mainly 70% of the world’s poor people that live in rural areas, many of whom depend on agriculture for their livelihoods. Over 2.5 billion people live on less than US$2 per day and increasing food prices will in all likelihood increase their food insecurity.

The increasing demand for biofuels is likely to increase the cost of land, labor, and agricultural inputs. For example, demand for feedstock crops such as maize and sugarcane has contributed significantly to global food price volatility, especially in grain markets.

Other factors contributing to a growing demand for grains are increasing incomes in some developing countries, which are shifting preferences from staple crops to meat and dairy; changing climate and its impact on crop productivity; a weak dollar and speculation. These changes have led to pressures on global agricultural markets and food costs. AKST could play a critical role in improving the benefits of bioenergy and reducing potential risks and costs.

Recent trends suggest that food and energy markets are likely to be more strongly linked in the future, such that fluctuations in the prices of one would lead to corresponding changes in food prices.

Policy Considerations

It is still controversial whether biofuels, particularly first generation biofuels, deliver net GHG benefits. Policies concerning biofuel production will need to require that feedstock production practices do not create net additional emissions of GHGs directly, or indirectly through land use change, i.e., that they do not displace arable land into natural ecosystems. Additional research is required to understand the lifecycle of greenhouse gas emissions from different biofuel feedstocks and technologies is required.

The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) provides information on how agricultural knowledge, science and technology can be used to reduce hunger and poverty, improve rural livelihoods and human health, and facilitate equitable environmental, socially and economically sustainable development. The full set of IAASTD reports include a Global and six sub-global reports and their respective summaries for Decision Makers as well as a Synthesis Report, including an Executive Summary. The reports were accepted at an Intergovernmental Plenary in Johannesburg in April 2008.

The assessment was sponsored by the United Nations, the World Bank and the Global Environment Facility (GEF). Five UN agencies were involved: the Food and Agriculture Organization (FAO), the UN Development Program (UNDP), the UN Educational, Scientific and Cultural Organization (UNESCO) and the World Health Organization (WHO).

IAASTD Issues in Brief are taken directly from the IAASTD Reports published in 2008 by Island Press.

Photo: ©FAO/Giulio Napolitano

The Earth is warming due to the accumulation of greenhouse gases (GHGs) from the intensive use of fossil fuels and other natural resources. GHGs include carbon dioxide (CO₂), methane, nitrous oxides, water vapor, ozone and others, but the two most important GHGs are carbon dioxide and methane, which are responsible for 96% of anthropogenic greenhouse effects. These GHGs are trapping heat over the Earth’s surface, resulting in changes in temperature and other climatic processes.

The Intergovernmental Panel on Climate Change (IPCC) has concluded that “warming of the climate system is unequivocal” and that “most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations.” Observed impacts include increasing frequency and intensity of extreme climatic events, such as more destructive floods, severe and sustained droughts and melting glaciers. These impacts may result in “harmful effects on important livelihood sectors such as agriculture, as well as adverse effects on human health and ecosystems—effects that seriously diminish food security and hinder poverty alleviation.” In fact, climate change, combined with other socioeconomic stresses, could alter the regional distribution of hunger and malnutrition, with large negative effects, especially in sub-Saharan Africa.

The Bioenergy Option

Given the crucial small-scale farmers are to efforts to decrease hunger and poverty and improve health and nutrition, it is important to identify options that promote sustainable livelihoods for small-scale producers and contribute to environmental sustainability. Increased food security, efficiency, recovery, deforestation, and developing and using cleaner, sustainable energy sources are key approaches to addressing climate change. Bioenergy has emerged as an alternative to fossil fuels and is being promoted as a cleaner source of energy.

