Making sure that biofuel development benefits small farmers and communities

O. Dubois

Some suggestions on how to achieve biofuel development that favours sustainable rural livelihoods.

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Adapted from the author's paper "How good enough biofuel governance can help rural livelihoods: making sure that biofuel development works for small farmers and communities", an unpublished background paper for FAO's *State of Food and Agriculture 2008*.

The quest for sustainable biofuel systems has increased tremendously over the past few years. Concerns about potential negative effects, such as deforestation and competition between food and biofuel production, have led to the demand for sustainability instruments such as standards, criteria and indicators to be applied through mandatory regulations and/or voluntary schemes such as certification.

To ensure that biofuels contribute to the Millennium Development Goals, and in particular to the first goal on food security and poverty reduction, it is important to ensure that biofuel development at least does not harm, and preferably favours, the livelihood strategies of small-scale producers and communities in rural areas. This article addresses what it takes to achieve biofuel development that favours sustainable rural livelihoods.

Biofuel systems are complex because:

- they are inherently composed of three quite diverse components – feedstock (raw material) supply, conversion technology and energy use;
- these components are influenced simultaneously by environmental, economic and social factors;
- they can serve various purposes, from national energy supply to community-level energy autonomy;
- they function at different scales, from large-scale to decentralized village-based schemes.

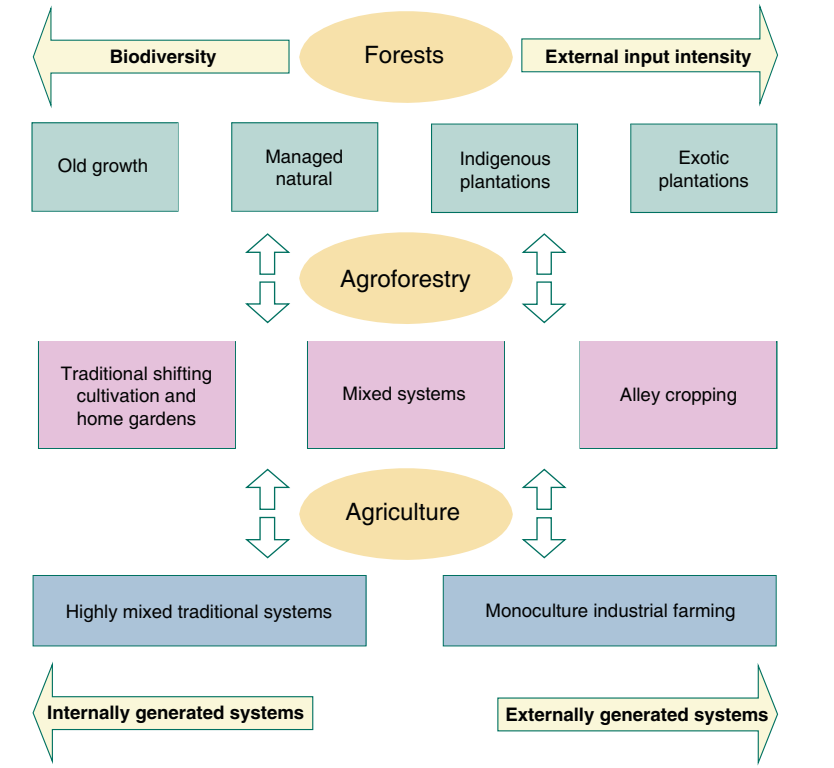
Biofuel development is also strongly influenced by current global trends such as transition to market economies, globalization, high and volatile fossil fuel prices and rising concerns about climate change. Yet biofuel development should be geared to people's livelihoods as well as to global and national energy needs. Livelihoods are sustainable (Ashby and Carney, 1999) when they:

- are resilient in the face of external shocks and stresses;
- are not dependent on external support (or if they are, this support should itself be economically and institutionally sustainable);
- maintain the long-term productivity of natural resources;
- do not undermine the livelihoods of, or compromise the livelihood options open to, others.

The article briefly discusses governance mechanisms that can ensure that small farmers and communities in rural areas do not lose out from the implementation of biofuel schemes.

