REPORT | 2008

# HIVOS KNOWLEDGE PROGRAMME

# FOOD, FEED AND FUELS

## a Knowledge Survey and Framework

SEI STOCKHOLM ENVIRONMENT INSTITUTE

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HIVOS

# FOOD, FEED AND FUELS

## Consequences of land use change patterns for livelihoods of marginalised people in the South

a Knowledge Survey and Framework, Prepared for Hivos by Stockholm Environment Institute

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# Summary

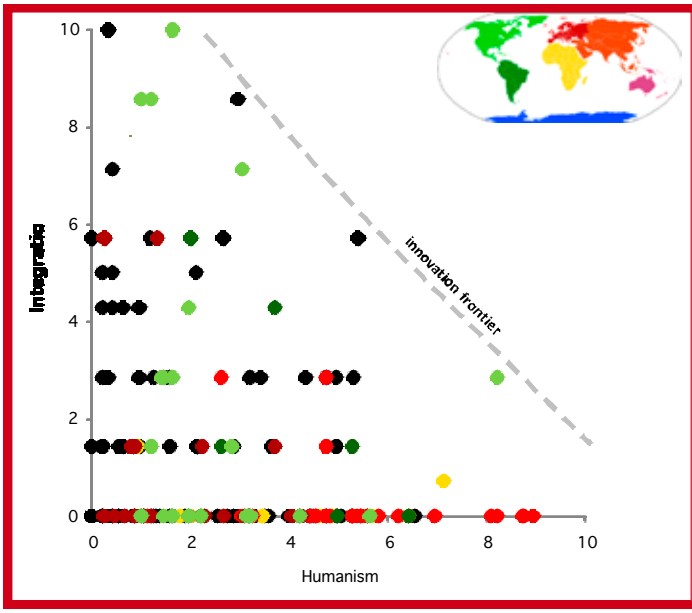
# Introduction

**Many recent trends threaten to reframe global policies on agriculture. These trends include climate change, rapid urbanization, economic growth, increasing meat in the global diet, and decreasing purchasing power of the poor. Recently, rising oil prices, harvest failures, animal diseases and low levels of stock have colluded with the longer-term trends to push food and feed prices upward, bringing the topic of agricultural policies to the fore.**

From mid-2007 to early 2008 Hivos partnered with Stockholm Environment Institute (SEI) to assess the state of knowledge on competing food, feed and fuels pressures on land use. The goal was to delineate knowledge needs in the field of sustainable economic development with a special focus on the economic position of marginalized groups. The results of this knowledge survey are summarized below. Based on the outcome of the survey, Hivos has decided to broaden its focus and develop knowledge on small producers' agency in the globalized market, and is currently exploring partnerships with interested knowledge centres.

## Methodology

The knowledge survey was based on a literature survey, consultation with energy and agricultural professionals, and the mapping of literature and organizations into a knowledge framework. The literature was classified in a system tabulating 57 different parameters, and then mapped onto a two-dimensional knowledge framework. One dimension of the framework measured the degree of integration between food, feed and fuels concerns; while the other dimension measured the degree of attention to humanist (rather than physical) parameters.
We found a broad distribution of literature on both axes, but also a clear "innovation frontier" revealing an absence of literature treating humanist issues in the full context of food, feed and fuel pressures taken together.




*<< Literature collected and categorized in the Knowledge framework. Horizontal striation in the data is due to a course formula for Integration that yields a limited set of unique values.*

## Findings

The survey was entitled *Food, Feed and Fuels; Consequences of land use change patterns for the livelihoods of marginalised people in the South*. Concerns about changing land use patterns are on the agendas of many research and advocacy organizations. Hivos is especially interested in the impact of these changes on the livelihoods of marginalised people in the South and formulated

seven related questions, pursuing median "answers" to each via the knowledge survey. Experts' opinions are clustered around the conclusions given below. Some questions remain unanswered and need further research, these knowledge gaps are listed in a subsequent paragraph.

*Q: What will be the impact on the terms of trade for agricultural bulk products from the South?*
A: A real potential for developing nations to improve their terms of trade is constrained by technological limitations and existing OECD agricultural policies. Developing countries located in tropical and sub-tropical regions have, in principle, a comparative advantage in primary agricultural production due to higher productivity and lower labor costs, ceteris paribus (other things being equal). Whether or not this advantage can be realized will depend on many other factors, such as access to technical support (e.g. agricultural equipment, agronomic knowledge), availability and cost of key inputs (e.g. water, fertilizer), and access to transport and distribution infrastructure. With the current system of trade supports in OECD countries, the terms of trade will improve only slightly and only in those cases where an exporting country in the South has special expertise with particular crops or agronomic techniques.

*Q: How will the increased competition for land affect the access and control of smallholders in the South to farmland?*
A: The likely effects of new food, feed and fuel demands on smallholders access & control to farmland vary regionally and are, amongst others, depending on land tenure schemes. Expansion of biofuel production will probably entail large-scale agro-industrial production, which might lead to consolidation of landholdings and dispossession.

*Q: To what extent will smallholders in the South profit from the increased commodity/food prices?*
A: It is difficult to generalize about the expected real-world impacts of biofuels on smallholders, owing to the different effects of: different feedstocks/ production systems; varying downstream (transportation) costs; existing (non-biofuel) crop production and processing patterns; and patterns of land holding. However, one thing that can be clearly extracted from the literature, is that there is a broad consensus that an expanding demand for agricultural sector products due to burgeoning biofuel demand is by no means guaranteed to benefit rural households.

*Q: What will be the impact of increased competition for farmland on food production, on food prices and on food security especially for households in the South without access to farmland including urban households?*
A: Food price pressures over the next 5 to 10 years will be substantive but not necessarily shocking, while a growing coupling between food and fuel prices will reduce food security. Non-producer households will be exposed to correlated price volatilities on their two primary budgets: food and fuel and will thus become more vulnerable. Increased pressure on land resources is expected to lead to a transfer of wealth away from urban residents and toward landholders.

*Q: What will be the impact on producer-consumer relations and on for instance gender relations, and how are they to be addressed?*
A: Knowledge on producer-consumer relations is typically framed in terms of contrasting rural and urban destinies, probably because most economic effects of biofuel development are likely to be indirect and hence have little obvious effect on producer-consumer relations. Gender issues are addressed in the literature studied but do not provide a consensus answer to the above question. Commercial biofuel farming, where labor is often paid on a quota system, seems to favor male employment; at times women offer unpaid labor to help their husbands meet the quotas. In China, and throughout Asia generally, small-scale biofuel development is viewed as a means toward improving the quality of life for women.

*Q: What will be the impact of increasing commodity/food prices for quality markets (social and environmental standards)?*
A: The likely effects of increased commodity and food prices on quality markets are yet unknown

*Q: How will the increased demand for land farmland/production conversion affect (agro- ) biodiversity, global warming?*
A: Biodiversity and carbon stores are both significantly threatened by increased land pressures and especially by conversion of natural ecosystems to bioenergy crop plantations. Negative impacts can be mitigated by utilizing existing agricultural and degraded land, and by employing appropriate management practices.

## Food, feed, fuels factors

The food-feed-fuels picture varies greatly from nation to nation, and even locale to locale. The balance of forces in any particular population will include, but not be limited to:

- Degree of economic development
- Degree of urbanization pressure
- Land availability and potential to expand arable land
- Legal protections for landless peasants and smallholders (strength of land tenure)
- Level of organization of smallholders
- The nation's trade balance in food
- The nation's trade balance in energy
- Traditional diet
- Degree of diet westernization
- Potential to expand arable land
- Cultural flexibility, especially surrounding gender roles
- Likely biofuels crops
- Forecast local climate change

"Given the current state of rural development policies and infrastructure in most developing countries, this competition for land is unlikely to benefit small farmers' access and control of farmland unless targeted policies are put into place."

## Knowledge gaps

Based on the knowledge survey, a set of knowledge gaps was also identified:

- Quantitative understanding of the effects of global prices when they are viewed on a national or subnational scale;
- The implications of quantitative, modeled results for typically externalized parameters like food security and human rights;
- Deployment schedules and policies for second-generation biofuels, which are uniformly agreed to be much less threatening than first-generation biofuels;
- Effects of increased commodity and food prices on quality markets;
- Integration of freshwater price and availability into agricultural and land use analyses; and
- Availability and effectiveness of legal protections for the rural poor

We equally found a distinct separation between existing economic modeling practices for agricultural markets and those for energy markets. Given the fact that biofuels could best be understood as an extension to existing, agricultural dynamics the various models require integration.

## Knowledge network

A description of the network of knowledge on food, feed and fuels pressures on land use was assembled, including "who to watch" organizations for each of the knowledge gaps. We observed a well-organized and coordinated "top-down" network associated with wealthy, OECD countries; and a "bottom-up" network composed principally of (very) small NGOs. The bottom-up network has valuable information to communicate, especially regarding the situations of smallholders, but contact between the top-down and bottom-up networks is sparse.

## Policy guidance

The survey made clear that the effects of the increased demand for biofuels could best be understood as an extension to existing agricultural dynamics. This made us look at other assumptions that had come to the fore and determine the following guidelines for future studies:

- Understand biofuels as an extension to existing agricultural dynamics
- Put human rights and ecology at the core, instead of economics
- Treat diet and fuel demands with equal concern
- Where economics are concerned, support model-based knowledge generation

"Many of the issues raised by biofuels are clearly not unique to biofuels, but rather are challenges that have faced agriculture and rural development policy for many decades."

## The way forward

Reflecting on the history of agricultural economics, and viewing biofuel developments as an extension of existing agricultural dynamics, Hivos decided to broaden its scope. Hivos will focus a Knowledge Programme on small producers' agency in the globalized market. The aim of this Knowledge Programme is to integrate knowledge about roles and opportunities for the rural poor and smallholders in particular by (a) fine-tuning our current understanding of trends in rural livelihoods and agricultural markets, (b) studying the modalities that can and are being used to enable the rural poor to take advantage of current opportunities while circumventing the risks, (c) studying experiences/best practices of smallholders' organisations and cooperatives in adapting to global and local market changes, and (d) analyzing different approaches and strategies used by international organizations to develop sustainable income / market opportunities for the rural poor. Hivos is currently exploring partnerships with interested knowledge centres.

## Hivos Knowledge Programme

Knowledge sharing within Hivos and with its partners has been a core activity of Hivos for quite some time. A need was identified to go beyond sharing and to initiate new knowledge programmes in cooperation with leading knowledge institutions in the North and the South. So in 2007 Hivos initiated a full-fledged Knowledge Programme focused on specific themes. The strategy used is knowledge integration. By integrating various forms of (new) knowledge – academic knowledge, practitioner knowledge, educational and cultural expressions of knowledge – new insights can be created and strategies formulated that contribute to the development of new policies and practices for the development sector. To this end, Hivos' Knowledge Programme focuses on specific themes related to its mission. Themes include Civil Society Building, Promoting Pluralism, Closed Societies in West Asia, Freedom of Expression and Sustainable Economic Development. See www.hivos.net for more information.

## Information

For more information on the Hivos Knowledge Programme, please contact the coordinator of the programme, Josine Stremmelaar (info@hivos.net). For more information about SEI, please contact scientist Roel Hammerschlag (roel@sei-us.org).

## About Hivos and SEI

Hivos, the Humanist Institute for Cooperation with Developing Countries, is a Dutch non-governmental organisation inspired by humanist values. Together with local organisations in developing countries, Hivos seeks to contribute to a free, fair and sustainable world in which citizens - women and men - have equal access to the resources and opportunities for their development.

Stockholm Environment Institute (SEI) is an international research organization working on sustainable development. Its U.S. Centre is a research affiliate of Tufts University in Massachusetts. SEI has a networking research approach, involving partners in the regions and places of research to incorporate local knowledge and values. In addition to providing policy analyses, SEI builds capacity in the developing world for integrated sustainability planning through training and collaboration on projects.

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# Report

# Food, Feed and Fuels

## 1. Methodology

This Knowledge Survey was conducted in three parts:

1. A broad literature survey, including grey literature;
2. Surveys and interviews with energy and agricultural professionals; and
3. Classification and mapping of literature and organizations into a Knowledge Framework.

### Literature Survey

Literature collected was limited to a publication or release date of January 1, 2000 or later. In order to be included in the survey, the literature was required to be motivated by an interest in either (1) the nature or consequences of increased demand for biofuels or (2) changing dietary patterns. The interest was allowed to be either explicit or implicit in the article. 208 items meeting these criteria were collected, in addition to several dozen additional articles not meeting the criteria but of affiliated interest. The literature survey can be considered current as of December 31, 2007.
Reference copies of nearly all cited literature are being supplied to Hivos separately, in electronic format (approximately 230 MB).

### Surveys and Interviews

An on-line survey was announced to the Community for Energy, Environment and Development (COMMEND) professional network, and in SEI's Renewable Energy for Development (RED) newsletter. 46 responses were received to the on-line survey, representing five continents. Paper surveys were distributed at the Biofuels Africa Conference in Cape Town, South Africa, November 5-7, 2007 (nine responses); and at the 13th Conference of the Parties to the UNFCCC in Bali, December 3-7, 2007 (four responses).
In total, we made contact with 20 individuals in Africa, 12 in Asia, and 15 in Latin America. Contacts in Europe and North America were in part casual and hence were not tracked or tallied.

### Development of a Knowledge Framework

*Classification Schema*

Each item of literature was assigned values in a classification schema, appearing in Figure 1 on page 14. In the figure, each one- or two-letter code identifying a parameter refers to a column in the Microsoft Excel spreadsheet <Hivos_main.xls> that serves as the project's central database. <Hivos_main.xls> is a part, by reference, of this report.
Each parameter is followed, in parentheses, by a list of the values that can be assigned to it. These allowed values vary by the type of parameter, as follows:

- Parameter Q (geographic focus) must be assigned a value from the pick-list {world/n.s., region, nation, subnation}
- An X must be assigned to one or more parameters R through W (the continents) only if parameter Q identifies a focus smaller than world/n.s. An X indicates that the literature focuses on the respective continent, or a nation/subnation within the continent. When a world-scope work also includes examples or case studies from a particular region, then an X may be assigned to one or more parameters R through W even though Q is world/n.s.
- At least one parameter Y through AB (populations) must be assigned an X. An X indicates that the literature concerns itself with the respective population. Multiple populations may be chosen.
- At least one parameter AC through AH (land use pressures) must be assigned an X. If none of the land use pressure parameters AC through AH can be checked off, then the literature

should not be in the catalogue; that is, the set of land use pressure parameters defines the scope of the literature survey.

- For parameters AI through BK (resource impacts) assign an X if the literature treats the resource qualitatively, or a Q if the literature describes original, quantitative work. It is allowed to assign a value to no resource impact parameters, if one or more response strategies (see below) does receive a value.
- For parameters BL through BU (response strategies) assign an X if the literature mentions the response strategy, or an A if the literature describes original and significant analysis. It is allowed to assign a value to no response strategy parameters, if one or more resource impacts (see above) does receive a value.

The spreadsheet includes additional notes defining each parameter more fully. Through sorting or filtering the database in <Hivos_main.xls>, a reader of this knowledge survey can extract significant detail beyond that displayed in the simplified, 2-dimensional Knowledge Framework.

### *From Full Classification to Simplified Knowledge Framework*

Automated formulae convert the values assigned during the classification process into the two principal axes of the knowledge framework. The formulae are available in columns CC through CM (Integration), and columns CN through CV (Humanism) of the literature database.

