VOLUME 1 | ISSUE 2 | MAY 2008

Ecoagriculture Policy Focus

Evaluating Biofuel Opportunities from a Landscape Perspective

Biofuels are energy sources derived from recently living plants, animals or their byproducts. People have been using traditional biofuels such as wood, charcoal, and dung for thousands of years for heating, cooking and manufacturing. Although, fossil fuels have become the backbone of industrialized economies, 70-90% of all energy needs in many African nations and rural Asia are still met by traditional biofuels. But in the wake of climate change and rising petroleum prices, biofuels have become relevant for industrialized economies too.

Recent discussions of biofuels have focused on large-scale commercial production to supply the global market of ethanol and biodiesel for transportation and industry. But for long term sustainability and broader social benefit, biofuels should not be pigeonholed as a petroleum substitute. Two billion poor have limited access to energy for basic needs and biofuels can provide the opportunity to reduce their energy poverty, thus contribute to rural development.

Analysis of environmental and livelihood impacts of biofuels are primarily being conducted on the national or global scale. Having a global scope is indeed important. But investment and management decisions often take place at the landscape scale. The impacts of agricultural practices on ecosystem services and livelihoods can also be clearly evaluated at the landscape scale. Hence, the questions of where and how to produce biofuels should also be considered at the landscape scale.

In a landscape, biofuel production should be simultaneously consistent with three essential goals: i) conservation of native biodiversity and ecosystem services, ii) sustainable production of agricultural or silvicultural goods; and iii) viable livelihoods for local people. Ecoagriculture is a landscape level participatory and multi-stakeholder approach that simultaneously advances these three goals.

In an ecoagriculture context, it is important to consider the whole spectrum of biofuel production and processing options, as illustrated by these three archetypal systems: i) smallholder production for local consumption, ii) smallholder production for commercial processing, and iii) medium to large scale commercial production and processing (see next page).

These systems differ in scale and their objectives and hence have different implications for conservation, production, and rural livelihoods.

Box 1. Evaluating Opportunities and Risks

We can understand the opportunities and risks involved with biofuel production in a given landscape by answering these three questions.

1. What energy source is being replaced by the biofuels produced?
Biogas replaces firewood or dung in a rural village. It provides a better fuel while reducing deforestation pressures and indoor air pollution. Corn ethanol replaces gasoline at the pump, but still uses corn produced using huge quantities of fossil fuels.

2. What is the social return of producing biofuels in the landscape?
The social return of biofuels in energy poor communities is much greater than social return on biofuels used by consumers running their second or third cars.

3. What are the opportunity costs of producing biofuels in the landscape?
We need to consider the other potential uses for the landscape besides biofuel production. A landscape with large corn farm could have been used to grow food for the people or as a protected area that conserves biodiversity and ecosystem services.

System 1: Smallholder production for local consumption

In the first system, the production is at a small scale and for local use primarily. To meet the small local demand, enough feedstock can be grown by complementing rather than competing with other farming and conservation activities in the landscape. For instance, growing annual or perennial energy crops in small plots or degraded lands will add landscape heterogeneity and improve habitat quality, without removing productive lands from food crop production. The energy crops will also help restore the degraded lands, while functioning as windbreaks for other crops and corridors for wildlife. The biofuel produced will substitute firewood and dung, reducing deforestation, indoor air pollution and improve health of women and children. This system has the greatest promise in reducing energy poverty among the world's two billion poorest and thus provides the greatest marginal social benefit.

Biogas digester in Honduras
(Source: www.sustainableharvest.org)

System 2: Smallholder production for commercial processing

Biogas in Cameroon
(Source: www.leffortcamerounais.com)

In the second system, smallholder farmers grow biofuel feedstock on small or community-run farms to be sold to commercial processors. The biofuels produced are destined for external markets, and likely to generate greater demand for feedstock. This presents the community with opportunities to diversify income sources by growing a mix of feedstock and crop plants. But it can also lead smallholder farmers to follow production guidelines of commercial processors that tend to homogenize their landscape and replace crop production. Either more habitats will be converted for crops causing biodiversity loss or food security of smallholder farmers will be reduced. Local cooperatives may be necessary to help farmers organize, achieve market clout to get fair prices and avoid reinforcing existing inequalities.