SUSTAINABILITY IN UNCERTAIN TIMES AND CHANGING ENVIRONMENTS

Biofuel systems can be developed in diverse land-use situations (Figure 1). Conventional management methods are efficient in differentiating these land uses according to physical criteria. However, actual land uses change not only according to physical factors but also because needs change as demands



Source: Bass, Hawthorne and Hughes, 1998

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Land-use spectrum as basis for biofuel development

from society, market opportunities and stakeholders' entitlements evolve. It is therefore important to consider the dynamics of land uses when assessing their environmental, economic and social impacts. Table 1 illustrates this through the different possible trajectories of forest cover, income and population density. In particular, it shows that different land cover trajectories are caused by and contribute to livelihood needs in different ways, and change over time.

It is increasingly accepted that modern policies and planning strategies regarding land use and natural resource management should account for "unpredictables" and "unknowns", hence uncertainty in land use and natural resource management (Dubois, 2003). They should be adaptive, following a learning process and involving continuous monitoring of the dynamics of environmental and socio-economic changes. And they should take into account the political dimension of land use and natural resource management, including power relationships, and develop approaches to deal with this dimension.

Uncertainty concerns not only ecological but also socio-economic circumstances, leading to different forms of vulnerability in rural areas. The aim of sustainable development should therefore be to manage, in time and space, change resulting from interactions among ecological, economic and socio-political factors.

HOW TO ADDRESS SUSTAINABLE BIOFUEL DEVELOPMENT IN PRACTICE

Approaches and instruments to achieve sustainable biofuel development can be characterized according to their mandatory or voluntary character as well as the scale of their application, as illustrated in Figure 2 (Van Dam *et al.*, 2006).

The performance of regulatory and voluntary instruments in terms of small farmers' and communities' livelihoods cannot yet be evaluated for biofuel development on a global scale because it is so recent, but lessons can be drawn from other types of land uses. Experience with forest resource management, for instance, has suggested that:

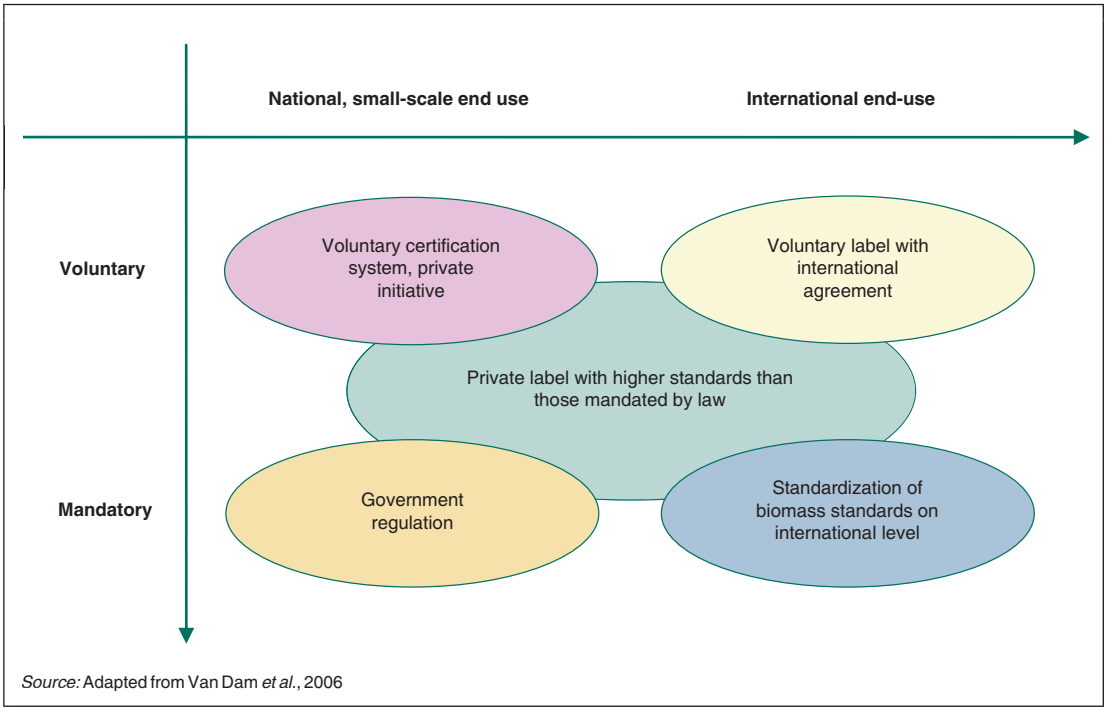
- "Control and command/fines and fences" strategies seldom work on the ground because they are not cost effective and are difficult to enforce.
- Collaborative strategies for sustainable resource management are more bound to achieve sustainable outcomes but they involve significant transaction costs (i.e. costs of interaction) in the short and medium term. Ways to reduce interaction costs include selecting key stakeholders according to their importance and influence, and involving representatives of stakeholder groups such as smallholder or community organizations in negotiating agreements (Dubois and Lowore, 2000; Abramovay and Magalhães, 2007).
- The use of voluntary schemes such as certification have primarily been driven from outside and often by donors. Subsidies provided by donors to help community enterprises obtain certification can undermine sustainable commercial decision-making by the enterprises. Although some communities value the non-market benefits of certification, such as recognition and credibility, the main driving force is the promise of greater market security. Without this security, communities may not continue with certification beyond an initial "honeymoon" period when support from donors and certifiers is at its highest (Bass *et al.*, 2001).