The integration axis describes the degree to which the work describes interactions between food, feed and fuel parameters together, rather than treating each topic in isolation. The formula is a mathematical function of parameters AC through AH (land use pressures) and AL through AW (resource impacts relating to food, feed and fuel). Quantitative treatments of interactions receive higher scores than qualitative ones.[a]

The humanism axis describes the degree to which the work includes human or social issues. The formula is a mathematical function of parameters Q through AB (geographic focus and population), BG through BJ (selected social resource impacts) and BL through BU (response strategies). A focus on select populations, social resources, or policy strategies drives higher values on this axis. The depth of policy analysis also drives higher scores on this axis.

## Project Deliverables

The results of the project are delivered on a CD containing directories as follows:

| directory | contents |
|---|---|
| report | this document in two formats: <Food Feed Fuels (rev C).pdf> and <Food Feed Fuels (rev C).doc>; and the PowerPoint presentation given at the February 11 delivery meeting, <Feed Feed Fuels.ppt> |
| catalogue | the catalogue of sources and organizations compiled during the survey, <resource index.xls> |
| sources | the sources indexed in the catalogue, numbered 101 through 367 |
| surveys | survey responses received via internet <survelys.xls>, and scanned versions of paper surveys received in Cape Town. |

**a** *The classified works comprise those discovered during the discovery phase of the project, through December 28, 2007. The additional thirty-seven works catalogued between December 29, 2007 and February 29, 2008 are not included in the framework analysis because they reflect our pursuit of specific, apparent knowledge gaps and would distort the less biased, earlier results.*

## Geographic focus

Q. geographic focus
( world/n.s. OR
region OR
nation OR
subnation )

R. Africa (X)

S. Asia (X)

T. Europe (X)

U. Latin America (X)

V. North America (X)

W. Oceania (X)

X. nation/subnation (*text field*)

## Population

Y. n.s. (X)

Z. rural (X)

AA. smallholders (X)

AB. urban (X)

## Land use pressures

AC. traditional biomass (X)

AD. 1st generation ethanol (X)

AE. 1st generation biodiesel (X)

AF. 2nd generation biofuels (X)

AG. other bioenergy (X)

AH. food/diets (X)

## Resource impacts

### land

AI. quantity (X or Q)

AJ. quality (X or Q)

AK. access/security (X or Q)

### food

AL. quantity (X or Q)

AM. price (X or Q)

AN. quality (X or Q)

AO. access/security (X or Q)

### feed

AP. quantity (X or Q)

AQ. price (X or Q)

AR. quality (X or Q)

AS. access/security (X or Q)

### fuel

AT. quantity (X or Q)

AU. price (X or Q)

AV. quality (X or Q)

AW. access/security (X or Q)

### water

AX. quantity (X or Q)

AY. price (X or Q)

AZ. quality (X or Q)

BA. access/security (X or Q)

### other physical

BB. general environment (X or Q)

BC. air quality (X or Q)

BD. GHG emissions (X or Q)

BE. agro- or bio-diversity (X or Q)

BF. materials (X or Q)

### social

BG. development/wealth/work (X or Q)

BH. health/human rights (X or Q)

BI. cultural value (X or Q)

BJ. gender equality (X or Q)

BK. military security (X or Q)

## Response strategies

BL. research (X or A)

BM. education (X or A)

BN. micro-finance (X or A)

BO. macrofinance/markets (X or A)

BP. trade policy (X or A)

BQ. domestic regulations (X or A)

BR. institutional structures (X or A)

BS. quality markets and standards (X or A)

BT. fuel technology (X or A)

BU. agricultural technology (X or A)

n.s. means "not specified"

**Figure 1** – *Literature classification schema. n.s. means not specified. The one- or two-letter code prior to each parameter refers to the corresponding column number in the literature database. Values in parentheses are values allowed to be assigned to the parameter.*

# 2. The Body of Knowledge, Viewed within the Framework

The literature collected during the discovery phase of the project is diagrammed in the Knowledge Framework, in Figure 2. We classified 208 works: 113 treating the food-feed-fuels topic on a global scale, 44 treating the topic in Europe or North America, and 51 in other continents. Works in other continents focused principally on Asia, which was the focus of 30 of the 51 non-Europe/North America studies.

The relative absence of South American literature surprised us, given the advanced development of the Brazilian biofuels industry. Upon closer examination, it appears that the reason for this is the advanced development itself. Because the industry is established, the primary "food vs. fuel" question is no longer asked. Brazilian concerns regarding social or environmental impacts of biofuels tend to seat in NGOs focused on corporate social responsibility; the question is no longer whether to advance a biofuels industry, but only how to minimize the impacts of the existing one.

### *Integration Axis*

The "food vs. fuel" aphorism reflects not just the collision of two different development interests, but also the collision of two bodies of research. Figure 3 shows how the body of literature collected

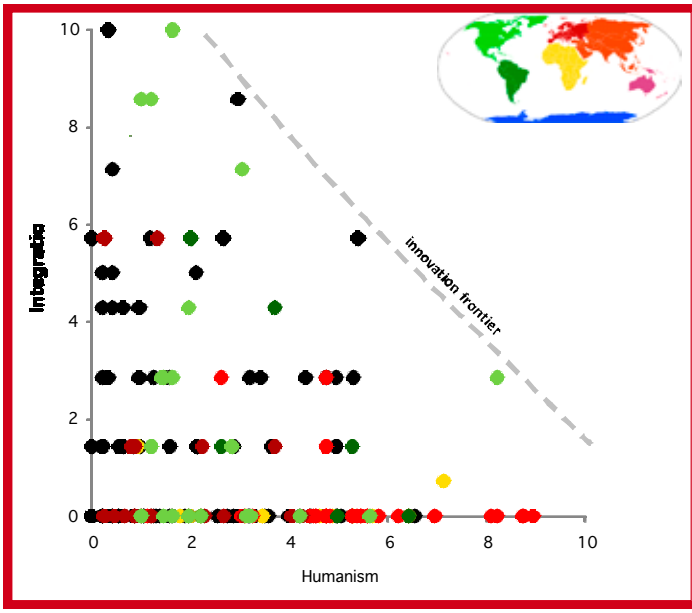


**Figure 2** – *Literature collected and categorized in the Knowledge framework. Horizontal striation in the data is due to a course formula for Integration that yields a limited set of unique values.*

for this knowledge survey apparently exploded in 2005-2006, driven primarily by a sudden interest in the impact of biofuels development on the agricultural sector.

Prior to this explosion of interest, energy and agricultural analysis were performed by different communities of researchers, using entirely different tools. The two communities utilized different, partial-equilibrium models for their respective sectors. Major concerns of energy policy analysis were resource limits, environmental impact, and economic burden; while major concerns of agricultural policy analysis were food security and economic burden.

Simultaneous consideration of all of these concerns requires not just new ways of thinking, but new modeling tools as well. In particular, global, computable general equilibrium are required for handling the complex, spatially inhomogeneous systems that support an economy where food and fuel are both dependent on land resources. Such models do not exist yet, and fully integrated, quantitative analysis will be impossible until they do.

On a qualitative level, researchers are making important strides in understanding the strength of the linkages between food and fuel economics. In 2000 and earlier, integrated treatments of food and fuel are virtually nonexistent, except to the extent that energy is understood as an important input

to agricultural production (for example, a particularly comprehensive UN report published in 1997 includes a subchapter dedicated to the interaction of energy and food security, that does not mention bioenergy, see 148 Section 2.1.4), but by 2007 sophisticated discussion of cross-elasticities between food and fuel prices (e.g. 311) accompany primitive efforts at integrated modeling (e.g. 131), and agricultural modelers are beginning to add biofuels as an explicit commodity (e.g. 289). Indeed, all but one of the 15 works with integration scores above 5 were published in 2006 or 2007.

### *Humanism Axis*

The humanism axis reflects a high degree of focus either on a small geographic region, on development, on social resources, on policy response strategies, or a combination of these. The axis is designed to disfavor works that treat solely the physical potentials for food or biofuels without incorporating a social context.

Our survey identified works that incorporated a broad array of humanist issues, but notably the upper-right quadrant of the Framework is unpopulated. The integration score increases with quantitative treatments of food, feed and fuel prices or quantities, and the empty upper-right quadrant reflects the absence of quantitative tools for handling humanist interest. That is, the current generation of models cannot examine national- or subnational-scale economies in the South, nor integrate fuel and food

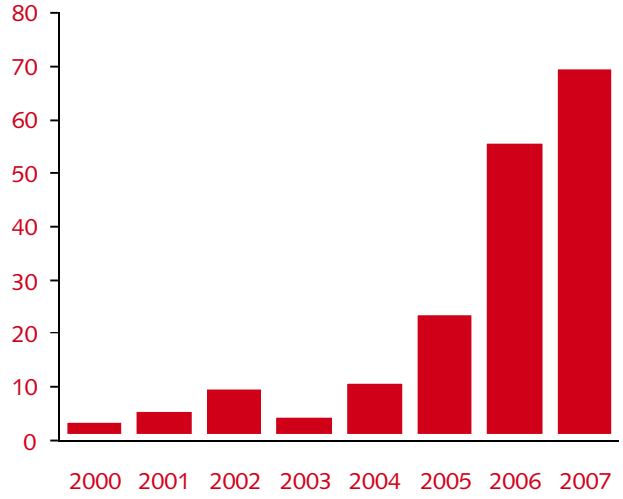


**Figure 3** – *Histogram of collected literature, binned by year of publication.*

flows to the extent necessary for accurate assessments of impact to development and welfare. However, the lower right quadrant of the distribution is quite dense with work, reflecting that a great deal of concern for humanist issues is being expressed. The publications treating Asian issues, furthest right on the humanism axis, are predominantly focused on India, and earn their high humanism scores through substantive analysis of policy responses.

### *Innovation Frontier*

The dashed line in Figure 2 describes an innovation frontier that demarcates, above all, the limitations of current analytic tools. Though concern about humanist issues are widely expressed in the literature, the quantitative tools necessary to estimate the effects of actual land use pressures on those issues do not exist. As models and other tools develop to allow integrated evaluation of national- or smaller-scale economic, environmental and social variables, new datapoints will appear in the upper-right quadrant of the graph.

All of the datapoints lying near the innovation frontier relate either to the world or to North America. The proximity of North American studies to the innovation frontier is probably the result of two

different phenomena. First, North American researchers have access to some of the most sophisticated models, and of course those researchers are inclined to study their own countries' economies first. Second, the highest-quality exogenous data available to those models comes from their resident country (usually, the United States). Thirdly, and probably most importantly, large subsidies of corn ethanol in the United States, coupled with new legislative initiatives toward further biofuels development and economic concerns about recent highs in maize prices (203), have led to a sense of urgency in understanding the U.S. position with respect to biofuels.

## 3. Estimated, State-of-the-Art Knowledge

In the Terms of Reference to the Knowledge Survey, Hivos provided a set of seven questions (Appendix D p. 71) that together describe the subject on which knowledge is being surveyed. Each of these seven questions is repeated below, followed by a summary of the prevailing answer indicated by our survey of the literature.

Keep in mind that each of the question responses below is not per se an answer, but rather our best estimate of the implied consensus opinion, including descriptions of those sub-questions for which insufficient data for any opinion exists.

### 1. What will be the impact of increased competition for farmland on food production, on food prices and on food security especially for households in the South without access to farmland including urban households?

*Major Agricultural Sector Models*

Impact on households without access to farmland can be estimated through forecasting changes to food and fuel prices. Doing so requires economic modeling; major agriculture sector models are stewarded by the OECD & FAO (271), the Economist Intelligence Unit (313), the International Food Policy and Research Institute (IFPRI) (286) and the Food and Agricultural Policy Research Institute (FAPRI) (289). All of these organizations have addressed the impacts of changing diets and biofuels development to world food prices, either in their regular forecasts, in special research reports, or both.

The most recent OECD-FAO Agricultural Outlook 2007-2016 forecasts a 0.7% p.a. increase in meat consumption in developed countries, contrasted with a much higher, 1.7% p.a. increase in developing countries driven by income growth (271 p.98); yet world prices for beef, pork and poultry are all expected to decline over the same period, mostly due to a gradual recovery from recent price shocks associated with disease outbreaks, only the price of lamb increases (271 p.97). Meat diets worldwide and increasing ethanol demand in the U.S., Canada, the EU and China are cited as the principal drivers of growing cereal demand (271 pp.52-54), but current price shocks, driven in part by U.S. ethanol demand, mean that world prices of most grains as of 2016 will be slightly below today's high levels (271 p.53). The growth in demand for coarse grains (maize) is forecast to require additional area, displacing principally soybean and secondarily wheat crops, but also occupying currently unused land in Latin America (271 p.55). Sugar production and prices are identified as coupled strongly to biofuels demand, but also to rising incomes, dietary convergence, urbanization and population growth (271 pp.85,92). Sugar-producing regions EU, Malaysia, Indonesia, South Africa, Colombia and the Philippines are embarking on renewable energy programs

**b** *Non-economic effects on such households are treated further in Section 6 below.*
**c** *One source points out that the process of diet transformation in Asia can be seen as involving two separate stages: (i) income-induced diet diversification and (ii) diet globalization and westernization. (301, p.282) It is likely that all developing countries will be subject tothese two separate forces, though the relative effects may differ greatly depending on the nature of the indigenous diets with respect to which the changes take place.*
**d** *We are not necessarily in agreement that sugar production is a rationale for starting a biofuels program. For example, South Africa has focused on maize for ethanol even though they are the largest sugar producer in the SADC region. (SEI staff)*

(271 p.84). World biodiesel feedstock production is characterized in the report as a two-pole source, with soybean oil from South America competing with palm oil from Southeast Asia. These and several other crops supply biodiesel feedstock in the importing regions (271 pp. 68-79).
IFPRI stewards a major sector model (IMPACT) but related publications are intermittent. The most recent, comprehensive forecast report was issued in 2002 and includes forecasts to 2025 (286). Changes in global diet are understood as an important driver in the report, which forecasts developing nations to more than double their meat consumption in the forecast period while the global average increase is 56% (286 p.2,92). However, biofuels are not discussed as a market driver. A 2007 IFPRI report to CGIAR, though short, incorporates IMPACT results based on two biofuels growth scenarios and predicts very large potential price increases to five major crops (Figure 4) (285). Further work with the IMPACT model is reported elsewhere (299).
The FAPRI U.S. and World Agricultural Outlook, like the OECD-FAO Agricultural Outlook, is an annual publication and forecasts to a 10-year horizon. The FAPRI 2007 outlook (289) has taken the additional step of reporting on biofuels as an independent subsector, focusing ethanol production and consumption forecasts on the U.S., Brazil, China, the EU and India. Biodiesel production and consumption is also tracked for the U.S. and EU. Ethanol price is projected to fall during the forecast period; biodiesel price is not tracked. The FAPRI 2007 outlook also includes national-scale prices in the meat sector, in addition to world prices that follow a similar decline+rise pattern to those forecast

| | Scenario 1 | Scenario 2 |
|---|---|---|
| Crop | Biofuel expansion [1] | Drastic biofuel expansion [2] |
| Cassava | 11.2 | 26.7 |
| Maize | 26.3 | 71.8 |
| Oilseeds | 18.1 | 44.4 |
| Sugar | 11.5 | 26.6 |
| Wheat | 8.3 | 20.0 |

Source: IFPRI IMPACT projections.
Notes: [1]Assumptions are based on actual biofuel production plans and projections in relevant countries and regions.
[2]Assumptions are based on doubling actual biofuel production plans and projections in relevant countries and regions.