System 3: Medium to large scale commercial production and processing

In the third system, biofuel feedstock is grown in large farms that are intensively managed for high yields and profits. These farms are usually monocultures that provide little wildlife habitat or ecosystem services. Such monocultures also tend to deplete soil nutrients and may pollute or draw down regional water supplies, jeopardizing future production. Replacing one corn monoculture for food by another corn monoculture for ethanol does not contribute to biodiversity or habitats. On the contrary, it creates a greater demand for farm land leading to conversion of previously protected or ecologically sensitive areas, as seen with soybeans in the Amazon and Cerrado, and oil palm in Indonesian rainforests. Policy guidelines and certification for sustainability will be needed to halt habitat loss due to land conversion. This scale of production favors the status quo and marginalizes smaller actors.

Harvesting sugarcane in a commercial plantation in Brazil
(Source: Andre Prenner)

Designing ecoagriculture landscapes for biofuel production

The rush for biofuels is partly driven by the perception that it is a greener fuel that is better for the environment and the people. We need to remain faithful to this green vision when we modify our landscapes to grow biofuel feedstock.

The following landscape design principles will help us achieve environmental sustainability and livelihood improvements while growing biofuel feedstock.

- Biofuel crop species and locations should be selected such that it improves the spatial heterogeneity of the landscape.
- Biofuel crop areas should be located such that the connectivity between different habitat patches are maintained or restored.
- Biofuel crops should be grown in lands that are less suitable for other important uses like crop production or wildlife habitats. This will help restore these unused lands while maximizing overall production of the landscape.
- A landscape already maintains several productive activities, from crop production to ecosystem services. Biofuel production should be capitalized on interstitial niches not yet exploited by these activities. For example, plant wastes or surplus can be utilized as feedstock or marginal lands can be used to grow hardy biofuel feedstock.
- Biofuel crop species should be selected such that they are well adapted to the local conditions and can grow well in low-input production.

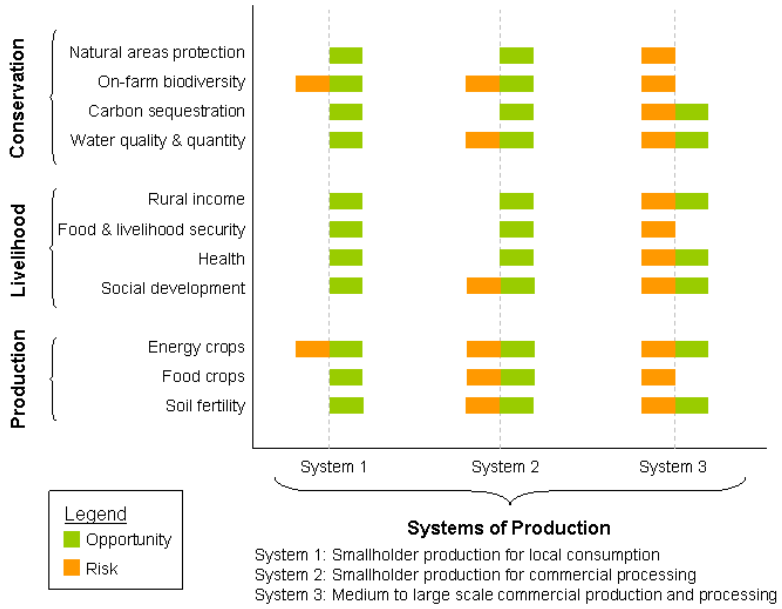

Figure 1. Summary of opportunities and risks for conservation, livelihoods and production in different systems of biofuel production

- Preference should be given to perennial and mixed species system to improve habitat complexity and minimize the risks to pest and disease faced by monocultures.