The growth in bioenergy production has been stimulated mostly by biofuel subsidies, fuel blending mandates, national interest in energy security, climate change mitigation and rural development programs. However, bioenergy has also triggered controversy. This attention is related to the soaring prices for grains, which have resulted, in part, from the expansion in global biofuels at the expense of food production. The underlying causes of the most recent increases in food prices are complex and include factors such as increased demand from rapidly growing economies (especially China), poor harvests due to an increasingly variable climate (e.g., the Australian drought), the use of food crops for bio-

For more information on IAASTD, please see www.assessment.org, to order go to www.islandpress.org/iaastd.
fuels (e.g., maize for bioethanol); higher energy prices; low food stocks; restrictions imposed on agricultural commodity exports by a number of significant exporters (e.g., Argentinia, India and Ukraine) to protect their domestic consumers.

What is bioenergy? Bioenergy refers to products of biomass that have been converted into liquid, solid or gas form. BIO is a form of energy obtained from living or dead plant material ranging from agricultural, forest and municipal wastes to crops grown specifically to make biofuels, such as bioethanol and biodiesel.

• Solid biofuels are plant material such as wood chips, and solid or woody bio- material that can be directly converted to energy, commonly in traditional cook stoves. Two of the most widely used wood crops are wood chips and bagasse. Bagasse has been used for decades for electricity generation at sugar mills. Millions of people in developing countries depend on traditional biofuels for their most basic cooking and heating needs; this dependence is most prevalent in sub-Saharan Africa and South Asia. In some countries, the share of biomass in energy use reaches 90%.

• Liquid biofuels are used for heating, cooking, lighting, transport and power generation. Bioethanol, biodiesel and pure plant oils are the most common forms of liquid biofuels.

• Gaseous biofuels include biogas, which is produced by digesting organic waste and is generally used for cooking, lighting and power generation at the village level.

What are the feedstocks for biofuel? Bioethanol: Sugarcane is considered the most efficient: production of sugar from sugarcane creates large amounts of sugars and fiber produced. Switch grass ( Panicum virgatum), wheat, sorghum, maize, biomass waste and residues, and municipal or agricultural waste can all serve as feedstock for the production of bioethanol. Enzymatic treatments and new strains of yeast are being developed at a rapid pace for producing etha- nol from cellulose, but are not yet commercially viable.

Biodiesel: Biodiesel is made from, among other things, animal fats, rapeseed, sunflower, soybean, palm oil, coconut, Jatropha, neem, castor beans, and palm kernel. These biodiesel crops synthesize diesel fuels from wood and straw. The vegetable oils obtained from oil palm (Elaeis guineensis), coconut (Cocos nucifera) and Jatropha curcas can be used directly as pure oils or converted into biodiesel. By-products from livestock and fisheries in developing countries can also provide raw material for biodiesel. For many countries, dependency on traditional biofuels and their feedstocks is expected to make biofuels globally competitive with petroleum fuels.

Bioenergy in 2020: Different regions, benefits and tradeoffs

Bioenergy in 2020 has the potential to produce additional energy, reduce greenhouse gas emissions, and increase trade among developing countries. It is expected to reduce energy use, 90%.

Energy security
In addition to climate change as a driver, in- creasing concerns about energy security and the rising cost of fossil fuels are causing many countries to view biofuels as an important el- ement of their national energy strategy. It is wide- ly assumed that by reducing demand for petro- leum, energy supplies would be more certain and expanding markets for biofuels would help boost crop prices, which could benefit farm- ers, and increase the number of hungry people. However, these assumptions are debatable and more studies are required to assess the poten- tial contribution of biofuel to energy security.

Environmental concerns
A considerable debate exists over the mag- nitude of disadvantages and environmental impacts of biofuels; however, the intensive cultivation of energy crops is expected to produce adverse environmental impacts on soil and groundwater, and to result in deforestation and loss of biodi- versity. Local, national and regional agricultural residues and by-products will have to take into ac- count tradeoffs between the need for promoting higher yields and the need for environmental and biodiversity conservation.