TABLE 1. Five possible trajectories of forest cover, income and population

Trajectory	Agricultural rent curve	Managed forest rent curve	Forest cover trend	Poverty and population trend	Location of identifying characteristic
Intensification with deforestation (e.g. soybean areas in Brazilian savannah)	Shifts up because of increasing urban or international demand for improved tenure	Is everywhere dominated by agricultural rent	Deforestation continues and stabilizes at low forest cover	Landowners prosper, labour demand probably increases, wages and/or workforces increase, with possible urban labour growth	Peri-urban, good soils, high-input agriculture and higher population density
Intensification with reforestation (e.g. woodlots)	Shifts up because of increasing urban demand, increasing returns and improved tenure	Shifts up because of increased demand, exhaustion of mined sources and demand for environmental services	Decreases, then rebounds	Landowners prosper, labour demand increases and wages and workforces increase	Peri-urban, medium to good soils, medium- to high-input agriculture and medium to high population density
Abandonment with regrowth (e.g. forests in Europe and the United States)	Shifts up because of increasing urban demand, then down because of rising wages	Shifts up because of improved tenure and increased demand for wood and environmental services	Decreases, then rebounds	Poverty decreases because of out-migration	Likely on marginal lands: hillsides and/or semi-remote forested land, or where population density is low
Abandonment and irreversible degradation (e.g. *Imperata* grasslands in Southeast Asia)	Shifts up and down because of land degradation	Never surfaces, either because of high costs or tenure or irreversibility of degradation	Decreases towards zero	Out-migration without poverty alleviation	Marginal lands, not near cities; nutrient-poor soils, slopes or highly fire-prone lands, grasslands in forest biomes
Deforestation and pauperization	Shifts up because of failing wages and increasing food demand	Shifts down because of soil degradation, and disputes over land tenure increase	Decreases towards zero	Larger but poorer population	Probably not near cities; anomalously high population density given remoteness and agroclimate

Source: Chomitz, 2006

2 Possible approaches to the implementation of policies for sustainable biofuel development



Source: Adapted from Van Dam *et al.*, 2006

Most of the current work on instruments for sustainable biofuel development is driven by voluntary initiatives (see Box below). These will have to be backed by the power of law and enforcement to have some chance of mitigating negative impacts of biofuel development. In many countries the judicial process is slow. Legal costs are often beyond the capacities of weaker groups in rural areas such as small-scale farmers and indigenous people, and enforcement of their rights may be hindered by links between powerful investors and political elites (UNDP, 2007).

