

Ferroni, Marco et al.

## Conference Paper

# Bioenergy and Land Use in Developing Countries

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## The Global Environment

# Bioenergy and Land Use in Developing Countries

### The Challenges

Food security and promoting modern uses of biomass as a source of energy in developing countries: Conflicting interests impossible to reconcile or two ends of a common strategy?

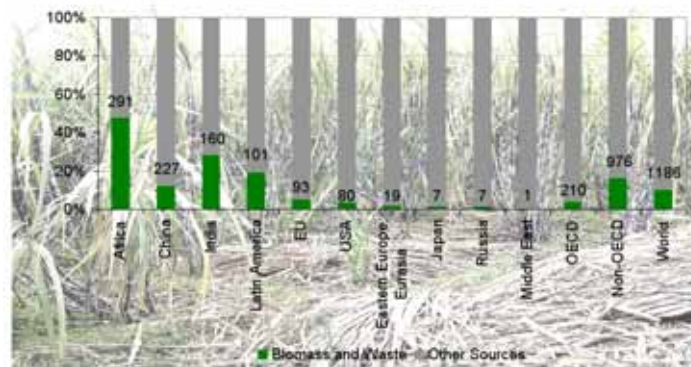
Biomass is the most important source of energy in many developing countries, most notably in Sub-Saharan Africa.

Although the bulk of biomass consumption comes from traditional uses of biomass such as the burning of firewood for basic household energy services, there is growing discussion on the potential to build up modern biomass energy industries in developing countries, e.g., biofuel and biogas industries.



On the one hand, biofuel production bears the danger of leading to land use competition, potentially crowding out food production and leading to higher agricultural prices that hit the world's poorest hardest.

Thus, it might, at first sight, seem cynical to think about using agricultural goods for providing fuel. On the other hand, high prices could provide incentives for agricultural sector development. This would ultimately promote food security and provide resources for biofuel production while benefiting rural areas in developing countries. Furthermore, the environmental dimension is crucial as well: Land use change resulting in massive CO<sub>2</sub> emissions is undesirable from a global climate point of view and could in addition aggravate problems of soil erosion and water availability. To avoid problems of food provision as well as to preserve valuable natural areas and carbon stocks it is proposed that mainly degraded land should be used to extend the agricultural area for biomass production. The development of an international certification scheme is necessary to promote a sustainable production of biofuels, including a certain greenhouse gas emission reduction target. Furthermore, south-south knowledge and technology transfer would be beneficial, given the dominant position of Brazil as an ethanol producer. In order to foster production and trade of biomass, the harmonization of technology and fuel standards is important as well as a reduction in trade barriers. Main questions to be addressed by the panel: What is the potential contribution of biomass energy to the future development of developing countries? How to prevent the adverse effects from changing land with high carbon storage value to agricultural land? How to prevent conflicts between energetic use of biomass and food security?



Share of Biomass and Waste in Total Primary Energy Demand 2006  
 (Numbers denote Primary Energy Demand from Biomass and Waste in Mtoe)  
 Source: World Energy Outlook 2008





## **Proposed Solutions**

### **Marco Ferroni**

*Executive Director and Board Member, of the SYNGENTA Foundation for Sustainable Agriculture*