Social concerns
The traditional use of solid biofuel for cooking is time consuming; causes uncontrolled burning and increases exposure to hazardous indoor air pollution. Solid biofuels are inefficient. The term, depending on the region, solid biofuel may mean: briquettes, agro waste, poultry biomass combustion leads to asthma and other respiratory problems, causing up to 1.5 million premature deaths per year. There are potential benefits of modern biofuels for rural communities, including improved environmental health, and new jobs and income generation. The move to biofuels is expected to create new industries and bring increased economic activ- ity to farming communities at the expense of feedstock production and manufacturing, hence the move has the potential to reduce poverty for some. However, an expansion in production of first generation biofuels predominantly from agricultural crops will raise prices of agricultural produce, which can result in increased hunger and poverty. Negative effects, such as the marginalization of small-scale farmers, are likely.

Mitigation of GHGs
The widespread use of bioenergy to mitigate climate change depends on reductions in biofuel emis- sions as well as their overall costs compared to other mitigation alternatives. Sugarcane-based biofuel and second generation biofuels may achieve reductions in greenhouse gas emissions through improved agricultural practices, such as crop rotation and the use of high- yielding crops, which can result in increased hunger and poverty. However, these assumptions are debatable and more studies are required to assess the potential contribution of biofuel to energy security.

International trade in biofuels and biofuel feed- stocks increased rapidly and is expected to increase further in the future. There is high demand for vegetable oil, under pressure from the EU biofuel mandate, has caused a rapid increase in vegetable oil prices with negative impacts on biofuel costs and food prices.

Food security concerns
With every one percent increase in the cost of food today, 16 million people are made food insecure. Food insecurity arises when people do not have physical and economic access to sufficient safe, nutritious, and culturally acceptable food to meet their dietary needs. Food insecurity is one of the major concerns surrounding the use of biofuels. Biofuel production competes with food, fiber and timber, and land and water use. There are concerns that this competition could affect food security, as food crops may be used as fuel and agricultural land may be used for biofuel production. At risk are the approxi-
What is bioenergy?

Bioenergy refers to products of biomass that have been converted into liquid, solid or gas forms, as a result of the raw material base and the technology employed, for energy generation. Bioenergy encompasses a wide spectrum of plant materials ranging from agricultural, forestry and municipal wastes to crops grown specifically to make biofuels, such as bioethanol and biodiesel.

Biofuels.

Biodiesel: Biodiesel is made from, among other things, animal fats, rapeseed, sunflower, soybean, palm oil, coconut, jojoba, and castor seed. Biodiesel also synthesizes diesel fuels from wood and straw. The vegetable oils obtained from oil palm (Elaeis sp), coconut (Cocos nucifera) and Jatropha curcas can be used directly as pure oils or converted into biodiesel. By-products from livestock and fishmeal production provide raw material for biodiesel. For many countries, biodiesel production depends on reductions in vegetable oils prices. biodiesel represents 3% of current world diesel consumption.

2nd Generation Biofuels

2nd Generation Biofuels also known as second generation sources economically viable.

Energy security.

In addition to climate change as a driver, increasing concerns about energy security and the rising cost of fossil fuels are causing many countries to rethink the role of biofuels as a component of their national energy strategy. It is widely assumed that by reducing demand for petrol, the availability of energy supplies would be more secure and expanding markets for biofuels would help boost crop prices, which could benefit farmers, as well as increase the number of hungry people. However, these assumptions are debatable and more studies are required to assess the potential contribution of biofuels to energy security.

Environmental concerns.

A considerable debate exists over the magnitude of environmental impacts of bioenergy crops however, the intensive cultivation of energy crops is expected to produce adverse environmental impacts on soil and groundwater, and to result in deforestation and loss of biodiversity. Local, national and regional agricultural practices will have to take into account trade-offs between the need for promoting higher yields and the need for environmental and biodiversity conservation.

Some practices with known negative effects include:

- Removal of crop residues, such as leaves, stem and straw, which can reduce soil moisture, carbon and nitrogen content, and water infiltration rates.
- Liquid biofuels are used for heating, cooking, light, transport and power generation and include cellulosic ethanol, biodiesel and biogas.
- Solid biofuels are plant matter such as wood chips and coal, which can be directly used as fuel, mainly in traditional cook stoves. Two of the most widely used forms are wood chips and bagasse. Bagasse has been used for decades for electricity generation at sugar mills. Millions of people in developing countries depend on traditional biofuels for their most basic cooking and heating needs; this dependence is most prevalent in sub-Saharan Africa and South Asia. Some countries, the share of biomass in energy use reaches 90%.
- Gaseous biofuels include biogas, which is produced by digesting organic waste and is generally used for cooking, lighting and power generation at the village level.