COMMUNITY BIOFUEL SYSTEMS

Biofuel has significant potential to promote rural development (Box opposite), especially when it uses locally produced feedstock, through:

- wider and more on-demand availability of energy, with all its related services for local development (for households, communities and production purposes);
- job creation, both directly and indirectly, especially for biofuel projects based on agriculture, although this is usually limited in small-scale schemes and depends on the degree of mechanization of production and processing operations in large-scale schemes;
- provision of an alternative to other forms of agricultural production, thus contributing to income diversification;
- increased local revenue generation.

However, it is a challenge to develop biofuel systems that will truly satisfy local needs and contribute to poverty reduction and food security. For example, the connections among employment, environmental impacts and beneficiaries of the energy produced are strictly local and could be made clear to everyone, but this rarely happens when planning and implementation are supply driven and top-down. Moreover, rural energy should be part of a much broader development approach if it is to have positive and sustainable impacts on the rural poor.

The following ingredients seem essential for successful community biofuel development projects that fulfil local needs (UNDP, 2000; Forsyth, 2005):

- participatory approaches involving a broad cross-section of the community, including the poorest groups;
- inclusion of production and supply of biomass as an integral part of the project (because the entire biofuel chain affects the local community) and sensitivity to other possible uses of feedstock (e.g. as food, fodder, soil amendment or fertilizer, construction material);
- minimized transaction costs, as described above;
- assurance mechanisms, such as contracts and understandings, to keep the community and private biofuel processors together in partnership;
- fostering of a local institution to take responsibility for design, implementation and ongoing management of the project;
- appropriate financial mechanisms.

Getting the financial mechanisms right is especially crucial and complex when dealing with the rural poor. Subsidies should be transparent and linked to the economic development they are supposed to promote (UN-Energy, 2007).

WHAT CAN GOVERNMENTS DO TO SUPPORT SUSTAINABLE BIOFUEL DEVELOPMENT?

The role of government can include, for example (ESMAP, 2005; Dubois and Lowore, 2000):

- providing an overall strategic vision for biofuel development;
- developing a series of policies related to biofuel development (Table 2), including incentives and removing disincentives – although to date the effect of most biofuel policies on consumers' food surplus situation and on greenhouse gas reduction remains uncertain;
- providing guidance in such areas

Example of a multistakeholder process: the Roundtable on Sustainable Palm Oil guidance for smallholders

The Roundtable on Sustainable Palm Oil (RSPO) (see www.rspo.org) is a global association of organizations promoting open dialogue throughout the palm oil supply chain, involving oil-palm growers, palm-oil processors and traders, consumer goods manufacturers, retailers, banks and investors, environmental and nature conservation non-governmental organizations (NGOs) and social and development NGOs.

The focal activity of RSPO has been the development of practicable principles and criteria for production of sustainable palm oil. Its strengths include its transparent, inclusive, consensus-based process, and its rapid progress in developing and field-testing the principles and criteria.

To encourage the engagement of smallholders, smallholders' organizations, non-company extension services and growers' associations, RSPO formed a Smallholder Task Force which works to:

- **ensure that the association's materials are translated into the major languages of the main countries where smallholders engage in oil palm cultivation;**
- **carry out diagnostic surveys of smallholder issues and views;**
- **test the RSPO principles and criteria with smallholders;**
- **hold open consultations;**
- **propose revised principles and criteria to RSPO.**

Source: Vermeulen and Goad, 2006; RSPO, 2007.

Example of a community biofuel development scheme: fostering jatropha biofuel in Malian villages

Mali is among the poorest countries in the world and has a highly unequal income distribution. It is land-locked and has few export opportunities. Sixty-five percent of the land area is desert or semi-desert, and 99 percent of the rural population lacks energy services, which are vital to increase productivity, add value to agricultural produce, increase income and enable rural people to escape from poverty.