**Figure 4** – *Percent increases in 2020 food crop prices relative to "baseline levels" (probably 2005/2006) induced by two biofuel expansion scenarios (285 p.8).*

by OECD-FAO, but with generally a larger net increase by the end of the forecast period.
Corn is forecast to demand increased land area, especially in the U.S. and Latin America, during the forecast period, but the increased production is accompanied by a decline in price after a peak years 2007-2010 (289 pp.186,187). Rapeseed and rapeseed oil prices are characterized as being driven in large part by EU biofuel directives, with a strong peak in 2007-2009 and then decreasing for the remainder of the forecast period (289 pp.241-243). Palm oil and palm kernel oil increase in price substantially during the projection period, but palm kernel meal experiences an anticorrelated, substantive decrease in price (289 p.267). China, which does not produce palm oil, is modeled to increase demand enormously, driven primarily by increasing demand for processed food products (289 p.266).

The Economist Intelligence Unit (EIU) World Commodity Forecasts dataset (313) provides historical and two-year projected prices for fourteen agricultural commodities and is updated quarterly. The two-year forecast horizon is intended for business decisionmaking rather than policy planning and adds little to the food-feed-fuels knowledge set. The underlying model could in theory inform future modeling developments but it is guarded as a proprietary instrument so its value to the greater

knowledge set is mitigated by the money price of substantive access. Likewise, the International Monetary Fund (IMF) releases regular macroeconomic forecasts, the latest of which focuses on "globalization and inequality" and examines the behaviors of both food and fuel prices (318). Like the EIU forecasts, the IMF forecasts reach less than two years into the future and thus have limited applicability to guiding long-term agricultural policies.
The United States Department of Agriculture (USDA) releases annual, 10-year projections of world agricultural trade balances, which are compiled under oversight by the Interagency Agricultural Projections Committee; the 2007 edition includes some minor treatment of biofuels influence on agricultural markets (323). The annual projections are a composite of various model results and expert judgment. The USDA is also cooperating with Penn State University on an international, partial-equilibrium model known as PEATSim, that includes biofuels as a distinct agricultural commodity (322). However, there is not a regular forecast publication associated with this model.

### *National-Scale Agricultural Sector Models*

Agricultural sector models have also been built for the purpose of examining effects in a single nation, though once again the focus has been on developed nations, where input data and research dollars are more widely available; publications describing such national-scale sector models have been issued for the U.S. (290, 291) and the European Union (316).

### *CGEs and GTAP*

An excellent literature review published by Rajagopal & Zilberman at the World Bank points out the severe limitations of using agricultural sector models like those above to forecast the highly integrated economic effects expected for biofuels, which affect the agricultural, energy, industrial and transportation sectors (287, p.51). More comprehensive, computable general equilibrium (CGE) models are necessary to forecast the integrated effects. Most existing CGE models model a single nation's economy; for example the U.S. of replacing 20% of crude oil consumption with ethanol (315), and an Austrian CGE model has been used to predict economic benefits of biofuel demand driven by a national carbon tax (293). Sophisticated, national-scale CGE models exist for only a few, developed nations and hence do not shed much light on the prospects for the South.
The majority of international economic modeling described in the literature is connected to the Global Trade Analysis Project (GTAP) dataset and models. But even these analyses tend to give the greatest analytical depth to developed nations. One study concludes that the dominant global effect of substituting switchgrass for oil in the U.S. energy market is a strengthening of the dollar (since the U.S. becomes less dependent on imports) and associated, negative effects for importers of U.S. goods that depress all other regions except south Asia (292). The MIT Joint Program on the Science and Policy of Global Change stewards a CGE model connected to GTAP data known as the Emissions Prediction and Policy Analysis (EPPA) model, and used it to demonstrate that quadrupled oil prices and GHG stabilization policies inspired by U.S. legislative proposals could create a global demand for about 2 Gha of biofuel crops by the year 2100, roughly the same amount of land currently used for the global food supply (294).

Other studies use GTAP data to examine whether the European biofuels directive can be met without mandatory blending ratios (298), whether the directive will be met largely with imports and how it will affect the European livestock sector (297). The need for imports seems to be a uniform outcome for both modeling efforts.
Largely independently from the GTAP, FAPRI-associated researchers have analyzed the effect of removing U.S. ethanol trade barriers on global agricultural and energy markets, using a 6-region model examining interactions between the U.S., Brazil, the EU, China, Japan and a Rest-of-World aggregate (295). The strongest conclusion is a significant increase in land pressure to grow sugar-cane in Brazil, and corresponding effects on sugar prices.

### *Accounting*

Without economic modeling, it is possible to analyze benefits and costs from small, local initiatives that do not significantly impact the greater economy, using straightforward spreadsheets. Though many such calculations certainly exist, in most cases they are proprietary studies that are unpublished and unavailable to the research community. Our database does include one published study of this sort, covering initiatives in North China (288).

### *Summary of Effects to Urban Households*

On a global-average basis, increased pressures on land are expected to push food prices upward, and therefore present an economic and food security burden to urban households. However, the economic effects are likely to unfold more slowly than some of the more impassioned voices in the debate would imply, as a current spike in agricultural prices is expected to decay over the next five to seven years, presenting a price cushion to absorb the effects of new land pressures.

Several researchers emphasize the importance of free trade to supporting developing nations during a presumed bioenergy transition, and the need to develop biofuel export balances in the South (where many candidate biofuel crops are most productively grown) underlines this.

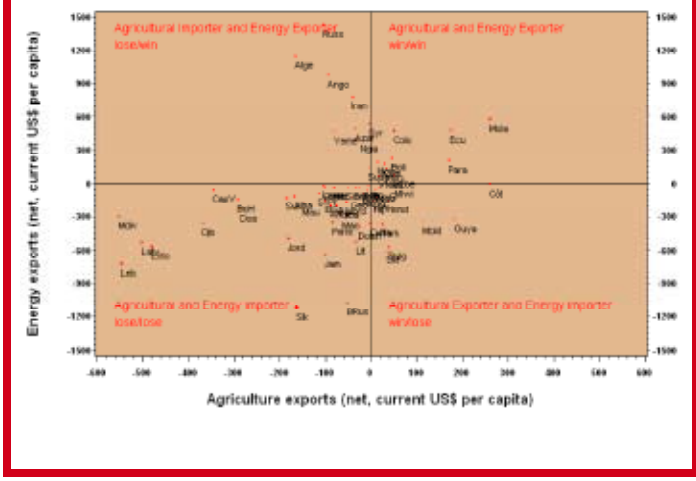


**Figure 5** – *An example of economic welfare impacts assessed by J Schmidhuber (from 311). Only countries with less than US$5000 per capita GDP are included in the graphic.*

### *Translations to Food Security*

Definitions of "food security" vary widely; one researcher catalogued some 200 different, published definitions (351 p.25). Virtually all definitions focus on continuous access to sufficient food. "Access" in turn is first of all economic, but also social (is the food physically available; are there social systems blocking access through means other than price). Economic modeling gets at the price component of access but does little to address the social component. Social barriers to food access can only be inventoried on a case-by-case basis, an exercise that has not been done on a global scale, to our knowledge.

In many definitions, the continuity of the access is highlighted. Some commentators have pointed out that a major biofuels market will tie food and fuel prices together, increasing food price volatility.[e] (e.g. 271 p.63, 285) In the most extreme case, poor populations' food prices may be determined in part by developed nations' relatively inelastic demand for automobile fuel.

The larger energy market (beyond just bioenergy) theoretically provides a price ceiling effect (311), but the mitigating value of this effect differs depending on opinions about the stability of energy

**e** *There is little concern in the literature regarding biofuel markets' converse effect on oil prices, and indeed such effects, if any, will probably be dwarfed by effects of climate regulation on oil prices (287 p.52).*

prices. As energy prices increase, more crops become economically viable energy feedstocks, and the linkage between energy and food prices strengthens. The greatest threat to non-producer households may be per se this linkage, exposing the lowest-income households to correlated price volatilities on their two primary budgets. On a national level, countries that are net importers of both food and energy are most threatened, unless they manage to become an energy exporter through aggressively pursuing the new bioenergy markets. Which of the least developed countries are net importers of food depends on how "food" is defined; 43 of 52 countries analyzed by Schmidhuber in 311 are determined to be net importers, implying that increases in food trade prices are likely to emphasize wealth disparities between nations.
Similarly, a more recent analysis of agricultural trade balances by the World Bank (351) identifies 42 of 58 low-income countries to be net food importers, but finds that only 24 of the 58 countries are net importers when the definition of agricultural commodities is expanded to include tropical crops, feeds and agricultural raw materials. This is promising news, indicating that the current trade situation may allow an expanded agricultural market to benefit many of the poorer nations, provided farmers are able to make appropriate crop substitutions.

## 2. What will be the impact on the terms of trade for agricultural bulk products from the South?

### *An Agricultural Production Advantage of Developing Countries is Available but Constrained*

Developing countries located in tropical and sub-tropical regions have, in principle, a comparative advantage in primary agricultural production due to higher productivity and lower labor costs, ceteris paribus (other things being equal). Whether or not this advantage can be realized will depend on many other factors, such as access to technical support (e.g. agricultural equipment, agronomic knowledge), availability and cost of key inputs (e.g. water, fertilizer), and access to transport and distribution infrastructure.
Trade in agricultural bulk products (i.e. agricultural commodities) is, in theory, less affected by external factors such as technology and industrial market structure since there is minimal processing involved. When demand for these commodities tightens due to their use as inputs in other economic sectors – namely biofuels – then the total demand and hence the prices of these commodities will go up, ceteris paribus. Those producers and countries with a comparative advantage in such products will tend to benefit under such conditions. Again, whether this happens in practice depends on a number of other factors, including the extent to which markets are distorted by subsidies and taxes of various kinds and non-tariff barriers to trade such as quality standards (269).
In the case of the least developed countries (LDCs), poor macroeconomic conditions and the lack of infrastructure will tend to have a greater impact than other factors. For land-locked countries, (e.g. Malawi, Zambia), bulk agricultural products present additional constraints; they incur higher costs to reach international markets and the infrastructure for land transport is already more costly and less available (105, 363, 364). An additional issue in the LDCs is the fact that the overwhelming majority of farmers are subsistence farmers and their participation in international markets is already highly constrained, if it exists at all. As they tend to buy and sell in local markets or informal (in-kind) markets, the effect from rising prices depends on how much they participate in regional and international markets.

### *Markets Are Distorted by Agricultural Subsidies in Developed Countries*

Agricultural markets remain highly distorted by the Common Agricultural Policy within the EU, by the U.S. farm support programs, and by other support systems still in use around the world. The least developed countries are disadvantaged in the current system, and a number of countries with good soils and climate are nevertheless net food importers. They cannot subsidize their own farmers nor can they place import tariffs on primary agricultural markets since this would endanger the poor.

The same barriers apply to feedstocks for biofuels production, although the final products are classified in varying ways. Biodiesel in considered an industrial product, while ethanol is considered an agricultural product. However, where the oil or oilseeds are traded, they will in some cases be classified as agricultural products. The agricultural sector was supposed to be addressed in the current Doha round, but little progress has yet been made.

### *Future Carbon Valuation May Affect Trade Balance*

Yet another issue that could affect the terms of trade, but which is somewhat independent of the relation between food and fuels, is the difference in the carbon burden of agricultural products in different regions and countries. The lower use of external fertilizers in the South, especially in sub-Saharan Africa, results in a lower carbon burden for agricultural products. As carbon trading mechanisms and carbon penalties become more widespread and applicable, the terms of trade could improve, depending on the carbon price. At the same time, if the market improves for their agricultural products, countries in the South might choose to invest some of the additional income in buying fertilizers in order to raise their yields further, which would in turn raise the carbon burden. If the least developed countries are exempt from carbon penalties, then they can do so without having the negative effects on competitiveness.

### *Approaches Available to Mitigate Trade Balances for LDCs*

With the current system of trade supports in OECD countries, the terms of trade will improve only slightly and only in those cases where an exporting country in the South has special expertise with particular crops or agronomic techniques. In the longer term, the terms of trade will improve, if the pressure on prices is maintained through the additional demand created by biofuels production. The LDCs in regions with high population density and land pressure will tend to benefit the most from the improved terms of trade, since extensive expansion is constrained. The LDCs in those areas with lower population density and good growing conditions, such as certain regions of sub-Saharan Africa, will tend to benefit less from the improved terms of trade, since they will face competition from expansion at the extensive margin. Both types of producers will face the common difficulties associated with maintaining competitiveness in markets for undifferentiated and divisible products. Land-locked countries will face similar problems as they did at lower prices, although initially some markets would be more accessible since transport costs are proportional to weight and not to cost. Even with the improved terms of trade, there are nevertheless good reasons for the LDCs to maintain a diversified portfolio of products across different sectors and across different levels of processing and value-added. In this respect, the move to modern bioenergy and biofuels could potentially be made more beneficial, since there are many non-energy products that might be developed and marketed at the same time. The comparative advantage in agriculture would then potentially be multiplied by the number of products being produced from the same raw materials. The concept of the biorefinery that makes the best use of raw material would need to be adapted to a lower tech structure than what is being developed in the U.S. and Europe (365). The biorefinery is the subject of considerable analysis in North and South (366), and furthermore the recognition that the South has the greater reserve of raw materials has additional implications, albeit beyond the scope of this discussion, for the relation between food and fuel in international trade.

## 3. What will be the impact of increasing commodity/food prices for quality markets (social and environmental standards)?

### *No Literature*

We were unable to find literature examining the effect of increasing agricultural prices on quality markets. Even the fairly mature body of literature on organic food standards does not seem to include a quantitative analysis of this question, though treatments of various other price effects do

exist (e.g. 355, 358, 360). However, in our effort to find literature we discovered a broad body of writing on other aspects of agricultural quality markets, described below.

### *Experience with Certification Standards for Bioenergy*

Certification and quality standards have been proposed as a means, "to ensure that carbon savings are delivered and wider environmental benefits are maximized" (207) in the production of biomass for energy (e.g. 212, 221, 208, 274, 119, 228, 253, 307, 309, 305). Increasing trade and imports of biomass from developing countries to reduce costs and increase supply has heightened concerns regarding the sustainable production of biomass (See Question 2: Trade).

Sustainability criteria for bioenergy have been developed in the UK (LowCVP), Belgium, Switzerland, and Brazil (Social Fuel Seal), and are under consideration in the Netherlands, Germany and by the European Commission (101, 305). Several initiatives including the Roundtable on Sustainable Palm Oil, the Roundtable on Sustainable Soy, the Better Sugarcane Initiative, and the Roundtable on Sustainable Biofuels bring together international level stakeholders to develop voluntary codes of good practice for producers within the industry (112, 253, 235). An overview of several current certification programs is available in van Dam et al. 2006 (308). Proposed good practice guidelines focus on the following aspects: greenhouse gas lifecycle efficiency, social impacts (wages, child labor, employment, health care, education, food security), environmental impacts (biodiversity, soil and water resources), and implementation (measurable and verifiable) (112, 305, 221, 212, 139). Recommendations stress that biomass production should not just avoid negative environmental and social impacts, but in fact be an improvement over current conditions and be designed according to regional requirements (221, 212, 305).

