

FOOD SECURITY AND BIOENERGY Concept Note¹

Introduction

This concept note was drafted for participants of the First FAO Technical Consultation on Bioenergy and Food Security (April 2007) as background information for working group discussions. The note provides a broad overview of food security concepts to help develop an understanding of the multiple pathways through which bioenergy developments may affect food security.² Although there are many linkages between traditional biomass and food security, the rapid development of liquid biofuels from food crop feedstock may have the greatest immediate impact on food security. Development of bioenergy sectors is essentially the starting point for assessing food security implications, thus, the strong emphasis of this consultation on bioenergy potentials.³

Key Questions

The following key questions are relevant to developing a common understanding of the primary issues related to bioenergy and food security:

- 1) What are the expected impacts on food prices at all levels on food insecure households?
- 2) What are the implications for food availability in terms of competition for natural resources, such as land or water, or human resources, such as labour? What about inputs to agriculture, particularly for households dependent on own food production?
- 3) What are the implications on incomes, employment and land rents given current inequities in access to productive resources? Is there anything different about bioenergy that could mitigate or overcome factors of exclusion that contribute in part to food insecurity and rural poverty?
- 4) What are the implications of bioenergy on environmental sustainability and climate change as they affect food security?
- 5) Who (public sector, private sector, civil society) is best placed to monitor and address possible conflicts arising from the competition between food, feed or fuel use of biomass?
- 6) How can low-income food deficit countries ensure that food security concerns are addressed, given the possibility of unintended consequences due to rapid development of bioenergy and the complex linkages between agriculture, energy, environment and trade?

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² Food security exists when all people, at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. The four pillars of food security are availability, stability of supply, access and utilization.

³ Bioenergy work at FAO is organised through the International Bioenergy Platform (IBEP), a framework launched in May 2006 to facilitate collaboration on bioenergy based on knowledge management and mobilization. FAO also hosts the Secretariat of the Global Bioenergy Partnership (GBEP), funded by the Italian government since start-up in September 2006. A major three-year project on Bioenergy and Food Security (funded by the German government) became operational in FAO in late January 2007, and a bioenergy information portal, funded by FAO, has entered its final test phase (public May 2007). Refer to IBEP <ftp://ftp.fao.org/docrep/fao/009/A0469E/A0469E00.pdf>.

KEY CONCEPTS

Who are the Hungry?

Some 70 percent of the 854 million hungry people in the world live in rural areas and depend on agriculture, and are often concentrated in regions that are particularly vulnerable to environmental degradation and climate change. An estimated 820 million are in developing countries, 25 million in countries in transition and 9 million in industrialized countries. Hunger claims up to 25,000 lives every day, two thirds of them children under the age of five, and is currently the leading threat to global health, killing more people than AIDS, malaria and tuberculosis combined. Although the proportion of undernourished in the world has declined from 20 percent to 17 percent since the mid-1990s, the absolute number of hungry people has remained the same. Global progress towards halving the proportion of hungry people by 2015 remains slow and largely uneven. Only Latin America and the Caribbean, amongst developing regions, have reduced the prevalence of hunger at a rapid enough pace to reach the Millennium Development Goals (MDG) target.

Approximately 30 percent of world grain supplies are currently used to feed livestock (and only indirectly to feed people); thus, the implications of biofuel development on food security will also be linked to changes in dietary patterns. One third of the projected increase in food demand over the next three decades is expected to come from dietary changes as more people are able to afford calorie-intensive meat and dairy products. Population growth in developing countries, roughly double that of industrialized countries, plus rising per capita incomes, economic growth and increased urbanization, are driving the increased demand for animal products, feedstuffs, higher value processed foods and horticultural crops. Production of these items requires relatively large resource inputs, including additional land and water to grow crops for animal feed. Continued increases in global demand for animal products may be an additional source of pressure on available supplies of biomass.

Country typologies key starting point for analysis

Growth rates of agricultural production and consumption in developing countries have outpaced those of industrialized economies in recent years.⁴ This has not been the case, however, for most of the Least Developed Countries (LDCs), where agricultural output has not kept pace with population growth and increased domestic demand. Preliminary analysis of the impact of bioenergy on food security should thus highlight differences between developing, least developed, and low-income food deficit countries (LIFDCs). These two latter groups are typically the most food insecure, given high dependence on staple food imports and exports of primary tropical commodities.