What are the feedstocks for biofuel?

Bioethanol.

Sugarcane is considered the most efficient feedstock because of the high sugar content and high yields. However, there are trade-offs because higher sugar content means lower yields.

Biodiesel.

The yields of biodiesel for the different feedstocks are not comparable. The biodiesel yield of soybean is higher than that of rapeseed, but the biodiesel yield of rapeseed is higher than that of soybean. Therefore, it is important to consider the biodiesel yield of each feedstock in order to determine the most efficient feedstock for biodiesel production.
fuels (e.g., maize for bioethanol); higher energy prices; increasing concerns about energy security and climate change; and, in response to the high food prices, restrictions imposed on agricultural commodity exports by a number of significant exporters (e.g., Argentinia, India and Ukraine) to protect their domestic consumers.

2nd Generation Biofuels

These biofuels are cellulosic ethanol, waste based on a complex carbohydrate, derived from non-grain parts of plants including switch grass, prairie grasses, trees and forestry. Biofuels are produced through hydrolysis/fermentation, gasification or pyrolysis. Various feedstock crops need more focus on making second generation sources economically viable.

Bioenergy

Bioenergy refers to products of biomass that have been converted into liquid, solid or gas form, depending on the raw material base and the technology employed, for energy generation. Biomass encompasses a wide spectrum of plant materials ranging from agricultural, forestry and municipal wastes to crops grown specifically to make biofuels, such as bioethanol and biodiesel.

• Solid biofuels are plant material such as wood chips, and other solid or woody biofuels, that can be directly used as fuel, mainly in traditional cook stoves. Two of the most widely used forms are wood chips and bagasse. Bagasse has been used for decades for electricity generation at sugar mills. Millions of people in developing countries depend on traditional biofuels for their most basic cooking and heating needs; this dependence is most prevalent in sub-Saharan Africa and South Asia. In some countries, the share of biomass in energy use reaches 90%.

• Liquid biofuels are used for heating, cooking, lighting, transport and power generation. Bioethanol, biodiesel and pure plant oils are the most common forms of liquid biofuels.

• Gaseous biofuels include biogas, which is produced by digesting organic waste and is generally used for cooking, lighting and power generation at the village level.

What are the feedstocks for biofuel?

Bioethanol: Sugarcane is considered the most efficient feedstock crop. It produces large amounts of sugars and fiber produced. Switch grass ( Panicum virgatum), wheat, sorghum, graze, maize, biomass waste and residues, and numerous other plant waste can all serve as feedstock for the production of bioethanol. Enzymatic treatments and new strains of yeast are being developed at a rapid pace for producing etha

Energy security

In addition to climate change as a driver, in

creasing concerns about energy security and the rising cost of fossil fuels are causing many concerns about energy security. It is widely

assumed that by reducing demand for petrol, energy fuels would be more secure and expanding markets for biofuels would help boost biofuel crops, which could benefit farmers, and increase the number of hungry people. However, these assumptions are debatable and more studies are required to assess the potential contribution of biofuel to energy security.

Environmental concerns

A considerable debate exists over the magnitudes of different GHG emissions from biofuels; however, the intensive cultivation of energy crops is expected to produce adverse environmental impacts on soil and groundwater, and to result in deforestation and loss of biodiversity. Local, national and regional agricultural regulations will have to take into account trade-offs between the need for promoting higher yields and the need for environmental and biodiversity conservation.

Some practices with known negative effects include:

• Removal of crop residues, such as leaves and stalks for use in co-generation, can negatively affect soil structure, promote erosion and reduce ecosystem sustainability.

• Heavy extraction of water for the irrigation

of feedstock crops could affect water availability, particularly in water stressed regions.

• In Southeast Asia, oil palm plantations for biodiesel production have caused deforestation and biodiversity losses.