#### ***How to prevent conflicts between energetic use of biomass and food security?***

1. Recognize the importance of optimizing productivity of current land in order to protect what remains of natural forests and virgin land. Agricultural intensification on existing land helps enhance food security for all, reduce the pressure on deforestation and make more land potentially available for energy crops if so required. (Apart from being a significant source of greenhouse gas emissions, deforestation of tropical rainforests due to the clearing of land for agriculture has affected local and regional climate, caused soil erosion and reduced tropical species relying on these lands and vegetation.)
2. Raise agricultural productivity. Produce more with less, raising in particular the efficiency of land and water use. Step up agricultural R&D. Pay attention to the 'D' dimension (product development and introduction) which often suffers from relative neglect in (public) national and international agricultural research. Upgrade efforts to extend solutions to resource-poor small farmers in developing and emerging countries.
3. Recognize that improvements in agricultural productivity call for action on multiple fronts: 'technology' (i.e., improved crop varieties and seed, fertilizer, tools and machinery, and crop protection); physical infrastructure and connectivity; institutions that serve the farming community; credit and insurance products; access to markets at remunerative prices; trade, price and subsidy reform. The DOHA Round should be completed, with significant reforms on products that matter to the poorest countries.
4. Recognize that with technology, agricultural intensification can and must be brought about sustainably, on existing agricultural and rehabilitated degraded land (see below), without encroachment into forests, while positively conserving water, managing soil fertility and controlling erosion. Rich importing countries practicing extensive agriculture (or growing biofuels) should take note of the implications of their stance, which may include land use change elsewhere in the world.
5. Build awareness of land use and land use change as critical issues deserving attention. Climate change and, to a degree, deforestation (a form of land use change) have surfaced as global issues of concern. Land use and the need to protect land and the quality of soils by avoiding deforestation and land degradation, material loss, process disturbance and environmental pollution have not. There is limited awareness of the increasing pressure on land owing to changing food consumption patterns. Global data on land and soil degradation are out of date: the 1991 Global Assessment of Soil Deterioration (GLASOD), which is based on data from the 1980s, needs to be updated. Furthermore, industrialization and urbanization should be regulated by zoning laws and regulations that economize land.
6. Provide incentives for the rehabilitation of degraded land for agricultural purposes in developing countries. There are many forms and sources of land degradation ranging from the reversible at some levels of investment to the irreversible. In general, research has found that farmers' willingness to invest in soil and land improvement is closely linked to the income perspectives tied to that land. A matter, therefore, of prioritizing agriculture where it is taxed or undervalued and giving it a fair break.
7. Avoid simplistic calls for moratoria on bioenergy and biofuels. Bioenergy strategies should be closely linked with agriculture, forestry, climate change mitigation, poverty reduction and rural development strategies. The production and use of bioenergy must not put food security at risk, or undermine the goals of nature and biodiversity conservation and net GHG emissions reductions. In some developing countries, the cultivation of certain energy crops on lands not newly reclaimed from forests or wetlands can harness agricultural growth for broader rural development, raise energy security in climate-neutral ways, create



business opportunities and jobs, generate foreign exchange, and in the process enhance food security. Also, we should not in this context forget the potential of tree crops (for energy and other purposes) to restore degraded land which later could become available for food production.

### ***What is the potential contribution of biomass energy to the future development of developing countries?***

1. Modernize the use of traditional biomass as the main form of energy available to the poorest third of mankind. This requires a focus on rural areas to control the health hazards associated with this type of energy while raising fuel efficiency (for example, by improving cooking stoves). Small-scale installations to harness energy from biogenic waste for household needs could make possible significant improvements in comfort, the use of time, and land quality by reducing the need to gather wood.
2. Exploit the potential of biogenic waste and residues as sources of fuel in the generation of electricity (in co-generation or gasification plants). Develop the science and data needed to estimate the quantities that could be available on a sustainable basis. (According to one estimate, the total sustainable worldwide biomass energy potential amounts to about 30% of total energy consumption today. Part of this is biogenic waste and residues.)
3. Develop biochar from renewable forestry resources or biogenic waste streams. Biochar deserves attention in developing and industrialized countries alike as a form of bioenergy that could be carbon-negative, not only carbon-neutral, while possessing significant soil enrichment properties – within the limits of the quantity of biomass that is sustainably available and usable, for example, without encroaching on unmanaged forests.
4. Manage risk. The risks from uncontrolled expansion of bioenergy are four: the potential threat to food security (but, as implied earlier, there could also be complementarity over different time horizons), the threat to biodiversity, the threat to soils and water, and the climate risk associated with land use changes for the purpose of growing energy crops.

### ***How to prevent the adverse effects from changing land with high carbon storage value to agricultural land?***

1. Recognize that the adverse effects from changing land with high carbon storage value to agricultural land, in large measure, cannot be prevented. The challenge and the task, therefore, are to create incentives that limit conversion.
2. Accept that there is no free lunch. The goal of reducing atmospheric carbon concentrations requires us to address carbon emissions from fossil fuels, industrial practices, and also terrestrial systems. Research shows that the full integration of terrestrial systems and the use of fossil fuels in a comprehensive model to limit atmospheric carbon concentration lowers the cost of meeting environmental goals, but has implications for agriculture, causing food prices to rise through competition for land, unless technology contributes sufficiently to raising per hectare food and agricultural yields.

#### **Bettina Kretschmer**

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The Pros and Cons of bioenergy are not the same everywhere: At one end of the spectrum, countries with a large land endowment relative to the size of their population like Brazil operate





large-scale industrial bioenergy production. At the other end, traditional uses of bioenergy prevail in low income countries with a poorly developed transport and energy infrastructure (DR Congo, e.g., has a share of over 95% of traditional bioenergy use in its energy balance (cf. [http://www.globalbioenergy.org/fileadmin/user\\_upload/gbep/docs/2007\\_events/press\\_G8/Bioenergy\\_Facts\\_and\\_Figures\\_01.pdf](http://www.globalbioenergy.org/fileadmin/user_upload/gbep/docs/2007_events/press_G8/Bioenergy_Facts_and_Figures_01.pdf)). Hence, solutions to the development process and the role of bioenergy need to be assessed in a differentiated manner.