### *Lessons from Other Certification Systems*

Key lessons from forestry sector certification programs and organic agriculture labels provide guidance for evaluating certification as a tool in the biofuels market (208,112). Several barriers have limited the effectiveness of wood product certification programs and similar challenges could be expected in a biofuels certification program. Tracking the chain-of-custody of wood products from the forest has proven to be extremely difficult due to the ease with which shipping documents can be falsified and illegal products can be traded between countries without strong cooperation and communication (112). Without a multilateral requirement, certification has largely led to a segmentation of the market where both certified and non-certified products are available without a demonstratable reduction of the problem (112). Furthermore 90% of certified products are from OECD countries, while tropical regions supply only 5% of the certified wood (112). The presence of many different certification schemes has led to an undermining of the transparency of the market and increased costs for certified products relative to non certified products (112). Many of these barriers are echoed in challenges that have been identified for a certification scheme for biofuels, including: certification schemes come at a cost to free trade (305, 310) and may need to be regulated by the WTO (112, 308); strong incentives for certified biofuel production without adequate supply from qualifying resources will put enormous pressure on vulnerable land and forested areas (112); and indirect effects of displacement and leakage
as a result of certification schemes will be important but difficult to regulate (221, 112, 101).

### *Economic Effects of Certification Systems*

Few studies have provided quantitative analysis of the impact on biofuel cost and the effectiveness on addressing sustainability concerns of a certification scheme. Results from case studies in Brazil and the Ukraine on the impact of sustainability criteria on biofuels costs found the overall impact on costs is estimated at 35-88% in Brazil and 10-26% in the Ukraine (274). Social and environmental criteria were found to have a limited impact on costs, however minimum wage standards increased costs of production by 8% in Ukraine, and up to 42% in Brazil (274). Costs of compliance with sustainability

criteria may be substantial and are strongly related to the scale of operation, the strictness of sustainability criteria, the number of sustainability criteria and the expertise required to check them adequately (308). Delzeit et al. 2007 (305) evaluated the feasibility and effectiveness of sustainability standards based on a case study in Brazil. Several challenges to measuring and verifying sustainability criteria were identified including: problematic verification of worker minimum wage due to lack of both an official register of employees or legal contracts; low credibility of certification that producers do not hire children; lack of techniques and documentation to allow mills to measure their emissions and determine the GHG lifecycle efficiency of production; and determination that there is no ability to limit displacement and leakage of increased pressure on ecological systems through a certification scheme (305).

Although limited, insight on how rising prices impact quality markets can be drawn from lessons learned in other quality markets and ecolabeling programs. High minimum prices for quality market products have been shown to limit market size (309). Fair Trade products favoring producers through minimum prices and favorable terms of trade and business facilitation have been less attractive to downstream product retailers and consumers due to higher minimum prices (309). Preliminary evidence, limited by the relatively short existence of ecolabels, suggests that price premia for ecolabelled products are not often sustained (308). The explanation for this lack of persistence is not clear, a shift in production patterns increasing supply of ecolabelled products may be satisfying demand and reducing price or it may be largely an indication that consumers are unwilling to pay higher prices for ecolabelled products (308). Research on organic rice production in Thailand has found that the price premia, which makes organic farming practices profitable for producers, are primarily driven by high product demand relative to the supply available (308). Given the likelihood of market entry increasing supply relative to demand, the economic sustainability and durability of this price premium for organic products may be in question (308). These results suggest that consumer's valuation of the intrinsic benefits of organic products may not be the most important driver of the present price differentials (308). Without a guaranteed price premia or profit premia for producers of quality market products, as has been observed in the organic foods market, biofuels producers may find it unprofitable to produce an ecolabeled product.

### *Characteristics Marking Successful Implementation*

The reasons why certain ecolabel or quality market products are more successful than others to spread through the market are not well understood (308). Success has been tied to a wide range of factors, few related to the final consumer or the environmental characteristics of the ecolabel (308). Ecolabels have been most useful when developed in conjunction with complimentary policy initiatives as seen in the adoption of the Blue Angel label for reduced construction noise machinery in Germany and the Energy Star label in the US (342). Two approaches to governance of bio-energy markets have been examined by Verdonk et al. (2007) the use of a voluntary bio-energy labeling organization (BLO) or a mandatory International Agreement on Bio-Energy (IAB) (308, 309). A comparison of these governance systems is presented in Figure 6 (next page).

The BLO system, similar to the Fair Trade market, provides the greatest advantages to producers, but depends on conscious consumers and is not as attractive to retailers or customers (309). The IAB system, overcomes the reliance on conscious consumers placing governments in the role of requiring certification of imports (309). This system provides a fast growth strategy, though as found in forestry sector certification programs this system is less attractive for and has led to less involvement of southern producers (309). The "producer pays" system for certification has been a barrier to their participation (309). However, under the IAB system countries would have the opportunity to subsidize quality biofuels markets to lower the price difference with unsustainable sources of energy (308). These types of programs referred to as a "green box" are permitted under WTO agreements as long as they are not directed at particular products, and include direct income supports for farmers that are decoupled from current production levels or prices (308).

| Instrument | Description | Purpose |
|---|---|---|
| **Pillar BLO:** | | |
| Progressive certification | Multiple levels of compliance on sustainability criteria | Certification of production; Enables participation of many producers |
| Progressive price premium | Linked to the level of compliance and product quality | Incentive for producers to participate and to increase the level of compliance |
| Impact assessments | On local economy, food & energy supplies, complementary GHG using LCA studies | Prevents leakage effects and food & energy shortages; ensures GHG complementary |
| Marketing assistance | Advice programs on certification and organizing trade relations; certification subsidies for small & Southern producers | Enhances involvement of and benefits for small & Southern producers |
| Buyers groups | Actors from industry and civil society | Stimulate demand of BLO certified bio-energy |
| Monitoring | Chain-of-custody certification | Certification of trade |
| **Pillar IAB:** | | |
| Covenants | Agreement between industries and governments | Increases use of BLO certified bio-energy |
| National import & production rules | Based on BLO certification | Limits import and production of non-BLO certified bio-energy |
| Regulation of market prices | Internalize environmental costs in prices energy | Lowers the price difference with unsustainable sources of energy |

**Figure 6** – *Comparison of bio-energy labeling organization (BLO) and International Agreement on Bio-Energy (IAB) governance systems. (308)*

## 4. How will the increased competition for land affect the access and control of smallholders in the South to farmland?

*Consensus on Threat to Smallholder Livelihoods*

A rising demand for biofuels is expected to introduce significant added pressure on agricultural land; (see discussion under Question 1). This can happen either directly, through the expansion of agricultural land specifically for the cultivation of biofuel feedstocks, or indirectly, through the displacement by biofuel feedstocks of other crops, which then causes the expansion of agricultural land to produce the other crops. Sugarcane production in Brazil, is cited as an example of the latter; it has been observed to indirectly contribute to deforestation – even though cane isn't grown in Amazonia – by displacing soy production or cattle ranching (283, Brief 8). Biofuel production is an inherently land-intensive undertaking, with even a relatively efficient biofuel cycle (such as cane ethanol) requiring on the order of one hectare of agricultural land to fuel a single vehicle (or much more land for less efficient fuel cycles such as soy biodiesel) (108). This is to be contrasted with the much smaller amount of arable land currently allocated to producing food: approximately 0.2 hectares of cropland on average per person (108).

Given the current state of rural development policies and infrastructure in most developing countries, this competition for land is unlikely to benefit small farmers' access and control of farmland unless targeted policies are put into place. This is because the expansion of biofuel into a major portion of agricultural commodity trade, would (absent explicit policies) primarily entail large-scale agro-industrial production, presumably of monocultures optimized for high yields at lowest cost, as is the case with other large-volume agricultural commodities. This is driven in part by the economies of scale to be exploited at the farm level in biofuel feedstock production and at the facility level in conversion of feedstocks to refined fuels, and also agricultural policies biased toward large landholders and agri-business (283, Brief 6, 111; 278). (Ironically, this concentration may occur even though small farmers can be more productive than large farmers when considering all of the outputs from

the farm (232).) Concerns about the consolidation of land-holdings, and dispossession of rural households and small landholders have thus been raised, particularly in areas where land tenure is insecure (132, 283, Brief 11), as well as for indigenous and other peoples who rely on forest products, natural resources, and ecosystem services for their livelihoods (119; 266). It is particularly challenging to ensure that the (often customary) land rights of indigenous communities are not abridged (270). These outcomes are likely to accompany the increasing trend toward commercial agricultural production (221) in any event, but are likely to be exacerbated by a burgeoning demand for biofuels (111).

The experience of Brazil appears to bear out these concerns. While biomass production was promoted using the argument that rural jobs would be created, the end result was a concentration of land ownership centered on the production of monocultures (143). The development of more efficient harvesting machines has increased rural unemployment, while the displacement of small farmers and rural unemployment has led to land-related conflicts (143). Unfortunately, second-generation cellulosic biomass may only intensify this pressure because of economies of scale (283, Brief 11); moreover, the land converted to cellulosic biomass can be of lower quality than for first-generation biomass, which may relax pressure on food production in aggregate, but increase the potential for displacement of subsistence farmers and grazing (132).

### *Responses Catalogued in the Literature*

It is possible that small farmers could benefit, especially if they were organized into producers' groups (283, Brief 6; 236, focus B; 111), if they specialize in bioenergy crops that can be grown on marginal land (283, Brief 6), or if revenue-sharing schemes are established (283, Brief 11). Government policies can encourage the broad sharing of the economic benefits from biofuel production (278). It is also true that a rise in agricultural prices that is more rapid than the growth in wages, which could occur if biofuel demand rises sharply, would likely be of benefit to small farmers. Past experience has shown that falling or stable agricultural prices in the presence of rising wages has led to the stagnation and failure of unsubsidized small farms (233), although counteracting this potential positive trend is the higher production costs that biofuels may impose (221). It has also been argued that increased access to finance, combined with policies that support farmer groups and contract security, can allow small farmers to benefit (141). As an entirely different approach to supporting small farmers, some authors have proposed that rural areas could become energy-independent by growing and processing their own fuel (126; 207). This could potentially avoid the problems outlined above by reducing the influence of external incentives toward large-scale production.

Another way in which the pressure to concentrate land holdings could be mitigated is that competition for land could be reduced. Various observations have been made regarding ways this could happen. Innovation and investments in agricultural technology that improve productivity (for food, feed, and fuel) can reduce land requirements (283: Brief 3). The efficient exploitation of existing agricultural wastes, and efficient livestock management practices, also provides an opportunity for developing bioenergy without requiring new land to come into production. (141, 283, Brief 7, Brief 11) Multipurpose crops can help balance the many demands for agricultural products within a given household's land holdings (283, Brief 7). Many have argued that biofuel feedstocks (specifically, woody and herbaceous feedstocks) are less demanding with respect to land quality, and can be sited on marginal or even degraded lands, thus putting relatively less pressure on higher quality land that is more suitable for food production. (141) It has been noted, however, that biomass production costs on degraded or lower-quality lands are generally higher due to lower yields and accessibility difficulties, and deforested areas may be easier as they may have more productive soil, but are generally considered unsustainable in the long term (221).

## 5. To what extent will smallholders in the South profit from the increased commodity/food prices?

### *Consensus on Uncertain Benefits to Smallholders*

The oft-presented argument that the expansion of biofuels will benefit rural agricultural producers (including smallholders) is based on an assumption that higher prices (see question 1 above) for agricultural commodities, along with a large demand for rurally-produced and labor-intensive biofuel feedstocks and refined biofuels will yield higher revenue for the rural agricultural sector, which translates into higher incomes for rural agricultural households. In principle, these incomes could be stable and reliable, and accrue to both land-holding households or households of agricultural wage laborers, in both industrialized (177) and developing (119, 132, 141, 221) countries. Moreover, the fact that biofuel feedstocks are relatively low in energy density and cannot cost-effectively be transported far, supports the argument that the value-adding processes of converting feedstocks into refined fuels will necessarily take place in rural areas; construction and operation of rurally-sited conversion facilities will thus contribute to rural economies as well (283: Brief 2, 10, 236, focus B), although this will be offset by the tendency toward large centralized facilities, for the sake of exploiting techno-economic economies of scale and vertical integration for cost reduction and quality control (236, 283; Brief 6). It is not necessarily the case however that economies of scale exist in the production of biofuel feedstock, and it can in fact be argued that small farms are more productive, providing all the agriculture outputs of a multi-product cropping system are considered (232).

It is difficult to generalize about the expected real-world impacts of biofuels on smallholders, owing to the different effects of: different feedstocks/ production systems; varying downstream (transportation) costs; existing (non-biofuel) crop production and processing patterns; and patterns of land holding (111). However, one thing that can be clearly extracted from the literature, is that there is a broad consensus that an expanding demand for agricultural sector products due to burgeoning biofuel demand is by no means guaranteed to benefit rural households (e.g., 108; 119, 141, 146, 221, 236, 270, 283:Brief 3, 6, 11).

### *Potential Measures to Improve Outcomes for Smallholders*

Some biofuel systems claim to have implemented arrangements (e.g. 178, 221) that do benefit rural households. Brazil, for example, where 1 million rural jobs have been created and 30 percent of cane production is in the hands of independent producers, has been held up as an important example (119, 283, Brief 8) where benefits do accrue to small farmers and laborers. However, these claims have been strongly contested (143, 266).

Various measures – many of which deviate significantly from the status quo – would need to be put in place before benefits could be ensured. Ownership systems (e.g., cooperative production) and revenue sharing for feedstock production would need to ensure a space for small-holders in the agricultural production system (141). International trade regimes would need to not discriminate against developing country producers (111). Land administration and land tenure systems (111, 232) would need to honor and secure small-holders' and indigenous communities' claims. Positive contributions to rural livelihoods will require addressing issues such as seasonality of employment and off-season alternatives (111, 283, Brief 8), volatility due to an immature and unstable market (221), child labor (221), mechanization (143, 221), and availability of agricultural extension (141). There is a role for international institutions in some of these domains (141).

On balance, current trading conditions present several policy problems, and these prevent developing countries from reaping the benefits of the biofuels trade, while imposing environmental and social costs (119). Various authors have cautioned that expansion and globalization of agricultural commodity markets, and innovations in agricultural technology in recent decades, have not benefited a sizable portion (one-third according to [233]) of agricultural producers. If precedent is a guide, international agricultural commodity markets operating under status quo terms of trade will

benefit only a minority of farmers who are able to invest, progress, access markets, and compete effectively (233). Studies of several agricultural commodity markets find that the benefits from export production in the developing world have increasingly accrued to actors in upper parts of the chain, while the primary producers have received comparatively little (119). In particular, where producers are dependent on a very few international traders bringing their products into the international market, there is a risk that primary producers will receive very few benefits (119).

### *Interactions of Food and Fuel Pressures*

In addition to the impacts (benefits or disbenefits) of higher food prices will be the impacts of changes in fuel prices. The appearance of a modern biofuels industry may lead to broader local accessibility of high quality fuels, but it could conversely lead to the lower availability (or increased price) of raw, low quality feedstocks (such as agricultural residues or dung) that continue to be the staple rural household energy resource. Generally speaking, food price increases would be beneficial to farmers who produce a net surplus of food, but they would be detrimental to poor consumers and food-deficit farmers, who would have to balance more expensive food against less costly energy. Since the poor typically spend much larger shares of their consumption budget on food than energy, this trade-off is unlikely to be favorable (283, Brief 12).

Many of the issues raised by biofuels are clearly not unique to biofuels, but rather are challenges that have faced agriculture and rural development policy for many decades. However, the potential scale and rate of growth of biofuel production poses unique challenges (111).

## 6. What will be the impact on producer-consumer relations and on for instance gender relations, and how are they to be addressed?

### *Producer-Consumer Relations Considered on the Rural-Urban Axis*

Though no single publication says so directly, the literature when taken together implies that increased pressure on land resources will foreshadow a transfer of wealth away from urban residents and toward landholders. Whether "toward landholders" also means toward rural communities, depends on the nature of the legal and social structures in the country or region being examined (see discussion in Question 5 above).