Areas for policy development

Concern about climate change and the environment is one of the factors behind the current rush for biofuels. It is, therefore, ironic that the U.S. and E.U.'s mandates on increasing the proportion of biofuels in national energy supply have instead favored large-scale production that does little for the environment or the energy poor. National and global policy action is necessary to fulfill the environmental and livelihood promises of biofuels. We recommend four areas of action where policy can make a difference.

1. Biofuels governance

Currently, huge momentum propels large-scale biofuel production, underlining the need for policies that move these production systems towards sustainability. Regulations and certification programs need to be guided by landscape design principles and be sensitive to social well-being in the production landscapes. Biofuel development needs to be integrated into participatory landscape planning processes and investments.

Standards set on the basis of social and ecological outcomes by governments (e.g., the Netherlands, UK, EU, state of California, USA), private business groups (e.g., Roundtable on Sustainable Palm Oil) and civil society will help counteract the incentive to produce more fuel for cheap by exploiting habitats and human rights.

For example, the Dutch government is considering greenhouse gas emissions, competition with food and local needs, biodiversity, environment, prosperity and social well-being as criteria to assess the sustainability of large scale

biomass production for biofuels.

Ultimately, certification programs require institutional mechanisms for global tracking and monitoring. Regulations require political commitment and institutional capacity for enforcement. And biofuel development should welcome and encourage landscape planning to guide investments.

2. Pricing, incentives, and subsidies

If biofuels are to be sustainable, we need to make sure that environmental costs and benefits for biofuel production are internalized to reflect the true cost of production. Hence, policies need to be designed that provide incentives to feedstock growers to also become stewards of the environment.

Monetary valuation of the environmental benefits of sustainable feedstock production, in the form of carbon offsets or payments for ecosystem services, can be one form of incentive for better production practices. This will also ensure that small scale producers can remain competitive against energy giants.

3. Guide technological development for biofuels

Technologies that are scale neutral will ensure competitive participation by small scale producers. Technologies that accept a diversity of feedstock for conversion should be encouraged to provide greater flexibility to producers. For example, technologies that use cellulose (which is found in all plant cells) will give producers the option to use plant byproducts as feedstock. This can reduce the use of productive farm land for growing biofuel crops rather than food crops.

4. Biofuels and rural development

Biofuels, especially in smallholder production for local consumption, have great potential for rural development and poverty alleviation. Yet, the rush for biofuels has led some governments to appropriate protected natural habitats or rural lands from the rural poor to use it for large scale production.

Instead, national and global policy makers should seize this opportunity to tie biofuels to achieving the related Millennium Development Goals.

There is a need to formalize and respect local control of resources. In addition, financial, technical and policy support should be provided for smallholder production to bring benefits to the rural poor.

Finally, international dialogue needs to take place within international agencies and conventions such as the United Nations, World Bank, Convention on Biological Diversity, the UN Framework Convention on Climate Change, etc. to advance the role of biofuels in alleviating poverty and improving rural energy supply.

Ecoagriculture Policy Focus Series

The Policy Focus series, produced by Ecoagriculture Partners in collaboration with other organizations, highlights issues relevant to policy experts and decision makers in the fields of agriculture, conservation and rural development to promote integrative solutions

This brief was prepared with input from the following organizations: Cornell University, Ecoagriculture Partners, and International Union for Conservation of Nature (IUCN).

Key References

Milder, J.C., J.A. McNeely, S. Shames, and S.J. Scherr. 2008. Biofuels and ecoagriculture: can bioenergy production enhance landscape-scale ecosystem conservation and rural livelihoods? *International Journal of Agricultural Sustainability* 6(2): in press.

McNeely, J.A. and S.J. Scherr. 2003. *Ecoagriculture*. Washington, DC: Island Press.

Scherr, S.J. and J.A. McNeely (ed.). 2007. *Farming with Nature: the Science and Practice of Ecoagriculture*. Washington, DC: Island Press.

Ecoagriculture Partners

730 11th St NW, Suite 301 • Washington DC 20001 • USA • www.ecoagriculture.org