### ***Auditing industrial bioenergy production***

In countries where land and water resources are abundant and food production can meet local demand, industrial bioenergy production may well be an option to limit dependency on fossil energy and to fight climate change if it is competitive with fossil fuel prices or if it can compete with other climate mitigation options. Nevertheless, large-scale bioenergy production also bears risks. Recent studies (cf. Fargione, Joseph, Jason Hill, David Tilman, Stephen, Polasky, and Peter Hawthorne, Land clearing and the biofuel carbon debt. *Science*, 319, 2008, 1235–1238) put into question whether biomass-based energy could have any potential to reduce CO<sub>2</sub> emissions at all if virgin land is converted into cropland for biomass production. It could take over a hundred years to “pay back” the emissions debt caused by the land-use change if tropical rainforest is cleared for cultivating energy crops. Another problem is the – probably irreversible – loss of biodiversity. To avoid these direct effects a certification scheme is needed that takes into account the actual greenhouse gas savings obtained from the use of bioenergy. In order to also avoid indirect land-use effects certification schemes need to be extended to all agricultural production activities, i.e., it would need to include food and industrial biomass production as well. Such a global land use control system might well limit significantly the expansion of the world’s agricultural area devoted to bioenergy production.

### ***Modernizing traditional uses of bioenergy***

The situation is different in countries whose energy supply relies highly on the traditional use of bioenergy, e.g., firewood. Here, bioenergy is used in a very inefficient and unsustainable way, leading to – or aggravating – desertification-related problems and to a diminished potential for food production. These problems are especially severe in regions that are afflicted by hunger anyway since for farmers in such regions the lack of modern energy services limits agricultural productivity and low productivity limits the access to modern energy. Modernizing the small-scale use of bioenergy is a possibility to improve the quality and availability of energy services and simultaneously provide the opportunities for an improvement in agricultural productivity.

### ***Advancing farming techniques***

Adapting the use of bioenergy to each country’s particularities provides opportunities to develop rural areas and could open up access to larger markets. Furthermore, higher agricultural productivity resulting from the use of modern farming techniques can expand the available land area for both food and bioenergy production. Modern bioenergy production could then even contribute to higher food security on a local and global scale. The fact that agricultural prices are currently on a high level provides incentives for strengthening the agricultural sector: costly food imports could be reduced and exports become more profitable.

Given this background, countries should carefully analyse whether the development of a bioenergy industry will actually yield benefits in the long run – as has been shown they are not a priori given. Necessary regulations and policy measures will highly depend on the regional conditions. From a global sustainability point of view the use of bioenergy for climate mitigation purposes is only justified if the greenhouse gas savings are accounted for, e.g., in a certification scheme for biomass.



## Ruud van Eck

CEO, Diligent Energy Systems

### ***The diligent way for bio-energy and land-use in developing countries***

#### **The challenge**

Although there has been much debate recently about how biofuel production is taking away valuable farmland for food production in developing countries, this is in fact not the main issue. There is still sufficient land to produce both food and bio-energy in many developing countries – certainly in Eastern Africa. The real problem is that in these countries the current methods to produce and distribute food (and also to produce and distribute bio-energy such as charcoal and fuelwood), are grossly inefficient. In East-Africa, agriculture is a sector of predominantly very small farmers, who have little access to resources (quality seed materials, pesticides, fertilizer, machinery, technical advice etc) and often little access to markets in further areas. In fact, these farmers have very few means to do their farming with – except their labour, and the rights to their land. There is not much “unused” land either – almost always, there is someone claiming an (informal) right to it: for grazing, for access to water, for harvesting wood, for hunting – etcetera.

Western investors seeking to promote bio-energy products generally come with a different perspective on farming. They think in terms of modern, large-scale plantation style production, and need land titles to control production methods and to have collateral for investors. Such investments generate tensions on many areas. The obvious problem is how to deal with land ownership and rights to use land, particularly when such rights are hardly ever formalised, and when the legal standards to compensate the owners of such rights are still extremely low. Other aspects include labour markets and conditions; use of available water sources and infrastructure; control and supervision of environmental standards, etcetera. But the main source of conflict is one of status and culture: western investors now seek to use African farmland and labour to produce a product for their own needs, when hardly any-one cared about developing the African’ agricultural sector for the African’ needs for decades.