A 15-year project in the township of Garalo aims set up electricity generators fuelled by jatropha oil for 10 000 people and to reduce village poverty. The population is mainly engaged in agriculture (mostly millet, sorghum and rice, as well as cotton for income generation), raising cattle and fishing. Electricity is required to pump water for irrigation, to operate agricultural processing equipment, to chill vegetables and for lighting and refrigeration services in small shops and restaurants. Jatropha (mainly *Jatropha curcas*) is well known in Mali where it is used for protective hedges, erosion control and traditional soap-making. The project will implement 1 000 ha of plantations of jatropha and other oil-producing plants and will provide training at different levels to ensure quality of the processed oil. Expected environmental benefits include carbon-dioxide emission savings of 9 000 tonnes per year as well as protection of soil against erosion to combat deforestation and desertification.

In the village of Tiécourabougou, the Mali-Folkcenter Nyeeta, a Malian non-governmental organization, has launched "energy service centres" based on jatropha. Some 20 ha of plantations grow seeds to produce jatropha oil for uses such as millet grinding and battery charging by villages within a 20-km radius.

The money spent on locally grown fuel stays in the community to stimulate the local economy. On a macro-economic level, this implies a reduction of the country's expenses on imported fossil fuels, saving hard-earned foreign currency reserves.

Source: FACT, 2007; UN-Energy, 2007.

as possible environmental changes, market identification, legal compliance, quality control and information dissemination;

- providing financial assistance to complement the mobilization of local resources;
- clarifying territorial rights and providing a legal framework for their recognition;
- protecting against pressures from other economic sectors;
- providing and maintaining basic infrastructure to support biofuel product development and marketing;
- providing formal rules for conflict resolution if local rules are insufficient;
- linking different decision-making levels;
- creating and enforcing regulations (giving heed to local needs) in those situations where local activity has an impact on a wider community and local approaches will not secure the interests of more distant communities (as in watershed management, for example).

STRATEGIES AND TOOLS TO GET STAKEHOLDERS' ROLES RIGHT

Trade-offs between different interests will often have to be made at the interface between sustainable biofuel development and sustainable livelihoods. The key question is who wins and who loses from biofuel development, with a particular emphasis on making sure that disadvantaged rural groups do not lose out. Successfully addressing this question requires the development of "good enough" local governance mechanisms (both formal and informal) that ensure adequate and sustained bargaining power for these groups.

A matrix comparing the environmental, agronomic, socio-economic and policy aspects of alternative land-use systems, produced by the Alternatives-to-Slash-and-Burn Programme, helps understand the trade-offs between different land-use options according to different interests and concerns (Table 3). Such a matrix could easily be adapted to assess different biofuel development options as a basis for multistakeholder negotiation.

An illustrative pyramid of governance elements necessary to achieve sustainable forest management (Mayers, Bass and

TABLE 2. Types of policy tools and some examples

Type of policy	Some examples
Incentive – tax or subsidy	Excise tax credit for renewable energy, carbon tax, subsidies for flex fuel vehicles, price supports and deficiency payments, tariffs or subsidies on imports/exports
Direct control	Renewable fuel standards, mandatory blending, emission control standards, efficiency standards, acreage control, quotas on import/export
Enforcement of property rights and trading	Cap and trade
Educational and informational programmes	Labelling
Improving governance	Certification programmes
Compensation schemes	Payment for environmental services

Source: Rajagopal and Zilberman, 2007

Macqueen, 2005) is also applicable to sustainable biofuel development (Figure 3). The lower tiers (basic policy and institutional elements) push, while the higher tiers (more sophisticated mechanisms that generate demand) pull, for sustainable biofuel development. Elements in the lower tiers are more numerous and often more fundamental to progress.

The pyramid's foundations are less directly controlled by biofuel stakeholders, but it is crucial that these stakeholders understand the constraints and opportunities emanating from beyond the biofuel sector to enable them to argue their case and influence those with the power to improve the foundations.

Taking the construction analogy further, Mayers, Bass and Macqueen (2005) suggest five "plumbing and wiring systems" as necessary complements to the building stones:

- information (access, coverage, quality, transparency);
- participatory mechanisms (representation, equal opportunity, access);
- finances (internalising externalities, cost efficiency);
- skills (equity and efficiency in building social and human capital);
- planning and process management (priority-setting, decision-making, coordination and accountability).

