Indirect effects of bioenergy – Effects on landscapes and livelihoods

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IUCN, the International Union for Conservation of Nature, is the world's oldest and largest global environmental network - a democratic membership union with more than 1,000 government and NGO member organizations, and almost 11,000 volunteer scientists in more than 160 countries. IUCN helps the world find pragmatic solutions to our most pressing environment and development challenges. It supports scientific research, manages field projects all over the world and brings governments, non-government organizations, United Nations agencies, companies and local communities together to develop and implement policy, laws and best practice.

Ecosystems and Human Well-being

Human well-being is highly dependent on ecosystems and the services they provide. Ecosystem services are the multiple benefits provided by ecosystems to humans.
- provisioning services (food, water and genetic resources)
- regulating services (regulation of climate, flood protection, and water quality)
- cultural services (recreational and spiritual benefits)
- supporting services (soil formation, pollination, and nutrient cycling)

Many of these services are also the basic services provided by ecosystems that are needed for productive bio-energy systems.

In 2005 the Millennium Ecosystem Assessment showed that over the past 50 years ecosystems have been changing more rapidly than ever before. Approximately 60 percent of the ecosystem services examined in the Assessment are being degraded or used unsustainably. Only 4 ecosystem services have enhanced over the past 50 years, 3 of which involve food production (crop, livestock and aquaculture).

Human activity has caused between 50 and 1000 times more extinctions in the last 100 years than would have happened due to natural processes. IUCN Red List (2008) shows that currently almost 17.000 species are threatened with extinction, whereas only 785 are known to have become extinct in the past 100 years.

The main reasons for the decline in ecosystems and ecosystem services are:
- habitat conversion
- pollution
- overexploitation of natural resources
- climate change
- invasive species

Many people are dependent *directly* on ecosystems for their subsistence and livelihoods, though the exact number of people depending is difficult to estimate. Lipton (2004)[i] estimated that 75% of the world population that lives below the poverty line (i.e. 1.2 billion people living on less that 1 US$ a day) depends directly on ecosystems services for subsistence.

Furthermore, 2.6 billion people are dependent on traditional forms of biomass (e.g. fuel wood, charcoal) for heating and cooking[ii]. This in fact provides a huge opportunity for bio-energy or

other sustainable energy solutions. Access to modern energy services could help alleviate poverty and more energy-efficient use of the traditional biomass could provide opportunities to decrease pressure on the resource base of traditional forms of bio energy, from tropical forest to drylands.

The rush for land and how to define 'idle', 'marginal' and 'degraded' land.

There is ample evidence that the extra demand for bio energy cannot be met with intensification of yields alone. The demand for bio-energy, together with the increasing demands for food, feed and fibre will lead to an expansion of arable land. Estimations of how much additional arable land for bio energy is needed differ a lot. IEA estimates that land requirements under IEA Alternative Policy scenario will amount to 52.8 million ha in 2030 (compared to 13.8 million ha of arable land in 2004)[iii]. Other studies, based on economic model scenarios, estimate the land requirements for bio energy in 2050 as high as 1500 million ha.[iv] So the amount of additional land that is required to meet the demands for bio energy is unsure, but a significant expansion of the current arable land area is to be expected.

The question is, where will the expansion of arable land most likely take place. To avoid food conflicts and forest conversion, many policies promote the use of 'degraded' or 'idle' land (i.e. the European Directive for the promotion of the use of energy from renewable sources). However, the potential of 'reserve' land, 'marginal', 'degraded', 'underutilized' or 'idle' land may be limited. Land that is 'marginal' in the eyes of an agronomist may not be 'marginal' from a biodiversity or social perspective. FAO[1] and IFPRI[2] both predict that additional land will be taken into production for food (even without extra demand for bio-energy feedstock) will take place mainly in South America and Africa.[v] OECD[3] also mentions South East Asia and the Caribbean as promising regions to deliver large scale biofuel feedstock.[vi] So, it is reasonable to expect an increasing demand for land in these regions.

The food price spikes of 2008 demonstrated the impacts that the extra demand for biofuel feedstock is already having on other markets. While the relative impact that biofuel markets have on commodity and food prices is highly debated, IFPRI found that increased biofuel demand in 2000–07 is estimated to have contributed to 30 percent of the weighted average increase of cereal prices[vii]. One may argue that as food prices go up, poor farmers may benefit from the high prices. This is true if farmers have a surplus to sell to the market and that the higher prices trickle down to this level. However, most subsistence farmers or small holders in developing countries are net food buyers, and suffer from high food prices.

Land tenure and other social indirect effects

Increasing demands for land coupled with increasing commodity and food prices will lead to higher values of land, which in turn has an effect on land tenure aspects[viii] (figure 1). The value of land is influenced via direct and indirect pathways. As crop production expands there will be an additional demand for land to produce biofuel (direct pathway). Indirectly, via displacement, there will be an increased demand for land to produce food, feed, fodder, fiber. As prices of commodities increase, land values will increase even further.