LDCs have the highest proportion of chronically undernourished populations, and have become increasingly reliant on imports of basic commodities to ensure food security. For many, this has also resulted in increased exposure to international market price fluctuations, increasing overall food insecurity. Further development of bioenergy systems will increasingly highlight the direct linkages between food security and energy security. These linkages function as an additional source of uncertainty in global production and marketing systems; markets that are already more susceptible to greater variability in pricing and production due in part to trade liberalization and structural adjustments in food and agricultural sectors. Natural disasters and lack of productive input factors, such as fertilizer or water

⁴ OECD-FAO Agricultural Outlook: 2006-2015, OECD-FAO Paris, 2006.

resources, also constrain or result in lost agricultural output, and lowers overall food availability.

The competition for more arable land and water resources directed to biofuel production may lead to higher and less stable food prices, for countries that are both net food importers and exporters. This may be particularly true for low-income, food deficit countries (LIFDCs) that already have a large proportion of undernourished and are net importers of basic foods, and may face serious problems of food access within vulnerable populations. Poor households tend to spend a larger proportion of income on food than other items, including energy, and thus, may be particularly challenged by rising food prices, globally and locally.⁵

Linkages between prices, biofuel and food security

Current and expected trends in energy prices may catalyze further growth in bioenergy production and more rapid adoption of bio-based fuels. Biofuel represent an important and growing source of demand for agricultural commodities. Recent FAO research notes that prices for fossil fuels may essentially establish floor and ceiling prices for agricultural commodities used as feedstock.⁶ Major producers of biofuel, such as Brazil, the United States, the EU and Canada are either expected to reduce exports of basic feedstock commodities (cereals or oilseeds) and increase biofuel imports. This has serious economic, environmental and food security implications for many developing countries, particularly countries that have large proportions of poor food insecure people living in rural areas.

Agricultural commodity prices have long been influenced by energy prices, because of the importance of fertilizers and machinery as inputs in commodity production processes. The possibility of increased competition for agricultural, water and other natural resources for bioenergy systems instead of food production is already evident. However, given potentially significant markets for bioenergy, competition for resources could induce result in price increases that adversely affect the ability of lower income consumers to purchase food.

Rising commodity prices, while beneficial to producers, will mean higher food prices with the degree of price rise depending on many factors including, as mentioned, energy prices, with negative consequences for poor consumers. Expanded use of agricultural commodities for biofuel production will strengthen this price relationship and could increase the volatility of food prices with negative food security implications. Developing guidelines to analyse how bioenergy can contribute to rural development, as well as formulate policy to ensure that the food security concerns of the rural poor, particularly female smallholders and household heads, is vitally important to ensure that the outcomes of rapid bioenergy development are positive.

There are indications that increased production of biofuel will further link prices of fossil fuels with biofuel feedstock. Prices of sugar and molasses already show high correlations with world oil prices. Increased production of biofuel adds another

⁵ Countries with 20 to 34 percent of the population considered undernourished include Bangladesh, Bolivia, Botswana, Cambodia, Cameroon, Chad, Congo, Dominican Republic, Gambia, Guatemala, Guinea, Honduras, India, Kenya, Laos Peoples Democratic Republic, Malawi, Mali, Mongolia, Namibia, Nicaragua, Niger, Pakistan, Panama, Senegal, Sri Lanka, Sudan, Thailand, Togo. Countries with more than 35 percent of the population considered undernourished include Angola, Burundi, Central African Republic, Chad, Democratic Republic of the Congo, Democratic People's Republic of Korea, Eritrea, Ethiopia, Haiti, Liberia, Madagascar, Mozambique, Rwanda, Sierra Leone, United Republic of Tanzania, Tajikistan, Yemen, Zambia and Zimbabwe (FAO SOFI 2006).

⁶ Impact of increased biomass use on agricultural markets, prices and food security: a longer-term perspective, Josef Schmidhuber, Senior Economist, FAO, November 2006.

layer of uncertainty and risk to volatile price relationships by linking food and oil prices; demand can become less elastic (through biofuel consumption mandates), therefore comprising an increasing share of a given crop's market, which gives rise to greater price variability and market volatility. End-users can mitigate energy price volatility where technical options exist for easier fuel-switching, for example, through flex-fuel vehicles, although the extent to which this would benefit poorer populations remains unclear. Increased price volatility may be more detrimental to food security than long-term price trends, to the extent that the poor are usually less able to adjust in the short term. Increased trade in biofuel also has the potential to mitigate some of this price volatility. However, the expected price increases due to greater demand for biofuel crops may induce farmers to increase production and thereby mitigate some of these price effects in the longer term. Appropriate trade policies could potentially minimize tensions between biofuel and food production by allowing trade to flow internationally in response to fluctuations in domestic supply and demand, thus helping to stabilize prices.