The involvement of local communities and small farmers in the co-management of biofuel systems should be an important principle of biofuel policies and practice, and a major component of international biofuel aid programmes. However, in other natural resource sectors (e.g. forestry) and rural development, the initial enthusiasm for this principle has been tempered by experience and recognition of the challenges it presents – providing a lesson for biofuel development. These challenges include:

- political and institutional issues underlying natural resource management;
- the importance of context;
- the difficulty of reducing specificity to the community level because rural populations are often composed of many separate groups, people use natural resources in different ways, and external actors influence the local rules of resource use and management.
- institutional transition in natural resource management, often including weakened traditional rules, increasing privatization and non-enforceability of formal rules.

A multiple strategy is therefore required, combining:

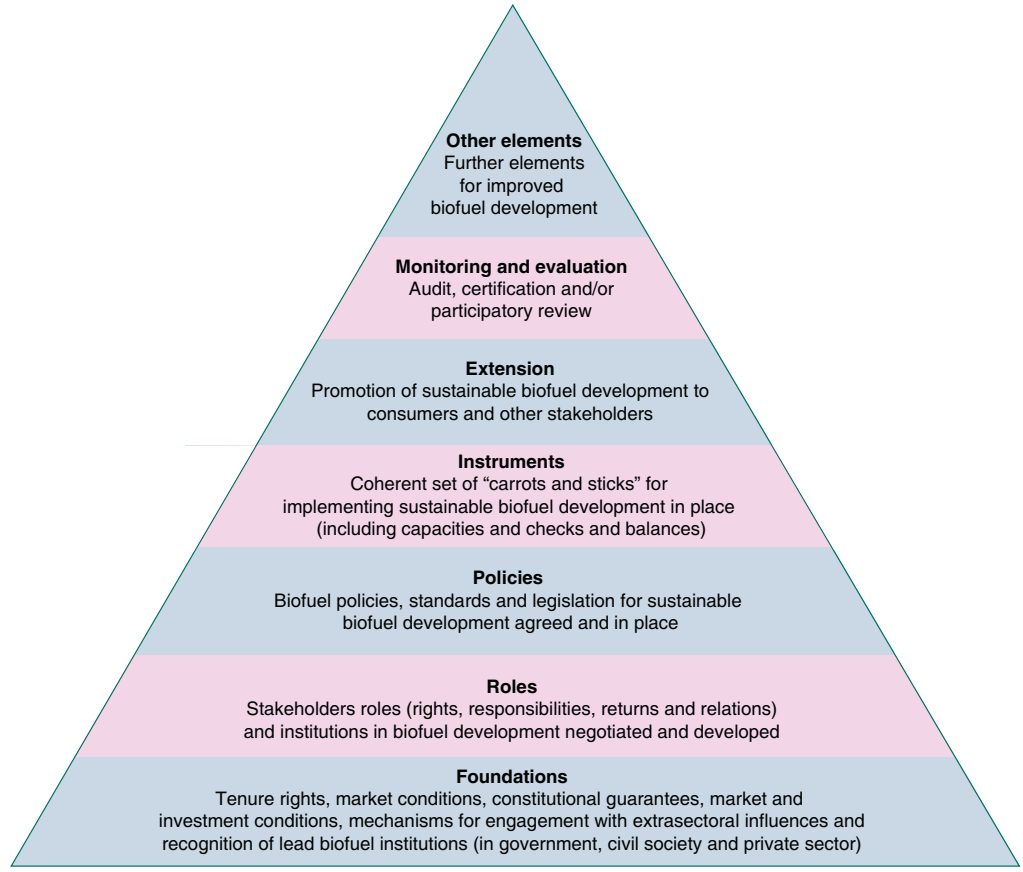
- national guidelines that clearly recognize the key role of communities and small farmers in achieving simultaneously better biofuel development and sustainable rural livelihoods;
- continuous potential for negotiation of the terms and conditions of the collaborative natural resource management agreement, particularly concerning the "four Rs" – rights, responsibilities, returns and mutual relationships – of stakeholders (Mayers, 2005);
- experimentation and monitoring of collaborative management involving rural people, and development of mechanisms that allow lessons from experimentation to feed into the policy-making process;
- long-term and demand-driven donor support to help in financing the transaction costs of this learning process;
- a flexible and iterative approach, following guidelines not blueprints.