In theory, modern-style bio-energy production in Africa may be very beneficial to rural African economies, bringing labour, technology, economic development and so on. It is not strange, however, that African farmers mistrust the real intentions of investors, and wonder how they can benefit from it. The real challenge, therefore, is to develop biofuel projects that promote in a balanced way the interests of both the western investors and the farming communities in developing countries.

#### **The solution**

##### **1. Bio-energy investors to work with farmers, not replacing them.**

Instead of setting up plantations, investors could promote existing farmers to produce biofuel crops for them. In East-Africa, there are plenty of farmers (mostly small, but also large) very eager to access new markets for their products. While many farmers are naturally conservative about investing heavily in new crops for unproven markets, they can certainly be convinced if the potential is promising and attractive enough (and if they can’t, then perhaps the case is not good enough...). While setting up relations with existing farmers is time consuming and difficult, there is much less risk of conflicts over land.

Investors should be careful, though, not to accept every farmer as a partner. Also in developing countries, there are good farmers and weaker ones – and it’s the good farmers, those with the potential to improve production quality and efficiency in the future if given proper tools, who should be supported most.



## **2. Combine bio-energy production with improvements in farming for food.**

The case for farmers to grow crops for a bio-fuel producer will become stronger if it also helps him improve his farming potential for other crops. Farmers in remote areas in East-Africa suffer from poor access to food markets, as well as from poor access to farming resources such as quality sowing material, fertilizers, pesticides and technical advice. Bio-energy producers can use the networks with farmers they establish, to provide such access to markets and resources at much lower costs than would otherwise be the case. Biofuel production and food production do not need to compete – in fact, it is more logical to expect that they support each other.

## **3. Be realistic about the potential market for biofuel from developing countries in the short term, but stick to the plan for the longer term.**

It takes time, resilience, and a long-term view of investors to develop biofuel production together with existing farmers. For quite a number of years, production volumes will remain low, while production costs will remain significantly above those of “1st generation” biofuels from more established production countries. However, the potential is certainly there for the longer term, if everyone in the sector stays on focus. Over time, more farmers will enter the network, existing farmers will extend their area planted, and farmers and the distribution chains will gradually improve efficiency and quality of production. To reach that stage, this form of biofuel production which also serve the interests of developing countries may need a bit of support in these initial years, for example through preferential fiscal treatment. This could be an efficient and justified way to spend development aid. The alternative: hyped markets combined with overly optimistic investors and misinformed governments, leading to misguided investments, leading to abandoned projects, leading to ever more frustrated, marginalised and isolated farming communities in developing countries.

## **4. Donor programmes to support national governments in promoting the right sort of bio-fuel investments.**

National governments often face the dilemma: to choose for foreign investors, or for the interests of their national (farmer) communities. They may be able to choose wiser if they know what their options are to serve both interests. Donor governments can play an important role in advising national governments to develop good investment frameworks – which both stimulate foreign investment and protect national interests.

## **5. Western markets to impose environmental and social criteria on biofuel production through certification.**

Western markets are still not very coherent in terms of the environmental and social standards they demand for (imported) biofuels. Producers that aim for higher standards find it hard to get recognition for what they achieve for developing countries, and to get this rewarded. Transparent and obligatory certification schemes will help to reduce the advantages that befall the “free-riders” in the market.

## **Background**

The company Diligent Energy Systems started in 2005 in Tanzania with an outgrower concept for *Jatropha* biofuel production. As of today, Diligent has supported some 5,000 farmers to grow *Jatropha* on some 3,500 ha of land, mainly as hedges around their farmlands, or in combination with foodcrop farming (“intercropping”). Although production volumes remain very modest, Diligent is among the first to produce *Jatropha* biofuel commercially (delivering, among others, to a consortium of Boeing and Air Newzealand for a test flight in January 2009). It is scaling up production volumes fast and has the ambition to grow to 10,000 ha of *Jatropha* planted over the next couple of years.





## **Marco Vollmar**

*Editor-in-Chief of German/English Programmes, Deutsche Welle Radio*

### **Questions to all panelists**

- Should there be a moratorium on bio fuel subsidies /mixing quotas (“Beimischungsquoten”)?
- Is it possible to both help the people in developing countries and make profit from biofuel production?
- Should industrialized countries try to meet the rising demand for biofuels with their own agricultural production?
- Wouldn't it make more sense to foster energy efficiency than to look to biofuels to satisfy the rising energy consumption?
- What criteria for sustainable biofuel production with low emissions would have to be included in an international certification system?
- Would the transfer of knowledge and technology, making it possible to process the biomass where it is produced, help the agricultural development of developing countries?
- Will the international financial crisis lead to less demand for biofuel plants from developing countries causing new problems for local farmers?