African analysis indicates that most economic effects of biofuel development are likely to be indirect (178) and hence have little obvious effect on producer-consumer relations. This article's author points to a revenue-sharing system implemented in the Mauritius sugar industry, that could ensure that biofuel profits benefit smallholders in particular. The publication also points to waste-to-energy projects potentially benefitting the urban poor, even going so far as to hypothesize that waste collection and sorting labor be wholly subcontracted to the urban poor themselves.

Urbanization is a well-documented trend that figures into much of the food-feed-fuels literature. Urbanization is correlated to increased participation in the labor force by women and increased demand for processed convenience foods (301). Hence urbanization, besides being a response to a commercializing agricultural sector, in turn affects the market basket demanded from the agricultural sector.

### *Industrial-Smallholder Relations*

Smallholders are likely to be required to commercialize to survive the anticipated agricultural transitions (301, 332). The greatest amount of concern is expressed not regarding producer-consumer relations, but rather industrial-smallholder relations. In particular the bottom-up knowledge network reports many instances of intense political pressures and sometimes even mortal violence surrounding efforts to acquire and consolidate small landholdings for the purpose of commercial palm oil plantations in Colombia (334), Indonesia (335) and many other countries (336, 337). Similar reports have been received regarding sugar cane and soy plantations (338 testimony of Mateus Trevisan).

Brazil in particular has a long history of violence surrounding land use policy; one source claims 773 assassinations in 33 years in the state of Pará alone (339).

### *Gender Issues*

Examinations of the Indian economy have identified small-scale biomass development to provide rural electrification (152, 126 p.654) and/or improve cookstove technologies (152 p.831); and for fueling a very large informal/small business sector (201). In particular, the change in cookstove technologies is perceived as a gender issue in a nation where women are most often the domestic workers. In China, and throughout Asia generally, small-scale biofuel development is also viewed as a means toward improving the quality of life for women, once again through improved cookstove technology (153, 183). Farm mechanization and urbanization combine to push rural women into the informal/small business sector, a phenomenon that has been studied in Africa and elsewhere (230). Gender issues have also been discussed with regard to commercial biofuels farming. Commercial farming, where labor is often paid on a quota system, favors male employment; at times women offer unpaid labor to help their husbands meet the quotas (266). Observers have reported women being preferentially selected for pesticide application and exposed to the associated dangers (340) and prostitution in plantation villages (270).

## 7. How will the increased demand for land farmland/production conversion affect (agro-) biodiversity, global warming?

### *Gross Land Use and Biodiversity Impacts*

Intensification and expansion of agriculture to meet increasing demand for bioenergy production has raised significant concerns about the impact of land-use change on agricultural and biological diversity, as well as on global warming. Currently, approximately 50% of the world's terrestrial, above-ground biomass is used by humans for food, construction, and fuel (264). Production of the biomass resources on agricultural and managed forestland occupies 70% of the total land area managed by humans (264). These demands have already led to shortages of land availability for human as well as for maintaining biodiversity of natural ecosystems (264). Several studies provide estimates of global bioenergy potential, though results vary significantly and provide an ultimately uncertain analysis of the environmental consequences of bioenergy expansion (210).

Intensification of agriculture to meet growing demand for energy crops, while providing adequate global food supply, is expected to lead to industrial monocropping practices (140). Greater inputs of fertilizer and pesticides would be required to provide increased crop yields under this cropping system (329, 141, 154). Health and diversity of the soil biota, critical components of the soil for plant growth, are adversely affected by this type of agricultural management. In particular frequent tillage, chemical inputs (pesticides, herbicides, and fertilizer), and lack of diversity of cropping systems lead to reduced soil health, reduced local biodiversity, and soil erosion (140, 264). Management strategies can serve as a tool to mitigate the impact of energy crop production on agro-diversity. These include increasing the diversity of the cropping system (both inter-species and intra-species variation) (140, 113, 182), choosing native and perennial feedstock types (reducing water loss and fertilizer use) (113), utilizing conservation tillage practices (113), and retaining plant residues (182). Field studies support the implementation of these strategies; biofuels derived from low-input, high-diversity mixtures of native grassland perennials were found to provide more usable energy, greater GHG reductions, and less agrichemical pollution per hectare than biofuel production from conventional corn or soybeans (154).
Bioenergy crops threaten biodiversity when natural lands are converted into energy plantations (154, 141, 140, 125). Few studies provide integrated assessment of the impact of expanded biofuel production on conversion of natural ecosystems. Nevertheless, expanding demand and value of

agricultural crops has been identified as a primary driver of deforestation, as has been observed with soya production in Latin America (125). An analysis based on the four IPCC SRES scenarios, found abandoned agricultural land to provide the greatest geographical and technical potential for biomass production of energy crops (182). Favoring existing or abandoned agricultural land, over conversion of natural ecosystems for bioenergy crop plantations can limit the negative impact on biodiversity (125, 140, 113, 329). Further results from the A1 scenario analysis project that significant amounts of forest land would be cut in regions of the world with the least abandoned cropland including the Middle East, Southern Africa, and South America (182). In Europe and the US, the conversion of abandoned agricultural lands currently set aside through regulation, providing valuable wildlife habitat and soil conservation, are now being considered for expanded energy crop production (125). Through the Roundtable on Sustainable Palm Oil in 2004, strategies were developed in Brazil, India, and Southeast Asia to address biodiversity concerns including setting aside land for conservation and increasing crop diversity (113). Management strategies can be employed to improve the habitat quality of energy crop plantations including providing hospitable border areas, protecting critical areas, and timing harvest and tillage dates to avoid disturbing critical lifecycle periods of resident wildlife (140). In some cases, where bioenergy production is more similar to the natural habitat than other neighboring agricultural options, plantations can serve to fill gaps, provide wildlife corridors, and limit edge effects (140).

### *Greenhouse Gas Balance*

Biofuels production can affect carbon emissions both through displacing fossil fuel energy use and by changing the amount of carbon sequestered on land (140). The extent to which biofuels reduce fossil fuel emissions depends on the lifecycle emissions of biofuel production based on the feedstock type, as well as the energy requirements for feedstock cultivation and biofuel generation (fertilizer inputs, fuel processing, and distribution) (113, 329, 140). Issues regarding the energy balance and lifecycle GHG emissions of biofuels have been raised in a large volume of published research. However, there is increasing concern that carbon losses from intensification of agriculture and clearing of natural lands leads to large emissions that are not fully accounted for in analysis of the lifecycle assessment of biofuels production (113, 125, 361, 362). The greatest carbon emissions result from clearing natural ecosystems; even if these lands are sustainably managed large carbon losses may negate all carbon benefits from biofuels production for decades or even centuries (113, 140, 361). Although poorly quantified at a global scale, the intensification of agriculture and expansion of production may lead to significant and non-linear impacts on soil carbon leading to large losses of carbon to the atmosphere (113, 125). These impacts have been especially acute in Southeast Asia where draining of tropical peatlands for palm oil production have resulted in large carbon losses (125). Biofuels production can enhance carbon sequestration when unproductive land is converted to bioenergy crop production and strategies such as conservation tillage are employed (113, 140).

### *Summary*

Research available to date presents a clear picture that conversion of natural ecosystems to bioenergy crop plantations presents lasting negative impacts on biodiversity and carbon storage (125, 140, 113, 329). Current management plans and certification programs are not believed to have yet presented credible proposals to address this land use conversion problem (125). Negative impacts can be mitigated by utilizing existing agricultural and degraded land, and by employing appropriate management practices (113, 140). However, key questions and concerns require further investigation including an assessment of the sustainable level of forestry and agricultural residue removal (113), analysis of the best management practices to reduce impact on wildlife and surrounding natural ecosystems (113), improved global estimates of soil carbon emissions from agriculture (125), and further integration of water resource needs into projections of technical feasibility of bioenergy production (182).

# 4. Principal Knowledge Gaps

## Effects of Quality Standards

Despite substantial experience with ecolabels and other types of quality standards worldwide, substantive analyses of their economic effects are few. The weaknesses of quality standards are well-documented, but we found no integrated, cost-benefit analyses of their value.

*Who to watch:*

For developments regarding the biofuels quality standards themselves: The Roundtable on Sustainable Biofuels, hosted by Ecole Polytechnique Fédérale de Lausanne, has the goal of reaching an international consensus on biofuel sustainability criteria by mid-year 2008. There are four working groups: Environment, Greenhouse Gases, Social Impacts and Implementation.

For developments regarding techno-economic analyses of quality standards: IEA Bioenergy (International Energy Agency Bioenergy) Task 40 in 2006 performed a very thorough survey of incipient quality standards (308) that was led by various staff of the Copernicus Institute at Universiteit Utrecht: Jinke van Dam, Martin Junginger, and André Faaij. Edward Smeets of Copernicus has also published on the topic.

## Water

A particularly profound knowledge gap appears to surround the effects of agricultural expansion on already strained water resources. First-generation biofuels are more irrigation-intensive than second-generation biofuels, but water demands of realistic second-generation scenarios have not yet been modeled. Only a few existing assessments of gross biomass potentials consider water as a limiting input, and none examine the social, political or economic dynamics associated with increased water demands.

*Who to watch:*

The International Food Policy Research Institute (IFPRI) stewards the agricultural sector model with the most sophisticated integration of water demands.

## Deployment Schedules and Policies for Second-Generation Fuels

General agreement exists that biofuel generation from agricultural residues is limited, that first-generation biofuel crops are inefficient converters of solar input (land area) to feedstock, and that a healthy biofuels industry must rely on second-generation biofuels, in which most of the plant mass is converted into fuel, to make most efficient use the agricultural land area's solar potential. However, second-generation biofuels are still considered to be at a relatively primitive state of development, and the degree to which they will be deployed is unknown, and probably unknowable. Some writers consider continued support of first-generation biofuels a necessary ushering in of second-generation biofuels, but others believe biofuels deployment should be mostly suspended until higher-quality feedstocks and conversion processes are available.

Who to watch: There does not appear to be a go-to agency for forecasts of deployment of second-generation biofuels. The best strategy, without such an agency, would be to watch technology centers in the countries with the most advanced biofuels industries. Technology centers are an appropriate target because the deployment of second-generation biofuels is constrained by feedstock-to-liquid conversion technologies, not by crops or agricultural technologies. Appropriate agencies might be, e.g.:

| | |
|---|---|
| **United States:** | U.S. Department of Energy, BioEnergy Science Center (BESC)<br>Oak Ridge, Tennessee |
| **Brazil:** | Brazilian Reference Center on Biomass (CENBIO)<br>Sao Paulo |
| **South Africa:** | Council for Scientific and Industrial Research (CSIR)<br>Modderfontein, Gauteng |

UNIDO, the United Nations Industrial Development Organization, is also keeping an eye on advanced biofuels refining technology (see 365) and their biofuels program could potentially evolve to become a knowledge node on second-generation biofuels deployment.

## Legal Protections for the Rural Poor

In our literature survey we encountered considerable concern regarding the consequences of industrialized agricultural practices on the landless poor and/or smallholders. However, there was little substantive policy analysis comparing the availability and effectiveness of legal structures available to protect these populations. It is possible that literature exists but was overlooked due to the way the literature survey was defined (driven by food and fuel pressures on land), so this rubrick deserves more attention. Even if literature does not exist, there is experience on this topic in several countries, most notably Brazil but also Indonesia, Cameroon and South Africa.

*Who to watch: Unknown.*

## High-Resolution, Global Economic Modeling

There is general agreement that major expansion of biofuels markets has potential to benefit countries that are net agricultural exporters and harm those that are net importers, and that these effects can be amplified when a country is a net exporter/importer of both agricultural and fuel commodities. Furthermore, the benefits tend to accrue to rural populations, while the harms tend to accrue to urban populations. On a global scale, results like these can be verified with the current generation of agro-economic models. But these global tendencies play out to a greater or lesser degree in each country depending on crop mixes, trade policies, domestic regulations and other factors. Current, global, agro-economic models do not have sufficient resolution to predict national- and subnational-scale effects reliably enough for policymaking decisions relevant to Hivos.
We suspect that there is a significant body of knowledge in the corporate sector regarding the marginal impacts of single-owner projects (i.e. ignoring macroeconomic effects) which could in principle be of use to an entity like Hivos for deciding to support or intervene with specific initiatives. However, this body of knowledge is largely proprietary and inaccessible.

Who to watch: The Global Trade Analysis Project (GTAP), stewarded by Purdue University in the United States, is in part a consortium of modelers that will be aware of the latest developments in modeling; it is also in part a dataset and model that is the likely framework for most advances in global economic modeling over the decade or so.

## Coupling of Economic and Extra-Economic Effects

Land pressure analyses are already challenged by a poor link between existing, economic modeling practices for agricultural markets versus those for energy markets. In addition to the weak link between themes of economic analysis, there is an even weaker link between the economic and non-economic assessments of effects on land pressures.
Specifically, many of the non-economic treatments in the literature present convincing arguments for threats to smallholders from agro-industry, pressures on gender relations, lost biodiversity, and release of carbon sequestered in standing forest. Model results speak with a quantitative authority

about food and fuel prices, but there is often little evidence that these couple in a meaningful way to extra-economic effects. Literature in which the economic and extra-economic effects are coupled in a meaningful way is extremely rare.
The absence of coupled analyses between economic and extra-economic effects also means there is no comprehensive treatment of food security effects of increased land use pressures, since food security is by definition a amalgam of economic and social parameters.
Who to watch: The United Nations Food and Agriculture Organization (FAO) follows a food security mandate, yet has access to and utilizes techno-economic assessment tools like agricultural sector models. The FAO has also convened a Consultative Group on Biofuels, Environment, and Food Security, making the food-fuel link an explicit concern.

# 5. Knowledge Networks

Knowledge on the Food-Feed-Fuels appears to be distributed in a pair of networks, that we call the top-down network and the bottom-up network.

## TOP-DOWN NETWORK

The top-down network is located principally in wealthy (OECD) countries. While the top-down and bottom-up networks each include nodes associated with individuals, in the top-down network, some knowledge is associated directly with institutions, and furthermore each node individual is usually associated with a stable institution.
In the top-down network, both the network and the knowledge itself is characterized by a top-down structure. The top-down network commands the world's economic modeling resources, most of which analyze food, feed and fuel prices and availability on global or, at the smallest, national scales. The top-down network's association with stable countries means an association with deliberate policy planning, which requires top-down, economy-wide assessments. In such assessments non-economic aspects of livelihood, where they are represented, need to be treated with statistical averages such as life expectancy. Work originating in the top-down network can score very high on the Integration scale, but rarely scores high on the Humanism scale.
Communications between nodes within the top-down network are very good, facilitated by professional publications, conferences, and high access to communications technologies. Most significant entities in the top-down network focus on analysis rather than intervention.
Important nodes in the current, top-down network are:

### International / Europe / North America

*Copernicus Institute*
Universiteit Utrecht
Heidelberglaan 2
3584 CS Utrecht
Netherlands
Several researchers at Copernicus Institute, led by André Faaij, have generated a significant body of literature on the techno-economic dimensions of biofuels, especially in the realm of achievable potentials.

*International Centre on Trade for Sustainable Development (ICTSD)*
7 Chemin de Balexert
1219 Châtelaine
Geneva, Switzerland
ICTSD, based in Geneva, has developed a biofuels component within its Trade and Environment

Programme and through analysis of agricultural trade policy. They specialize in conducting dialogues and assessments on the linkages between trade and sustainable development. They are well-connected with international organizations and are often represented at major conferences on these topics.