[1] FAO - Food and Agriculture Organisation of the United Nations
[2] IFPRI - International Food Policy Research Institute
[3] OECD - Organisation for Economic Co-operation and Development

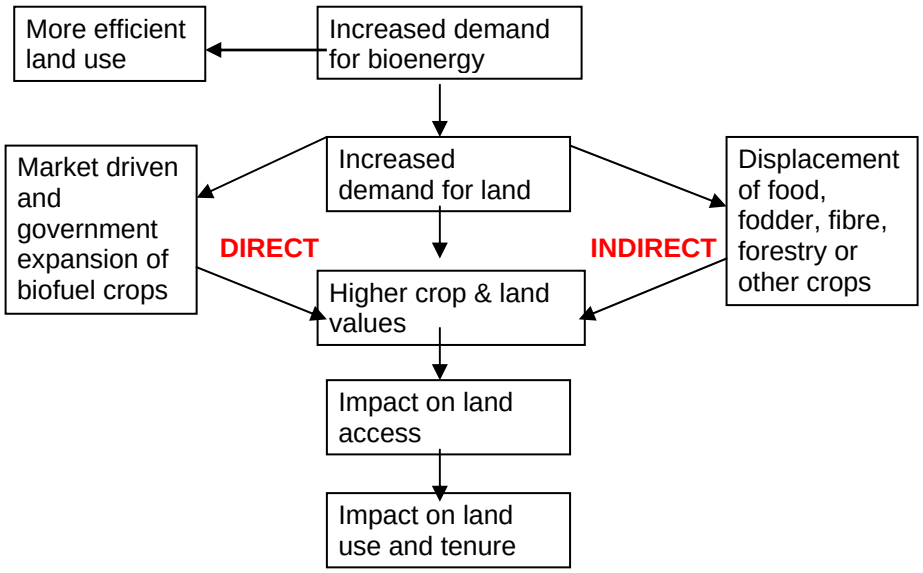

***Figure 1**. Increased demand for land by biofuel policies impacts on land use and land tenure issues, via both direct and indirect pathways. Source: Cotula et al.2008.*

Higher land values in turn have an effect on land tenure and land use. Land *use* indicates *what* crop is grown on the land and land *tenure* is defined as *who* has access to the land. As land use changes from subsistence farming to cash crop (i.e. for biofuel) the tenure aspects change as well.

Likewise, with higher land and crop values, changes in land access from small holder farming to large scale biofuel plantations might take place. Local communities who haven't formalized their land tenure and land rights aspects are particularly vulnerable to these changes. Indigenous people, whose land rights are not acknowledged by local authorities, belong to this vulnerable group.[ix]

Women are often responsible for food production in subsistence livelihoods. In fact women produce 50% of the worlds food supply; however, they only own 2 percent of al the land.[x] When the land use changes from subsistence farming to cash crops, usually men take control over the land[xi]. In Africa, ninety percent of the land remains outside the formal legal system (FAO, 2008), meaning that prior informed consent for large-scale biofuel developments is much harder to attain.

This is not just a theoretical model. In the real world changes are already taking place. Private sector companies have been speculating with high land values and acquire land overseas. Land values in Brazil increased twenty percent on average, but there are some parts of the state of Paraná where land values quadrupled compared to the 2007 prices. European investors have acquired land in West and East Africa for biofuel plantations, and not always with adequate consultation.

Other socio economic indirect effects of biofuels are related to labour and competition for labour. The competition of available labour for food and biofuel feedstock may cause subsistence farmers to divert labour from food production to the production of biofuel feedstock. Subsistence farmers, who previously produced crops for their family and community, now produce for external markets. While efficiencies and income may improve, risks are higher while linked to global markets mechanims, such as for food prices. Furthermore, bio energy projects may cause migration of workers and their families to an area which increases pressure on available resources (food, water, energy). This can be the case when labour intensive crops are used as a biofuel feedstock, such as *Jatropha curcas*. Other resources like water,are impacted by biofuel production as well, which may lead to undesirable situations in which food and biofuel production compete for the same water resource.

Conclusions

Not all bio energy systems pose equal risks on landscapes and livelihoods. In fact, modern bio energy systems may provide an opportunity for people dependent on traditional forms of bioenergy. However, with biofuel policies influencing changing patterns of land tenure, social inequity may increase. The worlds poorest may become even poorer, loosing their (informal) access to land resources. Much depends on the security of land tenure and social equity prior to the development of bio energy projects. Clear definitions are urgently needed to define 'marginal' and 'degraded' land. However, to gain insight in social aspects and land tenure aspects, one must take a landscape approach. Mitigation of negative indirect effects of bio energy is going to be huge challenge, particularly where land tenure is not formalized. Governments, NGOs, private sector and academia should join forces in facing these challenges.

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[i] Climate Change - IPCC, Parry 2007

[ii] World Energy Outlook 2006

[iii] FAO (2008) Climate Change, biofuel and land. Infosheet Accessed 12 May 2009 *ftp://ftp.fao.org/nr/HLCinfo/Land-Infosheet-En.pdf*

[iv] Azar *et al, 2005 and 2007* in: Field *et al*., 2008 Biomass energy: the scale of the potential resource. Trends in Ecology & Evolution, Volume 23, Issue 2, February 2008, Pages 65-72.

[v] Field *et al*., 2008 Biomass energy: the scale of the potential resource. Trends in Ecology & Evolution, Volume 23, Issue 2, February 2008, Pages 65-72

[vi] Doornbosch, R. and R. Steenblick (2007). *Biofuels: Is the Cure Worse than the Disease?* Round Table on Sustainable Development. Paris: Organization for Economic Cooperation and Development (OECD).

[vii] IFPRI, 2008 High Food Prices: The What, Who, and How of Proposed Policy Actions accessed at 12 May 2009 *http://www.ifpri.org/PUBS/ib/FoodPricesPolicyAction.pdf*

[viii] Cotula, L., Dyer, N., and Vermeulen, S., 2008 FUELLING EXCLUSION? THE BIOFUELS BOOM AND POOR PEOPLE'S ACCESS TO LAND, IIED, London. ISBN: 978-1-84369-702-2

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[x] FAO (2008) Climate Change, biofuel and land. Infosheet Accessed 12 May 2009 *ftp://ftp.fao.org/nr/HLCinfo/Land-Infosheet-En.pdf*

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