Bioenergy and the four dimensions of food security

According to FAO, food security exists when all people, at all times, have physical, social and economic access to sufficient amounts of safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. There are four dimensions to food security: availability, access, stability and utilization.⁷

Availability of adequate food supplies refers to the capacity of an agro-ecological system to meet overall demand for food (including animal products, livelihoods and how producers respond to markets). Food availability could be threatened by biofuel production to the extent that land, water, and other productive resources are diverted away from food production. The degree of potential competition between food, feed and fuel use of biomass will hinge on a variety of factors, including agricultural yields and the pace at which next-generation biofuel technologies develop. As second-generation technologies based on lignocellulosic feedstock become commercially viable, this may lessen the possible negative effects of land and resource competition on food availability. The market for biofuel feedstock offers a new and rapidly growing opportunity for agricultural producers and could contribute significantly to higher farm incomes. Modern bioenergy could make energy services available more widely and cheaply in remote rural areas, supporting productivity growth in agriculture or other sectors with positive implications for food availability and access to food.

Access to food refers to the ability of households to economically access food (or livelihoods), defined in terms of enough purchasing power or access to sufficient resources (entitlements). Bioenergy developments will have an impact on those populations vulnerable to food insecurity based on food access issues, to the extent that food prices rise faster than real incomes, reducing purchasing power and in turn, increasing food insecurity.⁸ Global food commodity prices are

⁷ FAO, with the financial support of Germany, has recently launched a three-year Bioenergy and Food Security project with the objective to mainstream food security concerns into assessments of bioenergy potentials through targeted analysis and field activities that are designed to support rural development. The elaboration of a methodological framework is currently underway that will integrate tools used to analyze biomass potential with those related to food security. Three national teams will develop country case studies in Asia, Africa and Latin America based upon an assessment of biomass production potential linked to the natural resource base and to external factor inputs, land availability and utilization, the agriculture, energy and environmental policy framework, and the analysis of qualitative and quantitative linkages to food security, social, economic and environmental indicators. The development of policy guidance that focuses on sustainable forms of bioenergy while safeguarding food security remains a primary objective.

⁸ Schmidhuber, November 2006.

expected to increase in the near to medium-term due to expanded biofuel production. Price increases have already occurred in major biofuel feedstock markets, for example, sugar, corn, rapeseed oil, palm oil, and soybean. In addition to raising feedstock prices, increased demand for energy crops might elevate the prices of basic foods, such as cereals, which comprise the major proportion of daily dietary intake of the poorest and least food secure. Thus, possible income gains to producers due to higher commodity prices may be offset by negative welfare effects on consumers, as their economic access to food is compromised. This appears to be the case for corn in 2006 and early 2007, as rising demand for biofuel production (ethanol) in the United States reduced exports and pressured world grain prices.⁹

Stability refers to the time dimension of food security. Stability of food supplies refers to those situations in which populations are vulnerable to either temporarily or permanently losing access to resources, factor inputs, social capital or livelihoods due to extreme weather events, economic or market failure, civil conflict or environmental degradation, and increasingly, conflict over natural resources. Temporal distinctions between chronic and transitory food insecurity may be important to understand in the context of rapid bioenergy development. Chronic food insecurity is a long term or persistent inability to meet minimum food consumption requirements, lasting for more than six months of the year. Transitory food insecurity is a short term or temporary inability to meet minimum food requirements, usually linked to the hungry (or lean) season, a more limited timeframe with some indication of capacity to recover from shocks.¹⁰ Further growth in biofuel could exert additional pressures on stability of food supplies as price volatility from the petroleum sector is more directly and strongly transmitted to the agricultural sector, increasing the risk of more severe chronic and transitory food insecurity.

Utilization of food refers to peoples' ability to absorb nutrients and is closely linked to health and nutrition factors, such as access to clean water, sanitation and medical services. The food utilization concept is also based on how food is used, such as nutrient loss during preparation, storage or processing, or cultural practices that negatively affect the consumption of enough nutritious food for certain family members, particularly, women and girls. If biofuel feedstock production competes for water supplies, it could make water less readily available for household use, threatening the health status and thus the food security status of affected individuals. On the other hand, if modern bioenergy replaces more polluting sources or expands the availability of energy services, it could make cooking both cheaper and cleaner, with positive implications for food utilization.