*The International Food Policy Research Institute*

2033 K Street, NW
Washington, DC 20006-1002
U.S.A.

The International Food Policy Research Institute (IFPRI) has turned out consistently thorough forecasts of agricultural markets and analyses of agricultural policy, both as they relate to biofuels and to dietary patterns. Mark W. Rosegrant developed the IMPACT model used for world agricultural market forecasting (286), and is a heavily published author on food security, especially in relation to water availability. Other IFPRI researchers have contributed to very strong overview publications; for example (283) brings together many of the world's strongest thinkers on bioenergy, both from inside and outside IFPRI, in a collection of issue briefs. IFPRI's reports to CGIAR (of which it is a research center) also present top-down overviews of current and future pressures to land use (e.g., 285).

*United Nations Food & Agriculture Organization (FAO)*

Viale delle Terme di Caracalla
00100 Rome
Italy

The FAO generally has become an important contributor to the field of knowledge, and appears to operate under management that permits relatively unfettered exploration of difficult development issues that large organizations often avoid; for example publication 233 staunchly advocates on behalf of the livelihoods of smallholders.

J. Schmidhuber is an economist with the Global Perspectives Unit of the United Nations Food and Agriculture Organization (FAO). He was a lead author of the latest edition of FAO's long-term forecast document, World Agriculture (330, 333). Schmidhuber's work stands out in attempting to forecast economic welfare ("winners and losers") on a country-by-country basis (311, 324). This type of work can be profoundly valuable in deeper knowledge research, because it identifies the countries where the cause for concern may be greatest. Figure 5 offers an example of the output of Schmidhuber's analyses.

## Asia

*Tsinghua University*

Beijing,100084
China

Tsinghua University appears to be an important center of Chinese research in the food-feed-fuels domain, though research tends toward technical development and away from policy analysis. Wang Gehua was the lead author of Biofuels for Transportation in China, a supporting study to the recent, comprehensive treatment Biofuels for Transport coordinated by the World Resources Institute (272). Tsinghua University also hosted a World Biofuels Symposium in 2006. Liu Dehua, of the Department of Chemical Engineering, has also been active on biofuels issues for several years (e.g. 343).

*Center for Sustainable Technologies*

Indian Institute of Science
Bangalore - 560012,
Karnataka, INDIA.

http://www.cst.iisc.ernet.in
Established in 1974 (originally as ASTRA – Center for Application of Science and Technology for Rural Areas), the Center for Sustainable Technologies is perhaps the preeminent institution in the developing world that has the objective of R&D for appropriate technologies, while also carrying out extension activities at a rural village site to explore the sociological and institutional factors involved in actual deployment. The main area of work has been in bioenergy technology, including sustainable generation of biomass resources and forestry.

*Combustion Gasification & Propulsion Laboratory (CGPL)*
Department of Aerospace Engineering, Indian Institute of Science
Bangalore - 560 012,
Karnataka, India
http://cgpl.iisc.ernet.in/site/Default.aspx
The CGPL, a sister organization to the Center for Sustainable Technologies, has been a leader in the science and engineering underlying the R&D in small- and medium-scale bioenergy technologies. The technology development undertaken in this laboratory has been a major contribution to the advancement globally of bioenergy technologies.

*Technology Informatics Design Endeavour (TIDE)*
No : 19, 9th cross, 6th main
Malleswaram, Bangalore, India
http://www.tide-india.org
TIDE, established in 1993, is another Indian NGO devoted to application of technological interventions to support rural development. A major focus has been bioenergy technologies, specifically efficient technologies for household and small-scale industrial applications. A priority is creating the institutional infrastructure to ensure that technological advancements can survive in the field, in a manner that contributes positively to rural livelihoods.

*The Energy and Resources Institute (TERI)*
Darbari Seth Block, IHC Complex, Lodhi Road
New Delhi, INDIA 110 003
TERI is an Indian non-profit research institute, founded in 1974, that has grown into one of India's largest and internationally best known research institutes in energy and environmental issues. It has ten offices, including several outside India. It's bioenergy-related work has combined technology development along with rurally-sited applications. Its work has ranged from small-scale (household) implementations to national assessments (e.g., of the potential of biofuels for transportation). TERI is extremely well-connected to Indian government policy-makers, and international institutions, and is often the default organization to which international actors go when seeking expertise on energy in India.

## Africa

*Council for Scientific and Industrial Research*
Modderfontein, Gauteng
CSIR does not have a history of publishing on the Food-Feed-Fuels topic, but is currently conducting related research, and provides an important infrastructure for future work, especially in the context of strengthening a South-South-North approach to tying the top-down and bottom-up networks together (see section Steps Forward below).

*COMPETE: Competence Platform for Bioenergy in Arid and Semi-arid Ecosystems in Africa*
WIP Renewable Energies (project coordinator)

Sylvensteinestraße 2
D-81369 Munich
Germany
The COMPETE consortium's Work Package 3 has a mandate to study the sustainability of alternative energy crop and agroforestry schemes, including trade-offs with other land uses.

## South America

*Polo Nacional de Biocombustiveis*
Escola Superior de Agricultura Luiz de Queiroz (ESALQ)
Avenida Padua Dias, 11 (Box 9)
Piracicaba (SP)
Brazil
ESALQ is a principal agricultural university of Brazil, in operation since 1901. Polo Bio was created in 2004 as a knowledge center within the school for advancing sustainable biofuels in Brazil.

*CENBIO (Brazilian national biomass reference centre)*
University of Sao Paulo
Av. Professor Luciano Gualberto, 1289
05508-010
São Paulo – SP
Brazil
www.cenbio.org.br
CENBIO is a coordinating centre for analysis, research, and outreach on biomass and bioenergy, led by Suani Coelho and Prof. Roberto Moreira. They are a networking organization, well-connected to government agencies, University research centres, and some international organizations such as IEA and UNDP.

## BOTTOM-UP NETWORK

The bottom-up network is associated with "on-the-ground" parties, including both economic actors and policy advocates. The economic actors are the farmers and commercial entities who control, and are controlled by, changes in land use patterns. These entities have extraordinarily fine knowledge regarding the viabilities of crops and cropping patterns, fuel conversion technologies, local traditions and habits in the livestock sector, and local trends in diet and lifestyle. However, the knowledge is rarely applied to land use policy, and often not even recognized by the parties themselves as a valuable resource.
Policy advocates in the bottom-up network typically self-select from the larger pool of economic actors. Though the policy advocates will often form small institutions (NGOs) around policy concerns, the NGOs typically live or die with the leadership of a single individual.
Literature published in the bottom-up network is often available only locally, and almost never in academic journals. Communication among members of the bottom-up network is poor, encumbered by language barriers, a lack of recognized venues, and even political suppression. However, the more well-established policy advocates in the bottom-up network can provide an important entryway for communication with the economic actors in the network, and simultaneously a connection point to the top-down network. Bottom-up networks tend to focus on direct intervention rather than analysis, which makes it more likely that they will focus on one aspect of the food-feed-fuels connection (such as promoting a particular biofuel crop) rather than considering food, feed, and fuels in combination.
By its nature, this network undergoes rapid change, so a comprehensive survey is not possible. As of this writing, examples of possible connection points to the bottom-up network are:

*Development Alternatives*
111/9-Z, Kishangarh
Vasant Kunj
New Delhi - 110070
India
http://www.devalt.org
Development Alternatives was established in 1983, as a non-profit devoted to technological innovation for development in India. Since its founding, DA has been a leader in working to establish village scale energy systems fueled by locally grown biomass and agricultural residues, with systems designed to create rural employment. It has since expanded into a broader range of activities.

*World Rainforest Movement*
Maldonado 1858
Montevideo 11200
Uruguay
Teresa Perez
WRM functions from a pair of offices, one in Uruguay and the other in the UK. Its core mission since its inception in 1986 has been protection of forest-dwelling peoples, but this core mission has supported an interest in peasant and smallholder rights generally. WRM has become a good repository for bottom-up network literature, beginning about a decade ago, on changing agricultural patterns.

## HOLLAND, HIVOS AND THE TWO NETWORKS

The Netherlands boasts an unusually high density of top-down knowledge regarding the food-feed-fuels topic. Specifically:

- Three members of the **Global Trade Analysis Project** (GTAP) Advisory Board are affiliated with Dutch institutions;
- The **Copernicus Institute** at Universiteit Utrecht is one of the most active research centers on biofuels technology and policy in the world;
- **Wageningen Universiteit en Researchcentrum** (Wageningen UR) has made substantial efforts to promote networking between food-feed-fuels researchers (e.g. 347) and ranks equally with Copernicus Institute in quality and volume of work on the topic;
- **EIA Biofuels Task 40**, which includes surveying global activity in biofuels certification, is led by;
- The Dutch Ministry of Foreign Affairs' **Directoraat-Generaal Internationale Samenwerking** (DGIS) has expressed explicit interest in the food-feed-fuels question; and
- **Rijksuniversiteit Groningen** houses IVEM, Centrum voor Energy en Milieukunde that hosts several researchers active on food-feed-fuels issues, of whom Sanderine Nonhebel, was most visible in our literature survey.

Hivos is an expert in networking with partner organizations that work "on the ground" in developing nations, and hence may happen to be in a particular powerful location, both geographically and intellectually speaking, to form a much-needed conduit between the top-down and bottom-up knowledge networks.

# 6. Policy Guidance for Hivos

## Choose Assistance Targets on a Case-By-Case Basis

The food-feed-fuels picture varies wildly from nation to nation, and even locale to locale. The balance of forces in any particular population will include, but not be limited to:

- Degree of economic development
- Degree of urbanization pressure
- Land availability and potential to expand arable land
- Legal protections for landless peasants and smallholders (strength of land tenure)
- Level of organization of smallholders
- The nation's trade balance in food
- The nation's trade balance in energy
- Traditional diet
- Degree of diet westernization
- Potential to expand arable land
- Cultural flexibility, especially surrounding gender roles
- Likely biofuels crops
- Forecast local climate change

It is simply impossible to make global statements about favoring or disfavoring biofuels or dietary patterns. A reasonable way forward would be to elaborate and formalize a version of the bullet list above, that becomes an evaluation tool regarding the threat, or lack thereof, that changing land use patterns may be to a particular population.

## Understand Biofuels as an Extension to Existing Agricultural Dynamics

Another useful exercise would be to carefully think through what the key differences are between biofuels and other agricultural commodities. For example: (i) potentially much larger scale, (unconstrained by human physiology), (ii) potentially much less "discriminating" – any feedstock works, without regard to taste, nutrition, cultural issues, GMO-content, or shelf-life. Then, given this set of differences, reflect on the long history of agricultural economics, rural sociology, development aid, development economics, etc., that has been dealing with the question of rural development, and decide what lessons from these fields remain applicable to biofuels, and what gets changed. (We suspect that not much will get changed, just the scale and perhaps urgency of the challenge.) Then, in response to this exercise:

(a) Where things remain the same, Hivos continues whatever it is doing on rural development, perhaps ramped up a bit due to the escalating threats. E.g., the slowly growing domain of fair trade agricultural markets can perhaps be directly extended to "fair trade biofuels" (though with a duly skeptical attitude about the total potential);

(b) Where things are different for biofuels, determine what special interventions might be valuable. E.g., the purported ability of biofuel feedstocks to be grown on degraded lands, and indeed to help restore lands to greater productivity, will probably not happen merely through free market activities (as suggested by some of the analyses we reviewed). This, however, could be a hugely important role for biofuels, and perhaps will require the intervention of civil society organizations such as Hivos.

## Put Human Rights and Ecology before Economics

Agricultural sector modeling reviewed in response to Question 1 implies that the medium-term effects of land pressure on food prices will not be as strong as some writers fear. Current highs in world agricultural prices, expected to soften over the next decade provide room to absorb a substantial amount of new price pressures. A long-term, global version of the Tortilla Crisis seems unlikely under these analyses, especially if international trade liberalization proceeds apace and allows

developing nations to effectively develop more of their unrealized agricultural potential.
The externalized impacts of fuel- and feed-based land pressures seem considerably more profound and immediate. Hundreds of examples of mortal strife over land use over the last several decades underline the realistic expectation of accelerated conflict with increased fuel and feed demands on land. Fuel and feed pressures, and fuel pressures especially, support industrial-scale monocropping that directly threatens biodiversity, land security, and cultural resources. Rural populations are at least as likely to be disturbed, if not entirely dismantled,
by these pressures as by food security per se.

## Treat diet and fuel demands with equal concern

Concern regarding the impact of biofuels on agricultural markets is widespread and sophisticated (represented by the large number of documents well-distributed along the Humanism axis). In our database, 183 publications are motivated at least in part by biofuels, while only 65 are motivated at least in part by food concerns. Yet, those analyses that do exist of the effects of changing diet indicate that the associated, increasing demands for feed, sugar and vegetable oils are as likely to upset food markets as biofuels.

It is our impression that, where threats to food security are concerned, biofuels may be receiving a disproportionate amount of attention relative to dietary changes. It is worth noting that the logical association between biofuels and land pressure is direct, while the logical association between dietary changes and land pressure is indirect (requiring the associated inferences between diet change and increased meat consumption, and between increased meat consumption and increased feed demands). The indirect link between diet change and land use pressure is probably in part responsible for the shortage of attention received by this equally serious land use pressure.
Still, it is necessary to acknowledge that growing biofuels and feed demands can be, in part, met together, since the unused portions of oilseed, soy or maize can be a component of livestock feed.
A useful and important role for Hivos might be to counter the attention weighted toward biofuels, by emphasizing diet pressures.

## Cultivate a South-South-North Knowledge Network

The top-down network is advancing the knowledge frontier by developing increasingly sophisticated economic models. An important way forward in this work is adapting relatively sophisticated, CGE modeling techniques to the national economies in the South. Meanwhile, the bottom-up network is communicating important, substantive issues regarding land tenure and human rights that are receiving less attention in academic literature than the biophysical parameters examined in modeling efforts.
Developing countries have been identified as important sites for additional crops and cropland demanded by changing agricultural markets. If trade liberalization moves forward, simple biophysical parameters make it likely that the brunt of agricultural change will be happening in the South. This implies both that forecasting of economic impacts needs to improve, and that land tenure and human rights concerns need to be brought more effectively to the international stage.
The more developed Southern nations are an obvious, vitally important link to strengthening the ties between the two, mostly isolated knowledge systems. Specifically, South Africa and Brazil have the infrastructure and experience necessary to deploy real economic research, experience with land tenure issues, and the wherewithal to include their continental neighbors in analyses.

## Where Economics are Concerned, Support Model-Based Knowledge Generation

The knowledge frontier diagrammed in Figure 2 describes the limits of our ability to treat humanist issues quantitatively. For example, economic analyses will become far more relevant to the welfare of

farmers in particular nations, once general equilibrium models exist that can predict the economic outcome for that nation of biofuels development or dietary change worldwide.
In the interests of understanding climate change, great effort has been expended toward modeling the global climate with general circulation models that require supercomputers weeks or months to compute. Now, to begin to understand how our economic and social systems can respond to climate and other global pressures, similarly intensive economic models may need to be developed that can forecast economic conditions in a geographically specific grid, just like climate models do now for the physical environment. Obviously, Hivos is not the organization to do this work, but Hivos could play a role in influencing where research in welfare economics is headed.

