihood of ethnic strife,” “level of local peoples’ involvement,” “confidence in continuing local access to land,” or “level of corruption.” Both the philosophy and techniques of system dynamics modeling encourage the inclusion of such soft variables in a model (e.g., see Sterman 1991).

Constructive debate will be enhanced if models address the most relevant issues, and inspire confidence that they are useful tools for examining different scenarios. This model, although an interesting first step, does neither. Perhaps future attempts will be more successful.

Responses to this article can be read online at:
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