Trade-related concerns

As first generation biofuels are rapidly economi-

cally competitive with petroleum fuels, their pro-
duction is promoted through a complex set of subsidies, regulations, trade restrictions and tariffs to reduce its cost. Liberalization of biofuel trade through the reduction of trade restrict-
dions and changes in the trade classification of biofuels would promote more effec-
tive allocation of production for the benefit of consumers in some countries.

International trade in biofuels and biofuel feed-

stocks increased rapidly and is expected to increase further through the demand for vegetable oil, under pressure from the EU biofuels mandate, has led to a rapid increase in vegetable oil prices with negative impacts on biofuel costs and food prices.

Food security concerns

With every one percent increase in the cost of food today, 16 million people are made food insecure.

Food insecurity arises when people do not have physical and economic access to sufficient safe, nutritious, and culturally acceptable food to meet their dietary needs. Food security is one of the major concerns surrounding the use of biofuels. Biofuel feedstock production com-

petes with food, fiber and land for water and fertilizers.

There are concerns that this competition could affect food security, as food crops may be used as fuel and agricultural land may be used for feedstock production. At risk are the approxi-
mainly 70% of the world’s poor people that live in rural areas, many of whom depend on agriculture for their livelihood. Over 2.7 billion people live on less than US$2 per day and increasing food prices will in all likelihood increase their food insecurity.

The increasing demand for biofuels is likely to increase the cost of land, labor, and agricultural inputs. For example, demand for feedstock crops such as maize and sugarcane has contributed significantly to global food price volatility, especially in grain markets.

Other factors contributing to a growing demand for grains are increasing incomes in some developing countries, which are shifting preferences from staple crops to meat and dairy; climate change and its impact on crop productivity; a weak dollar and speculation. These changes have led to pressures on global agricultural markets and food costs. AKST could play a critical role in improving the benefits of bioenergy and reducing potential risks and costs.

Recent trends suggest that food and energy markets are likely to be more strongly linked in the future, such that fluctuations in the prices of energy could lead to corresponding changes in food prices.

Policy Considerations

It is still controversial whether biofuels, particularly first generation biofuels, deliver net GHG benefits. Policies concerning biofuel production will need to require that feedstock production practices do not create net additional emissions of GHGs directly, or indirectly through land use change, i.e., that they do not displace arable land into natural ecosystems. Additional research is needed on the lifecycle of greenhouse gas emissions of different biofuel feedstocks and technologies is required.

It is important that national bioenergy strategies focus not only on energy opportunities, but are based on a comprehensive assessment of the effects on food security and the social and environmental benefits of bioenergy and its costs, such as increasing food prices, deforestation and competition for land and water.

A long history of policy failures and locally produced equipment that does not always perform optimally, have led to considerable skepticism among bioenergy stakeholders in many countries. The development of product standards, as well as demonstration projects and better knowledge dissemination, can increase market transparency and improve consumer confidence.

Institutional arrangements and power relationships strongly affect the ability of different stakeholders to participate in bioenergy production and consumption, as well as the distribution of the costs and benefits of these technologies. The poor are expected to experience significant disadvantages from current trends in biofuel policies. The weaknesses in institutionally linking the various sectors involved in food and energy production will have to be overcome through regulatory frameworks with policies addressing social and environmental sustainability.

The growth in bioenergy production has resulted, in part, from the expansion in global energy markets and food costs. AKST could play a critical role in improving the benefits of bioenergy and reducing potential risks and costs.

Recent trends suggest that food and energy markets are likely to be more strongly linked in the future, such that fluctuations in the prices of energy could lead to corresponding changes in food prices.

Policy Considerations

It is still controversial whether biofuels, particularly first generation biofuels, deliver net GHG benefits. Policies concerning biofuel production will need to require that feedstock production practices do not create net additional emissions of GHGs directly, or indirectly through land use change, i.e., that they do not displace arable land into natural ecosystems. Additional research is needed on the lifecycle of greenhouse gas emissions of different biofuel feedstocks and technologies is required.