# Appendices

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| 272 | Worldwatch Institute | 2006 | Biofuels for Transport: Global Potential and Implications for Sustainable Energy and Agriculture | report | EN | | | |
| 273 | Hunt, S.C.; J.L. Sawin; P. Stair | 2006 | Cultivating Renewable Alternatives to Oil | book chapter | EN | State of the World 2006 | | |
| 274 | Smeets, E.; A. Faaij.; I. Lewandowski | 2005 | The impact of sustainability criteria on the costs and potentials of bioenergy production | report | EN | | | |
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| 276 | Solomon, B.D.; J.R. Barnes; K.E. Halvorsen | 2007 | Grain and cellulosic ethanol: History, economics, and energy policy | journal article | EN | Biomass and Bioenergy | doi:10.1016/j.biombioe.2007.01.023 | |
| 277 | Wakker, A. et al. | 2005 | Biofuel and Bioenergy implementation scenarios | report | EN | | | |
| 278 | Worldwatch Institue | 2006 | Global potential and implications for sustainable agriculture and energy in the 21st century | grey | EN | Biofuels for trans-portation: Conference handout | May 2006 | |
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| 283 | Hazell, P & Pachauri, R K (eds.) | 2006 | Bioenergy and Agriculture: Promises and Challenges | report | EN | | | |
| 284 | Parry, M L et al | 2004 | Effects of climate change on global food production under SRES emissions and socio-economic scenarios | journal article | EN | Global Environmental Change | 14 | 53-67 |
| 285 | von Braun, J | 2007 | The World Food Situation: New Driving Forces and Required Actions | report | EN | | | |
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| 290 | Schneider, U.A. & McCarl, B.A. | 2003 | Economic Potential of Biomass Based Fuels for Greenhouse Gas Mitigation | journal article | EN | Environmental and Resource Economics | 24 | 291-312 |
| 291 | Chakravorty, Magne & Moreaux | 2006 | A dynamic model of food and clean energy | grey | EN | | | |
| 292 | McDonald, S; Robinson, S & Thierfelder, K | 2006 | Impact of switching production to bioenergy crops: The switchgrass example | journal article | EN | Energy Economics | 28 | 243-265 |
| 293 | Steininger, K W & Voraberger, H | 2003 | Exploiting the Medium Term Biomass Energy Potentials in Austria | journal article | EN | Environmental and Resource Economics | 24 | 359-377 |
| 294 | Reilly, J & Paltsev, S | 2007 | Biomass Energy and Competition for Land | report | EN | | | |
| 295 | Elobeid, A & Tokgoz, S | 2006 | Removal of U.S. Ethanol Domestic and Trade Distortions: Impact on U.S. and Brazilian Ethanol Markets | grey | EN | | | |

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| 297 | Gohin, A | 2007 | Impacts of the European Biofuel Policy on the Farm Sector: A General Equilibrium Assessment | proceedings | EN | Biofuels, Food & Feed Tradeoffs | April 12-13, 2007 | |
| 298 | Banse, M et al | 2007 | Impact of EU Biofuel Policies on World Agricultural and Food Markets | grey | EN | | | |
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| 301 | Pingali, Prabhu | 2006 | Westernization of Asian diets and the transformation of food systems: Implications for research and policy | journal article | EN | Food Policy | 32 | 281-298 |
| 302 | Cline, W R | 2007 | Global Warming and Agriculture: Impact Estimates by Country | book | EN | | | |
| 303 | Meade, B; Rosen, S; Shapouri, S | 2007 | Food Security Assessment, 2006 | report | EN | | | |
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| 311 | Schmidhuber, J | 2006 | Impact of an increased biomass use on agricultural markets, prices and food security: A longer-term perspective | proceedings | EN | International Symposium of Notre Europe | 27-29 Nov 2006 | |
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| 313 | Economist Intelligence Unit | 2007 | World commodity forecasts: Food feedstuffs and beverages. | report | EN | | | |
| 314 | Dong, F & Fuller, F H | 2007 | Changing Diets in China's Cities: Empirical Fact or Urban Legend? | report | EN | | | |
| 315 | Dixon, P B; Osborne, S; Rimmer, M T | 2007 | The Economy-Wide Effects in the United States of Replacing Crude Petroleum with Biomass | journal article | EN | Energy & Environment | 18 | 709-722 |
| 316 | Nowicki, P et al. | 2007 | SCENAR 2020: Scenario study on agriculture and the rural world | report | EN | | | |
| 317 | O'Toole, R & Matthews, A | 2002 | General Equilibrium, Partial Equilibrium and Partial Derivative: Elasticities in a CGE model | proceedings | EN | EcoMod 2002 | July 4-6, 2002 | |
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| 319 | Monbiot, George | 2007 | An Agricultural Crime Against Humanity | webpage | EN | Monbiot.com | November 6, 2007 | |
| 320 | Regmi, A (ed) | 2001 | Changing Structure of Global Food Consumption and Trade | book | EN | | | |
| 321 | Pacific Economic Cooperation Council | 2006 | Pacific Food System Outlook 2006-2007: The Future Role of Biofuels | report | EN | | | |
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| 324 | Schmidhuber, J & Shetty, P | 2005 | The nutrition transition to 2030. Why developing countries are likely to bear the major burden | journal article | EN | Acta Agriculturae Scand Section C | 2 | 150-166 |
| 325 | McMichael, A et al | 2007 | Food, livestock production, energy, climate change, and health | journal article | EN | Lancet | 370 | 1253-1263 |
| 326 | Somerville, C | 2006 | The Billion-Ton Biofuels Vision | magazine article | EN | Science | 312 | 1277 |
| 327 | Smeets, EMW & Faaij, APC | 2007 | Bioenergy Potentials from Forestry in 2050 | journal article | EN | Climatic Change | 81 | 353-390 |
| 328 | Batidzirai, B; Faaij, APC; Smeets, E | 2006 | Biomass and Bioenergy Supply from Mozambique | journal article | EN | Energy for Sustainable Development | 10 | 54-81 |
| 329 | Commission of the European Communities | 2006 | An EU strategy for biofuels impact assessment | report | EN | | | |
| 330 | Bruinsma, J (ed) | 2003 | World agriculture: towards 2015/2030: An FAO Perspective | report | EN | | | |
| 331 | Reardon, T; Timmer, P; Berdegue; J | 2004 | The Rapid Rise of Supermarkets in Developing Countries: Induced Organizational, Institutional, and Technological Change in Agrifood Systems | journal article | EN | Electronic Journal of Agricultural and Development Economics | 1 | 168-183 |
| 332 | Hazell, P | 2007 | Transformations in agriculture and their implications for rural development | journal article | EN | Electronic Journal of Agricultural and Development Economics | 4 | 47-65 |
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| 334 | Mingorance, F | 2006 | The flow of palm oil Colombia-Belgium/Europe: A Study from a Human Rights Perspective | report | EN | | | |
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| 338 | Global Forest Coalition | 2007 | Report of Seminar: "Biofuels - implications for the South" | grey | EN | | | |
| 339 | Amnesty International | 2006 | Brazil: The Eldorado dos Carajás massacre 10 years on | press release | EN | | | |
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| 341 | Goldemberg, J et al | 2004 | Ethanol learning curve—the Brazilian experience | journal article | EN | Biomass and Bioenergy | 26 | 301-304 |
| 342 | UNEP | 2005 | The trade and environmental effects of ecolabels: assessment and response | report | EN | | | |
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| 344 | Macedo, I C et al | 2004 | Assessment of greenhouse gas emissions in the production and use of fuel ethanol in Brazil | report | EN | | | |
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| 347 | Haverkort, et al (eds.) | 2007 | Food, Fuel or Forest? Opportunities, threats and knowledge gaps of feedstock production for bio-energy | proceedings | EN | | | |
| 348 | Smeets, EMW et al | 2007 | A bottom-up assessment and review of global bio-energy potentials to 2050 | journal article | EN | Progress in Energy and Combustion Science | 33 | 56-106 |
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| 353 | Raynolds, L T | 2000 | Re-embedding global agriculture: The international organic and fair trade movements | journal article | EN | Agriculture and Human Values | 17 | 297-309 |
| 354 | Raynolds, L T | 2004 | The Globalization of Organic Agro-Food Networks | journal article | EN | World Development | 32 | 725-743 |
| 355 | Guthman, J | 2004 | Back to the land: the paradox of organic food standards | journal article | EN | Environment and Planning A | 36 | 511-528 |
| 356 | Renard, M | 2005 | Quality certification, regulation and power in fair trade | journal article | EN | Journal of Rural Studies | 21 | 419-431 |
| 357 | González, A A & Nigh, R | 2005 | Smallholder participation and certification of organic farm products in Mexico | journal article | EN | Journal of Rural Studies | 21 | 449-460 |
| 358 | Neilson, J | 2007 | Institutions, the governance of quality and on-farm value retention for Indonesian specialty coffee | journal article | EN | Singapore Journal of Tropical Geography | 28 | 188-204 |
| 359 | Rigby, D & Bown, S | 2007 | Whatever Happened to Organic? Food, Nature and the Market for "Sustainable" Food | journal article | EN | Capitalism Nature Socialism | 18 | 81-102 |
| 360 | Kilian, B et al | 2006 | Is sustainable agriculture a viable strategy to improve farm income in Central America? A case study on coffee | journal article | EN | Journal of Business Research | 59 | 322-330 |
| 361 | Fargione, J et al | 2008 | Land Clearing and the Biofuel Carbon Debt | journal article | EN | Science | 319 | 1235-1238 |
| 362 | Searchinger, T et al | 2008 | Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Trhough Emissions from Land-Use Change | journal article | EN | Science | 319 | 1238-1240 |
| 363 | United Nations Conference on Trade and Development | 2006 | The Least Developed Countries Report 2006: Developing Productive Capacities | report | EN | | | |
| 364 | United Nations Conference on Trade and Development | 2005 | Effective Participation of Landlocked Developing Countries in the Multilateral Trading System | report | EN | | | |
| 365 | United Nations Industrial Development Organization | 2007 | UNIDO's Biofuels Strategy | grey | EN | | | |
| 366 | United States Department of Energy | 2005 | 1st International Biorefinery Workshop | grey | EN | | | |
| 367 | Commission of the European Communities | 2008 | Proposal for a directive on the promotion of the use of energy from renewable sources | grey | EN | | | |

# B. Active Organizations

| short name | full name | HQ country | satellite office countries | region of interest | URL |
|---|---|---|---|---|---|
| AGA | Animal Production and Health Division, Food and Agriculture Organization, United Nations | Italy | | | www.fao.org/ag/againfo/home/en/home.html |
| AIDEnvironment | AIDEnvironment | Netherlands | | global | www.aidenvironment.nl |
| AMI, CAAS | Agrometeorology Institute, Chinese Academy of Agricultural Sciences | China | | | www.ami.ac.cn |
| BESC | U.S. Department of Energy, BioEnergy Science Center | U.S. | | U.S. | bioenergycenter.org |
| Biofuelwatch | Biofuelwatch | UK | | | www.biofuelwatch.org.uk |
| Camagüey Meteorological Center | Camagüey Meteorological Center | Cuba | | | |
| CAS | Center for Agricultural Resources Research | China | | | |
| CEG, Newcastle | Civil Engineering and Geosciences, Newcastle University | UK | | | www.ceg.ncl.ac.uk/reimpact |
| CENBIO | Centro Nacional de Referência em Biomassa | Brazil | | Brazil | www.cenbio.org.br/in/ |
| CGIAR | Consultative Group on International Agricultural Research | US | | | www.cgiar.org |
| Copernicus Institute | Copernicus Institute for Sustainable Development and Innovation, Utrecht University | Netherlands | | | www.geo.uu.nl |
| CSE | Centre for Science and the Environment | India | | India | www.cseindia.org |
| CSIR | Council for Scientific and Industrial Research | South Africa | | | www.csir.co.za |
| CST | Center for Sustainable Technologies | India | | developing | www.cst.iisc.ernet.in |
| CTA | Technical Centre for Agricultural and Rural Cooperation ACP-EU | Netherlands | Brussels, Trinidad, Western Samoa | Africa, Caribbean, Pacific | www.cta.int |
| Desarrollos Agricolas | Desarrollos Agricolas SA, US | | | | www.desa.com.bo |
| Development Alternatives Group | Development Alternatives Group | India | | | www.devalt.org |

| short name | full name | HQ country | satellite office countries | region of interest | URL |
|---|---|---|---|---|---|
| eBio | European Bioethanol Fuel Association | Belgium | | EU | www.ebio.org |
| Eco-Build Africa | Eco-Build Africa | Kenya | | | www.ecobuild-africa.com (under construction) |
| Econexus | Econexus | UK | | | www.econexus.info |
| Ecosecurities | Ecosecurities | | | | |
| Embrapa Cerrados | Embrapa Cerrados | Brazil | | | www.embrapa.br |
| ERC, UCT | Energy Research Centre, University of Cape Town | South Africa | | | www.edrc.uct.ac.za |
| ETC Group | Action group on Erosion, Technology and Concentration | Canada | U.S., Mexico | south | www.etcgroup.org |
| FACT Foundation | Fuels from Agriculture in Communal Technology Foundation | Netherlands | | | www.fact-fuels.org |
| FAO | Food and Agriculture Organization, United Nations | Italy | | | www.fao.org |
| FAPRI | Food and Agricultural Policy Research Institute | US | | U.S. | www.fapri.iastate.edu |
| FEWS NET | Famine Early Warning Systems Network | | | Africa | www.fews.net |
| Friends of the Earth International | Friends of the Earth International | Netherlands | | | www.foei.org |
| Friends of the Earth, Brasil | Núcleo Amigos da Terra Brasil | Brazil | | | www.natbrasil.org.br |
| Friends of the Earth, US | Friends of the Earth, US | US | | | www.foe.org |
| GEM | Groupe d'Economie Mondiale | France | | | gem.sciences-po.fr |
| GRAIN | Genetic Resources Action International | Spain | | global | www.grain.org |
| GRR | Grupo de Reflexión Rural | Argentina | | | www.grr.org.ar |
| GTAP | Global Trade Analysis Project | U.S. | | global | www.gtap.agecon.purdue.edu |
| Hivos | Humanist Institute for Cooperation with Developing Countries | Netherlands | | south | www.hivos.nl |
| HREV | Human Rights Everywhere | Spain | | Colombia | www.hrev.org |
| IATP | Institute for Agriculture and Trade Policy | US | Switzerland | global | www.iatp.org |
| ICONE | Institute for International Trade Negotiations | Brazil | | global | www.iconebrasil.com.br |
| ICRAF | World Agroforestry Centre | Kenya | | | www.worldagrofo-restrycentre.org |

| short name | full name | HQ country | satellite office countries | region of interest | URL |
|---|---|---|---|---|---|
| ICTSD | International Centre on Trade for Sustainable Development | Switzerland | | global | www.ictsd.ch |
| IFPRI | International Food Policy Research Institute | US | China, Costa Rica, Ethiopia, India, Nigeria, Uganda | | www.ifpri.org |
| IIED | International Institute for Environment & Development | UK | | south | www.iied.org |
| IISD | International Institute for Sustainable Development | Canada | U.S., Switzerland | global | www.iisd.org |
| ILRI | International Livestock Research Instititute | | | | www.ilri.org |
| IPC | International Food & Agricultural Trade Policy Council | US | | global | www.agritrade.org |
| IWMI, CGIAR | International Water Management Institute | Sri Lanka | | | www.iwmi.cgiar.org |
| K.U.Leuven | Katholieke Universiteit Leuven | Belgium | | | www.kuleuven.ac.be |
| Kehati | Kehati | Indonesia | | | www.kehati.or.id |
| LEAD | Livestock, Environment and Development | | | | www.virtualcentre.org/en/frame.htm |
| LEI | Landbouw Economisch Institute | Netherlands | | | www.lei.wur.nl |
| Ministry of Energy, Iran | Ministry of Energy | Iran | | | |
| MST | Movimento dos Trabalhadores Rurais Sem Terra | Brazil | | | www.mstbrazil.org |
| NIFOR | Nigerian Institute for Oilpalm Research | Nigeria | | | |
| ODI | Overseas Development Institute | UK | India | south | www.odi.org.uk |
| OECD | Organization for Economic Cooperation and Development | France | Germany, Mexico, Japan, U.S. | | www.oecd.org |
| Office for the Formulation of the Land Use Plan for Puerto Rico | Office for the Formulation of the Land Use Plan for Puerto Rico | Puerto Rico | | | |
| Oxfam International | Oxfam International | UK | | | www.oxfam.org |
| Penn State | Pennsylvania State University | US | | | www.aers.psu.edu/faculty/CHinrichs/default.asp |