Ultimately, policy implementation, institutions and stakeholders' roles in biofuel development are all embedded in the local political and cultural context. Policies may address the issue of what is needed at the natural resource level, but it is the interactions between the assets, needs, institutions and relationships that determine how policies are to be implemented. This is therefore the level where capacity development should be given priority. The argument about ways to implement biofuel development usually concerns stakeholders' assets and entitlements, and other local institutions, but

TABLE 3. Matrix comparing the environmental, agronomic, socio-economic and policy/institutional aspects of alternative land-use systems

Land-use systems	Global environmental concerns		Agronomic sustainability concerns	Smallholders' socio-economic concerns		Policy and institutional issues
	Carbon sequestration (above-ground, (time-averaged) *(tonne/ha)*	Biodiversity (above-ground) *(plant species per plot)*	Plot-level production sustainability (overall rating)	Potential profitability (returns to land) *(US$/ha)*	Employment (average labour input) *(days/ha/year)*	Production incentives at private prices (returns to labour) *(US$/day)*
Forests						
Complex agroforests						
Simple agroforests						
Crop-fallow rotations						
Continuous annual crops						
Grassland, pastures						

Source: Palm *et al.*, 2005



Source: Adapted from Mayers, Bass and Macqueen, 2005

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Illustrative pyramid of necessary governance elements for sustainable biofuel development

progress often hinges on the quality of local stakeholders' relationships, local politics and culture, and the influence of outside pressures, in short the balance of different interest groups. ◆

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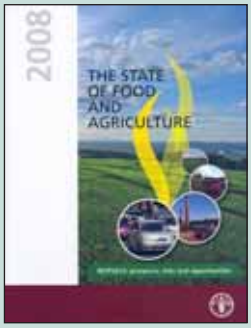
Do biofuels help mitigate climate change?

The 2008 edition of FAO's annual flagship publication *State of Food and Agriculture* focuses on prospects, risks and opportunities from biofuels. It raises issues of important interest to forestry – notably questioning the usual assumption that replacement of fossil fuels with fuels generated from biomass will necessarily reduce greenhouse gas emissions.

Greenhouse gases are emitted at many stages in the production of bioenergy crops and biofuels (including in production of agricultural inputs, fertilizer application, chemical processing and transport of biofuels). Moreover, they are emitted by land-use changes directly or indirectly triggered by increased biofuel production, for example when carbon stored in forest or grasslands is released during conversion to crop production. While maize produced for ethanol can generate greenhouse gas savings of about 1.8 tonnes of carbon dioxide per hectare per year, the conversion of



forest land to produce these crops can release 600 to 1 000 tonnes per hectare.

One study estimated that the conversion of tropical moist forest, peatland, savannah or grassland to produce ethanol and biodiesel in Brazil, Indonesia, Malaysia or the United States of America releases at least 17 times as much carbon dioxide as those biofuels save annually by replacing fossil fuels.

Another study concluded that in comparison with carbon emissions avoided by growing sugar cane, maize, wheat, sugar beet and rapeseed for ethanol and biodiesel on existing cropland, more carbon would be sequestered over a 30-year period by converting the cropland to forest.

State of Food and Agriculture 2008 notes that while biofuels are an important option for reducing greenhouse gas emissions, in many cases improving energy efficiency and conservation, increasing carbon sequestration through reforestation or changes in agricultural practices, or using other forms of renewable energy can be more cost-effective.

The complete text of *State of Food and Agriculture 2008* including references to the studies cited here is available online at: www.fao.org/docrep/011/i0100e/i0100e00.htm

The recent FAO publication *Forests and energy: key issues*, reviewed on p. 56 of this issue, provides additional perspectives on the complex relations among biofuels, agriculture, forests and climate change.