It is important that national bioenergy strategies focus not only on energy opportunities, but are based on a comprehensive assessment of the effects on food security and the social and environmental benefits of bioenergy and its costs, such as increasing food prices, deforestation and competition for land and water.

A long history of policy failures and locally produced equipment that does not always perform optimally, have led to considerable skepticism among bioenergy stakeholders in many countries. The development of product standards, as well as demonstration projects and better knowledge dissemination, can increase market transparency and improve consumer confidence.

Institutional arrangements and power relationships strongly affect the ability of different stakeholders to participate in bioenergy production and consumption, as well as the distribution of the costs and benefits of these technologies. The poor are expected to experience significant disadvantages from current trends in biofuel policies. The weaknesses in institutionally linking the various sectors involved in food and energy production will have to be overcome through regulatory frameworks with policies addressing social and environmental sustainability.

The growth in bioenergy production has been stimulated mostly by biofuel subsidies, fuel blending mandates, national interest in energy security, climate change mitigation and renewable development programs. However, bioenergy has also triggered controversy. This attention is related to the soaring prices for grains, which have resulted, in part, from the expansion in global biofuels at the expense of food production. The underlying causes of the most recent increases in food prices are complex and include factors such as increased demand from rapidly growing populations, and melting glaciers. These impacts may result in harmful effects on important livelihood sectors such as agriculture, as well as adverse effects on human health and ecosystems—effects that seriously diminish food security and hinder poverty alleviation. In fact, climate change, combined with other socioeconomic stresses, could alter the regional distribution of hunger and malnutrition, with large negative effects, especially in sub-Saharan Africa.

The Bioenergy Option

Given the crucial small-scale farmers are to efforts to decrease hunger and poverty and improve health and nutrition, it is important to identify options that promote sustainable livelihoods for small-scale producers and contribute to environmental sustainability, increased energy security, reversing deforestation, and developing and using cleaner, sustainable energy sources. Effective action on climate change. Bioenergy has emerged as an alternative to fossil fuels and is being promoted as a cleaner source of energy.

For more information on IAASD, please see www.agassessment.org. To order go to www.islandpress.org/iaa
mainly 70% of the world’s poor people that live in rural areas, many of whom depend on agriculture for their livelihoods. Over 2.7 billion people live on less than US$2 per day and increasing food prices will in all likelihood increase their food insecurity.

The increasing demand for biofuels is likely to increase the cost of land, labor, and agricultural inputs. For example, demand for feedstock crops such as maize and sugarcane has contributed significantly to global food price volatility, especially in grain markets.

Other factors contributing to a growing demand for grains are increasing incomes in some developing countries, which are shifting preferences from staple crops to meat and dairy; climate change and its impact on crop productivity; a weak dollar and speculation. These changes have led to pressures on global agricultural markets and food costs. AKST could play a critical role in improving the benefits of bioenergy and reducing potential risks and costs.

Recent trends suggest that food and energy markets are likely to be more strongly linked in the future, such that fluctuations in the prices of one could lead to corresponding changes in food prices.

Policy Considerations
It is still controversial whether biofuels, particularly first generation biofuels, deliver net GHG benefits. Policies concerning biofuel production will need to require that feedstock production practices do not create net additional emissions of GHGs directly, or indirectly through land use change, i.e., that they do not displace arable land into natural ecosystems. Additional research is needed on the lifecycle of greenhouse gas emissions of different biofuel feedstocks and technologies is required.

It is important that national bioenergy strategies focus not only on energy opportunities, but are based on a comprehensive assessment of the effects on food security and the social and environmental benefits of bioenergy and its feedstocks, such as increasing food prices, deforestation and competition for land and water.

A long history of policy failures and locally produced equipment that does not always perform optimally, have led to considerable skepticism about bioenergy in many countries. The development of product standards, as well as demonstration projects and better knowledge dissemination, can increase market transparency and improve consumer confidence.