| short name | full name | HQ country | satellite office countries | region of interest | URL |
|---|---|---|---|---|---|
| PoloBio | Polo Nacional de Biocombustiveis, Escola Superior de Agricultura Luiz de Queiroz (ESALQ) | Brazil | | U.S. | www.polobio.esalq.usp.br |
| ReVamp | University of Witwatersrand/ Johannesburg | South Africa | | | web.wits.ac.za |
| RHVP | Regional Hunger and Vulnarability Programme | South Africa | | Africa (southern) | www.wahenga.net |
| RIS | Research and Information Systems for Developing countries | India | | | www.ris.org.in |
| SAFeAGE | South African Freeze Alliance on Genetic Engineering | South Africa | | | www.safeage.org |
| SAGE, U Wisconsin | Center for Sustainability and the Global Environment, University of Wisconsin | US | | | www.sage.wisc.edu |
| SARPN | Southern Africa Regional Poverty Network | South Africa | | Africa (southern) | www.sarpn.org.za |
| Sawit Watch | Sawit Watch | Indonesia | | | www.sawitwatch.or.id |
| SCOPE, ICSU | Scientific Committee on Problems of the Environment, International Council for Science | France | | | www.icsu-scope.org |
| SEI | Stockholm Environment Institute | Sweden | | global | www.sei.se |
| SENSE | Research School for Socio-Economic and Natural Sciences of the Environment | Netherlands | | | www.sense.nl |
| SOPAC | Pacific Islands Applied Geoscience Commission | Fiji | | Pacific | www.sopac.org |
| SSN | SouthSouthNorth | South Africa | | south | www.southsouthnorth.org |
| TaTEDO | Tanzania Traditional Energy Development and Environment Organisation | Tanzania | | | www.tatedo.org |
| TERI | The Energy and Resources Institute | India | | | www.teriin.org |
| Tsinghua U | Tsingua University | China | | | www.tsinghua.edu.cn/eng/ |
| TWN | Third World Network | Malaysia | India, Uruguay, Switzerland, Ghana | south | www.twnside.org.sg |

| short name | full name | HQ country | satellite office countries | region of interest | URL |
|---|---|---|---|---|---|
| U Minnesota | University of Minnesota | US | | | fr.cfans.umn.edu/people/facstaff/becker/index.html |
| UKZN | University of KwaZulu-Natal | South Africa | | | www.ukzn.ac.za |
| UNDP | United Nations Development Programme | US | | | www.undp.org |
| University of Sussex | University of Sussex | UK | | | www.sussex.ac.uk |
| USDA | United States Department of Agriculture (Economic Research Service) | US | | | www.ers.usda.gov/AmberWaves/ |
| Vitae Civilis | Vitae Civilis Institute | Brazil | | | www.vitaecivilis.org.br |
| Wageningen UR | Wageningen Universiteit en Researchcentrum | Netherlands | | | www.wur.nl |
| WFP | World Food Programme, United Nations | Italy | | | www.wfp.org |
| World Bank | World Bank | US | | | www.worldbank.org |
| WRI | World Resources Institute | US | | | www.wri.org |
| WRM | World Rainforest Movement | Uruguay | UK | | www.wrm.org.uy |
| WWF | World Wildlife Fund | Switzerland | | | www.panda.org |

# C. Survey Respondents

| country | organization | respondent | survey |
|---|---|---|---|
| Africa | | | |
| D.R. Congo | Public Research Centre | Katcho Karume | COMMEND |
| Egypt | Misr Petroleum | Tawfik Azer | COMMEND |
| Eritrea | Department of Energy | Tesfai | COMMEND |
| Ethiopia | Ethiopian Science and Technology Agency | Alemayehu Zeleke Tufa | COMMEND |
| | Addis Ababa university | Yeshambel Girma | COMMEND |
| Gambia | Ministry of Energy | Kassi Bondi | COMMEND |
| Kenya | Institute for Research in Sustainable Energy and Development | David Yuko | COMMEND |
| Mozambique | Ministry for the Coordination of Environmental Affairs | Eduardo Jorge da Silva Baizo | COMMEND |
| Nigeria | Federal University of Technology, Minna | Dr. Egwim Evans | Cape Town |
| | Nigerian Institute for Oilpalm Research (NIFOR) | Obibuzor Jude Uche | Cape Town |
| South Africa | Council for Scientific and Industrial Research | Rudzani Makhado | COMMEND |
| | Southern African Biofuels Association | Erhard Seiler | Cape Town |
| | Kyoto Planet | Al Karaki | Cape Town |
| | PGBI Engineering & Constructors | Cameron McGregor | Cape Town |
| | Council for Scientific and Industrial Research | Rina Taviv | COMMEND |
| Tanzania | Environment and Social Sustainability Technologies Association (NESSTA) | Chrizant Kibogoyo | Cape Town |
| | Diligent Tanzania Ltd. | Janske van Eijck | Cape Town |
| Uganda | Uganda Oil Seed Producers and Processors Association (UOSPA) | Peter Otimodoch | Cape Town |
| Zambia | U. Zambia | Kumbukani Shadreck Banda | COMMEND |
| | Ministry of Energy and Water | Harriet Zulu | COMMEND |
| Asia | | | |
| China | Renmin U. of China | Guangqing Xu | COMMEND |
| | China national petroleum corpo-ration | Liu Gang | COMMEND |
| India | Waterfalls Institute of Technology Transfer | S. K. Chutani | COMMEND |
| | [independent] | R Kadian | COMMEND |
| | Indian Institute of Technology Delhi | Rashmi Kadian | COMMEND |
| Indonesia | Universitas Andalas | Aulia | COMMEND |
| Iran | K.N. Toosi U. of Technology | Arash Kia | COMMEND |
| | Department of the Environment | Faariba Darvishi | COMMEND |
| Thailand | Joint Graduate School of Energy and Environment | Werner Siemers | COMMEND |

| country | organization | respondent | survey |
|---|---|---|---|
| | The Global Environment Facility's Small Grants Programme | Ms. Suwimol Sereepaowong | COMMEND |
| Yemen | Al-Ajyaal for Sustainable Projects (ASP) | Abdulkadir | COMMEND |
| Europe | | | |
| Germany | Accenture | Kosel Marcus | COMMEND |
| Italy | none | Jeremy Schlickenrieder | COMMEND |
| Latvia | Latvian State Forest Research Institute Silava | Andis Lazdinsh | COMMEND |
| UK | U Oxford | John Ndonji | Cape Town |
| | Imperial College London | Niels Schulz | COMMEND |
| Latin America | | | |
| Argentina | Universidad Nacional del Sur | Marina Recalde | COMMEND |
| | Fundacion Bariloche | Gonzalo Bravo | COMMEND |
| Barbados | Caribbean Development Bank | Christina Ward | COMMEND |
| Brazil | Louis Dreyfus Bioenergia | Thomas Brieu | COMMEND |
| | Instituto de Pesquisas Energéticas e Nucleares | Jose Glaucio Garone | COMMEND |
| | Associaçao Plantas do Nordeste | Enrique Riegelhaupt | COMMEND |
| Cuba | National Institute of Economics Research | Jose Somoza Cabrera | COMMEND |
| Mexico | [independent] | Claudio Alatorre | COMMEND |
| | sider | Curiel Javier | COMMEND |
| | ENERGETIC SOLUTIONS IN MOTION INC. | Jose Celis Alarcon | COMMEND |
| | Instituto Tecnologico de Conkal | Juan A Rivera-Lorca | COMMEND |
| | [independent] | Emilio De Los Rios Ibarra | COMMEND |
| | UMA | Johan Clemancon | COMMEND |
| Peru | Municipalidad de Barranca – Peru | Alois Silva | COMMEND |
| Venezuela | [independent] | Griselda de Mora | COMMEND |
| North America | UC Berkeley | David Roland-Holst | COMMEND |
| U.S. | Environmental Defense | Freda Fung | COMMEND |
| | UC Berkeley | David Roland-Holst | COMMEND |

## Surveys

COMMEND Email request to COMMEND, online Community for Energy, Environment and Development, submission deadline Friday, December 21, 2007.

Cape Town Paper survey distributed at African Biofuels Conference, November 5-7, 2007

# D. Terms of Reference

## Terms of Reference for scouting mission on the KP theme proposed by the sustainable production team/sustainable economic development bureau of Hivos

### Hivos policy on knowledge based programming

*Access to knowledge, networks and decision-making*

Many civil society organizations operate simultaneously at the local, regional, national and international levels. Only by doing so can they exercise effective influence on trading measures, international environmental agreements or multilateral Hiv/Aids programmes. They switch increasingly between international lobbying, local development projects and focused publicity campaigns to bring about changes in policy or behaviour. Southern civil society organizations therefore do not only need money, they also need access to international networks and links to existing knowledge and information. For many partners, the traditional donor/beneficiary relationship is no longer adequate. They expect international donors to be more involved in implementing programmes than in the past, and to be able to use their networks to make knowledge accessible.

*Knowledge for development*

Knowledge sharing within the organization and with its partners has been a core activity of Hivos for quite some time. However, the need was felt to go beyond sharing and initiate new knowledge programmes developed in cooperation with a number of leading knowledge institutions in the North and the South. Based on its own practical experience and that of its partners in developing countries, Hivos develops programmes to develop and deepen knowledge (research & development), to share knowledge by means of training, exchanges, publications and e-learning programmes (linking & learning) and to apply knowledge (knowledge leveraging). Besides being a donor, Hivos thus also aims to become a knowledge actor in the field of development. In the period 2007-2010, Hivos will invest substantially in its knowledge programmes, which will thus replace part of its 'pure' financing role. So far, two programmes have been developed, namely the Civil Society Building Programme together with the Institute for Social Studies (ISS, The Hague) and the Promoting Pluralism programme in partnership with the University of Humanities (UvH, Utrecht). These programmes are coordinated from the Netherlands but involve international partners from the North and South.

### Sustainable economic development bureau programme

*Introduction*

The intention has been voiced to initiate a knowledge programme on a theme relevant to the Sustainable Economic Development Bureau and its partners. A knowledge need has been delineated, namely how the changing land use patterns induced by the sharply increased need for biofuels and biomass for energy and the growing demand for food and animal feed from fast growing developing countries will affect the livelihoods of marginalised people in the South.

Considering these developments will be of considerable influence in the coming years and may result in reframing global policies on agriculture, it is a topic that is on the agenda of many organizations dealing with rural development.

Quite some research is already being executed on the production of biofuels and the rapid increase of prices for commodities since 2005, however it seems that this has been mostly done from a technical point of view. Hivos, however, is interested in the socio-economic and ecological dimensions as well as the legal aspects of this issue and especially the impact of these changes on the liveli-

hoods for marginalised people in the south. In addition, not only rural developments should be addressed but also urban issues, such as the effects of these developments on consumers.
Hence, a scan will be executed of current programmes on this theme to get an overview of the research that is currently being executed and the disciplines covered. The aim is to find out whether the knowledge questions proposed by Hivos are unique in the sense that they are not already covered by other research institutes/organizations. Or, should this research already be executed, whether the research results are being translated into strategies, can be used for lobby and advocacy, are accessible to a wide range of stakeholders (for instance available in English and Spanish) and/or are catered towards development organizations.
The scan will be executed by an external consultant knowledgeable of this field. This document will be used as a term of reference for that consultant. The outcomes of this mission will form the basis of the decision making process at Hivos to decide whether this subject will become the leading theme for a new knowledge programme.

*Questions*

The working title of this knowledge programme is: *Food, Feed and Fuels; Consequences of land use change patterns for the livelihoods of marginalised people in the Sout*h. This theme of changing land use patterns concerns an issue which is on the agenda of many (research) organizations. Hivos, however, is especially interested in the impact of these changes on the livelihoods for marginalised people in the south.

More specifically, Hivos is interested in the following knowledge questions:

- What will be the impact on the terms of trade for agricultural bulk products from the South?
- How will the increased competition for land affect the access and control of smallholders in the South to farmland?
- To what extent will smallholders in the South profit from the increased commodity/food prices?
- What will be the impact of increased competition for farmland on food production, on food prices and on food security especially for households in the South without access to farmland including urban households?
- What will be the impact on producer-consumer relations and on for instance gender relations, and how are they to be addressed?
- What will be the impact of increasing commodity/food prices for quality markets (social and environmental standards)?
- How will the increased demand for land farmland/production conversion affect (agro- ) biodiversity, global warming?

## Scouting mission

*Questions*

Main questions: Are the knowledge questions stated above currently being adequately addressed by knowledge actors? Are results of research sufficiently translated into policies and strategies relevant for development organizations working in the South?

*Sub questions:*

Are there knowledge questions stated above that are not (yet) being adequately addressed? If so, why is that the case? Is the information produced by these institutes/organizations accessible to all stakeholders (especially to people/organizations in the South)? Are research results being translated into strategies? Can they be used for lobby and advocacy? Are these results catered towards development (partner) organizations in the South?

*Assignment*

The assignment has two main components, namely an extensive literary review and contacts with organizations active in the field in which the above mentioned questions will be addressed and based on which knowledge gaps will be outlined. These gaps may be delineated because knowledge on this issue as described in the ToR is not available or - when available - has not (yet) been sufficiently translated into policies and strategies relevant for development organizations working in the South. Contacts with organizations are aimed at capturing activities that are currently (or prospectively) being undertaken but have not (yet) been published.

*Literary review*

- A knowledge framework will be designed based on which relevant literature will be indexed.
- Significant published and unpublished works from 2000 onwards will be catalogued.
- Each work will be provided with an interpretation and placed within the knowledge framework.

*Contact organizations*

- A listing of major parties currently active in the field, with contact information where possible and focus of activities, will be created. This information will be gathered through SEI's network, the literary review and through a study of secondary sources (websites, research reports, portals, d-groups).
- Key organizations (academic centres, NGOs, multilateral organisations, action groups) and resource persons working in this field will be contacted to identify whether they are currently (or prospectively) addressing Hivos knowledge questions.

*Knowledge Gaps*

- A description of unpopulated quadrants in the framework, and prioritisation for populating each one, will be created to delineate knowledge gaps in this field.

## Result

A 30-to 40-page synthesis addressing the questions stated above based on an extensive literary review and contacts with organizations contributing to the field.

## Time Frame

The study will start on 1 October 2007 and the final report should be submitted to Hivos on 15 December 2007. SEI is invited to visit Hivos for a briefing to deliberate on the setting of the scouting mission including our current understandings of the issue, the knowledge questions posed and the knowledge framework. A debriefing session will be held during which the draft report (before 30 November) will be presented.

*design Tangerine, Rotterdam | photo iStock*

## Contact

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