Finally, determining the possible positive or negative effects on food security requires an understanding of the concept of **vulnerability**. Vulnerability in relation to food security is determined by the frequency and intensity of shocks affecting households and the capacity of these households to withstand these shocks. Vulnerable households and communities may face acute food crises due to many factors (not just weather-related) and adopt extreme coping strategies to meet food needs. The long-term and cumulative effect of resorting to these

⁹ According to C. Ford Runge and Benjamin Senauer, the enormous volume of corn required by the US ethanol industry is sending shock waves through the food system. The US accounts for some 40 percent of global corn production and over 50 percent of all corn exports. Corn futures rose to over \$4.38 a bushel in March 2007, the highest level in ten years. Wheat and rice prices have also surged to decade highs, because even as those grains are increasingly being used as substitutes for corn, farmers are planting more acres with corn and fewer acres with other crops. *How Biofuels Could Starve the Poor*, Foreign Affairs, May/June 2007.

¹⁰ Identification of methods and tools for emergency assessments to distinguish between chronic and transitory food insecurity, and to evaluate the effects of various types and combinations of shocks on these different livelihood groups, Stephen Devereaux, WFP/ODAN, February 2006, SENAC Project.

types of coping strategies reduces more sustainable access to food as well as access to factor inputs necessary to restore livelihood security and/or own food production. This is clearly the case for many countries in sub-Saharan Africa.

Chronic food insecurity reduces household and community capacity to face human-induced and natural hazard shocks, particularly when faced with an acute food crisis. Repeated shocks, such as higher food prices, loss of income or source of livelihood, or loss of food crops due to extreme weather events, may force households to cope with chronic poverty and seasonal or cyclical food insecurity, depleting household assets and resulting in deteriorating food security.¹¹

Environmental concerns related to bioenergy and implications for food security

The relationships between bioenergy and the environment, as related to food security, are complex and interdependent. Environmental and socio-economic benefits and trade-offs, particularly in terms of bioenergy and food security, must be analyzed and monitored across space and time. Energy (commodity) crops based on traditional agricultural output are already associated with land and soil degradation, water pollution and input and energy intensive production systems.

Local environmental issues related to resource use and the potential for further degradation of the natural resource base may result in conflict over access and control over natural resources. At the global level, the environmental issues are related to climate change and the potential for bioenergy to mitigate greenhouse gas emissions. This will depend on feedstock used, technological conversion and the impact on the global energy balance. The most direct link between the environment, bioenergy and food security is the impact of climate change on vulnerable, food insecure households, mostly as it relates to the frequency and severity of extreme weather events.

There may be no other region in the world where the relationship between chronic and transitory food insecurity resulting from vulnerability to economic, political and climatic shock is more challenging and urgent than sub-Saharan Africa. A more pronounced vulnerability to shocks of every kind exists in sub-Saharan Africa, with 30 percent of the population chronically food insecure, and subject to diseases of poverty, extreme weather events, remoteness and/or human-induced conflict. Many rural households in sub-Saharan Africa, for example, are dependent on traditional farming systems and rain fed agriculture. Frequent and extreme weather events in sub-Saharan Africa, influenced by seasonal hazards, climate variability linked to climate change, result in weather shocks (droughts and floods) that reduce food production and have negatively impact livelihoods that may have helped vulnerable people access food.

Currently, vulnerability analysis may help define the specific context and nature of risks to food security, although a standardized methodology for analysis and measurement does not exist and standardization may not be possible. There are important sources of traditional knowledge that often play an important role in mitigating shocks, but may be overlooked in current food security assessment methodologies. Examples from the Sahel have shown the importance of considering traditional knowledge of how to cope with drought in analyzing natural hazards, as well as efforts to map livelihood zones to help develop early warning systems. Thus, a wide range of quantitative and qualitative information

¹¹ The livelihoods approach in food security analysis is helpful given the emphasis on understanding the capacity of a household to manage risks, such as drought or extreme weather, thus livelihood security is a useful concept for the analysis of bioenergy and food security, particularly from the environmental and climate change perspective.

within an integrated livelihoods analysis framework may be necessary to understand bioenergy developments as related to food security and vulnerability.¹²

Policy domains shaping development of bioenergy sectors and food security impacts

At least four distinct policy domains are shaping development of the liquid biofuel sector: energy, environment, agriculture, and trade. Similarly, policies at the national, regional, and global levels are highly relevant and may interact in unexpected ways. Rural development policies have often tended to favour large-scale agriculture and livestock production to foster economic growth at the industrial level, often at the expense of more sustainable mixed farming systems typically employed by poorer people. Dedicating large tracts of land to single crop industrial output often contributes to deforestation, land degradation, contaminated surface and groundwater, and loss of biodiversity.