Institutional arrangements and power relationships strongly affect the ability of different stakeholders to participate in bioenergy production and consumption, as well as the distribution of the costs and benefits of these technologies. The poor are expected to experience significant disadvantages from current trends in biofuel policies. The weaknesses in institutional linkages between the various sectors involved in food and energy production will have to be overcome through regulatory frameworks with effective multi-stakeholder participation, promotion of equitable and environmental social monitoring and evaluation. An integrated approach is important to ensure policies addressing alternative renewable energy, energy efficiency, agriculture, rural development, sustainable water and land use and management.

The International Assessment of Agrotural Knowledge, Science and Technology for Development (IAASTD) provides information on how agricultural knowledge, science and technology can be used to reduce hunger and poverty, improve rural livelihoods and human health, and facilitate equitable environmental, socially and economically sustainable development. The full set of IAASTD reports includes a Global and five sub-Global reports and their respective summaries for Decision Makers as well as a Synthesis Report, including an Executive Summary. The reports were accepted at an inter-governmental plenary in Johannesburg in April 2008.

The assessment was sponsored by the United Nations, the World Bank and the Global Environment Facility (GEF). Five UN agencies were involved: the Food and Agriculture Organization (FAO), the UN Development Programme (UNDP), the UN Educational, Scientific and Cultural Organization (UNESCO) and the World Health Organization (WHO).

IAASTD Issues Briefs are taken directly from the IAASTD Reports published in 2008 by Island Press.

Bioenergy and Biofuels: Opportunities and Constraints

The Earth is warming due to the accumulation of greenhouse gases (GHGs) from the intensive use of fossil fuels and other natural resources. GHGs include carbon dioxide (CO₂), methane, nitrogen oxides, water vapor, ozone and others, but the most important include anthropogenic greenhouse gases. These GHGs are trapping heat over the Earth’s surface, resulting in changes in temperature and other climatic processes.

The Intergovernmental Panel on Climate Change (IPCC) has concluded that “warming of the climate system is now unequivocal” and that “most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations.” Observed impacts include increasing frequency and intensity of extreme climatic events, such as more destructive floods, severe and sustained droughts and melting glaciers. These impacts may result in harmful effects on important livelihood sectors such as agriculture, as well as adverse effects on human health and ecosystems—effects that seriously diminish food security and hinder poverty alleviation. In fact, climate change, combined with other socioeconomic stresses, could alter the regional distribution of hunger and malnutrition, with large negative effects, especially in sub-Saharan Africa.

The Bioenergy Option
Given the crucial small-scale farmers are to efforts to decrease hunger and poverty and improve health and nutrition, it is important to identify options that promote sustainable livelihoods for small-scale producers and contribute to environmental sustainability. Increasing food efficiency, reducing deforestation, and developing and using cleaner, sustainable energy sources are key approaches to addressing climate change. Bioenergy has emerged as an alternative to fossil fuels and is being promoted as a cleaner source of energy.

The growth in bioenergy production has been stimulated mostly by biofuel subsidies, fuel blending mandates, national interest in energy security, climate change mitigation and rural development programs. However, bioenergy has also triggered controversy. This attention has resulted, in part, from the expansion in global biofuels at the expense of food production. The underlying causes of the most recent increases in food prices are complex and include factors such as increased demand from rapidly growing economies (especially China), poor harvests due to an increasingly variable climate (e.g., the Australian drought), the use of food crops for bioenergylife and malnutrition. It is important to identify options that promote sustainable livelihoods for small-scale producers and contribute to environmental sustainability. Increasing food efficiency, reducing deforestation, and developing and using cleaner, sustainable energy sources are key approaches to addressing climate change. Bioenergy has emerged as an alternative to fossil fuels and is being promoted as a cleaner source of energy.

The growth in bioenergy production has been stimulated mostly by biofuel subsidies, fuel blending mandates, national interest in energy security, climate change mitigation and rural development programs. However, bioenergy has also triggered controversy. This attention has resulted, in part, from the expansion in global biofuels at the expense of food production. The underlying causes of the most recent increases in food prices are complex and include factors such as increased demand from rapidly growing economies (especially China), poor harvests due to an increasingly variable climate (e.g., the Australian drought), the use of food crops for bioenergy.