There are also growing socio-economic and environmental concerns about bioenergy systems based on large-scale monoculture agro-industrial crops. These systems may have a negative effect on food security due to competition for rural resources resulting in increased need for cash-based instruments to access credit, land and productive inputs. Female smallholders are often excluded from accessing the cash and resources necessary to focus on single crop output, and may be excluded from any potential benefits of bioenergy production, although they often play the most significant role in ensuring household food security. Smaller-scale systems can be promoted and/or small-scale farmers can be organized in terms of providing factor inputs and supporting contractual relationships with industrial actors involved in biomass feedstock production processing, product distribution, trade and transport.

Agriculture has become increasingly feminized, particularly in the poorer and more food insecure countries of the world.¹³ As the rate of male participation in rural agriculture declines (rural to urban migration, war, illness and death due to HIV/AIDS, particularly in sub-Saharan Africa), women increasingly bear the primary and dominant role in agricultural production. An estimated one-third of all rural households in sub-Saharan Africa are now headed by women, and these households are often forced to make adjustments in cropping patterns and farming systems due to lack of access to land, capital, credit and labour. FAO research indicates that these households also suffer disproportionately from environmental degradation, declining crop yields, water and fuel shortages, all of which result in increased vulnerability to chronic and transitory food insecurity.

Agricultural and energy markets are both highly distorted, making it difficult to predict the net effect of reforms in either sector. Although existing agricultural supports clearly depress commodity prices (feedstock), helping make liquid biofuel more competitive vis-à-vis fossil fuels, direct subsidies for biofuel are still required in most cases to overcome the cost advantage enjoyed by petroleum products. Whether such subsidies may be justified in the short term in terms of socio-economic and environmental objectives needs to be evaluated in a rigorous cost-benefit framework.

¹² For example, refer to the FAO-FSU Integrated Food Security and Humanitarian Phase Classification Reference Table, FAO, February 2006 or the FAO-ILO Livelihoods Assessment Toolkit, April 2007.

¹³ FAO research notes that although women are the principal food producers and providers globally, they remain invisible partners in development. The relative lack of available gender disaggregated data means that the contribution of women to agriculture remains poorly understood and that their specific needs are often missing in development planning.

Ethanol or biodiesel blending requirements mandated on environmental grounds may be inconsistent with trade barriers erected against imports of those products, or even become less effective due to trade barriers. By impeding imports of more efficiently produced biofuel from abroad, the combination of the two policies may divert more land from food production than would have been necessary to meet the blending requirement alone. Similarly, investments based on expected export opportunities that depend on preferential market access or policies that provide subsidies in importing countries, which could be eroded, must be carefully evaluated.¹⁴

Policymakers need to understand the interactions amongst these various policy domains to ensure that food security considerations are given priority. Integrated policy analysis that considers the effects and interactions of the relevant policy domains at different levels is required, particularly as related to those factors of exclusion, for example, gender, geographic remoteness, poverty (and the associated diseases of poverty), that may constrain political and economic participation.

The potential for world agriculture to be a significant source of feedstock for biofuel may offer development opportunities for countries with sufficient land and water resources as well as policies conducive to trade. At the same time, maintaining national and household level food security remains a major priority for most developing countries. Governments in developing countries have adopted various strategies, including efforts to increase production (often based on national goals to become self-sufficient in food production), market interventions, food or income transfers, distribution of food in-kind and maintenance of national food security reserves. Hunger and food insecurity in developing countries tends to be concentrated in rural areas, thus little sustained progress in food security is possible without paying particular attention to agriculture, factors of exclusion and rural development.

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¹⁴ There are examples of investment and policy support to small-scale, labour-intensive biofuel production systems aimed at providing employment and income for smallholders. For instance, Brazil recently introduced a social biodiesel program, focused on small rural cooperatives, that is targeted specifically at poverty reduction. The Brazilian government is now providing families of labourers with a new market for their oilseed crops with the aim of improving socio-economic conditions.