

**International Research Center  
for Energy and Economic  
Development**

**Occasional Papers:  
Number Forty-Three**

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**Biofuels in Africa:  
A Pathway to Development**

**By**

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## **Biofuels in Africa: A Pathway to Development?**

This paper investigates biofuels pathways and the potential outcomes of biofuels development for energy security and poverty alleviation in Africa. It also examines various options for biofuels development and its potential roles to improve or undermine the livelihoods of rural communities.

The economy of Africa is dominated by low-input and low-output small-scale rain-fed agriculture.<sup>1</sup> Increases in African agriculture production depend mainly on extensive use of land by bringing more under cultivation, not on increased labor and land productivity. Because of this dependence, rain-fed agriculture is especially vulnerable to climate variations, making many African countries susceptible to the changing drought patterns that will lead to food insecurity.

Most African nations depend on the export of primary agricultural and mineral commodities to earn foreign exchange to cover the costs for all their imports. Fossil fuels are imported by many non-oil-exporting African countries to provide energy to the modern sector, particularly transportation.

Access to reliable and cheap energy sources is one of the leading challenges facing economic development in Africa. Various sources of biomass, including wood and dung, are the dominant and cheap sources of energy for the majority of Africans, especially those in the rural areas. Energy for urban areas and for transportation depends primarily on imported fossil fuels.

African countries face increasing dependency on imported oil that negatively affects economic growth and employment. Expenditures toward energy imports have been increasing in Africa due to high oil prices. It is estimated that Sub-Saharan Africa spends 20 to 30 percent of its export earnings to pay for petroleum, although Africa has the lowest per-capita energy consumption in the world. For example, Tanzania's import of petroleum products has reached about 40 percent of its total imports.<sup>2</sup> Ethiopia now spends over U.S. \$1 billion annually to import oil, equivalent to 87 percent of its export earnings. According to some observers, the oil crisis in Africa is "unfolding a catastrophe that could set back efforts to reduce poverty and promote economic development."<sup>3</sup>

The record increase in the price of oil in 2007-2008 and a fear of peak oil have been important driving forces in the rapid acceptance of biofuels as an alternative energy source. Policy makers in Africa share the global consensus for a transition from fossil fuels to

renewable energy sources, such as biofuels.<sup>4</sup>

African policy makers at all levels are creating a favorable investment environment to attract foreign and local biofuels entrepreneurs. They are developing international partnerships with countries, such as Brazil and India, and with the European Union (EU), to transfer biofuels technology to Africa. If properly managed, these technologies can enhance the continent's energy and economic development that is dominated by rural livelihoods. However, if care is not taken in the implementation of biofuels, unintended social, economic, and environmental consequences may occur.

### **What Are Biofuels?**

Biofuels are defined as “fuels that can be produced from agricultural and forest products or the biodegradable portion of industrial and municipal waste.”<sup>5</sup> The major sources of energy in rural Africa are biofuels such as wood and dung. Liquid biofuels from grains and oil beans have been used to power engines for transportation since the early 20th century. In fact, Rudolph Diesel ran his engine with peanut oil and Henry Ford ran his first car on grain alcohol.<sup>6</sup> The availability of cheap fossil fuels, however, discouraged the use of biofuels, except during war-time shortages.

The two most common types of liquid biofuels are ethanol and biodiesel. Ethanol is derived from corn, sorghum, sugar cane, sugar beet, or cassava by adding yeast to ferment sugars into alcohol. Biodiesel is produced by processing grapeseed, algae, soy, castor, palm oil, jatrophia, and other oil beans. Biodiesel can be used either as an additive to other fuels or alone to power diesel engines. Second generation biofuels are produced through biomass to liquid conversion technology, such as a “gasification-to-liquid” process. These second generation biofuels have not been commercialized extensively due to high costs and current technical constraints.

### **Current Global Interest in Liquid Biofuels**

Industrialized nations have been developing biofuels for transportation by providing subsidies for research and development as well as for production. Other favorable government policies such as tax incentives have led to rapid expansion in the biofuels industry in a relatively short time.

The U.S. Congress, for instance, has mandated that “7.5 billion gallons (28 billion liters) of the nation's fuel come from ethanol or biodiesel by 2012.”<sup>7</sup> In fact, both the United States and the EU plan to double their respective ethanol and biodiesel consumption by

2016.<sup>8</sup> Furthermore, Japan has plans to reduce dependence on fossil fuels for transportation by 80 percent by 2032 through investments in biofuels.<sup>9</sup> Brazil, a pioneer in biofuels, is expected to triple its ethanol output to 30 million to 38 million liters per year by 2013.<sup>10</sup> Compellingly, estimates indicate that Brazil's "ethanol production [created] an estimated one million jobs and reduced the cost of oil imports by \$43.5 billion between 1976 and 2000."<sup>11</sup> Finally, India has committed to planting 14 million hectares of land with jatrophia and hopes to replace 20 percent of its diesel consumption by 2012.<sup>12</sup>

Although biofuels production is new to Africa, many companies are interested in investing in the continent. Industrialized nations, especially those constrained by land available for development (e.g., European countries and Japan), are eyeing Africa for the cultivation of biofuels. The EU, Israel, Brazil, India, and China have expressed serious interest in the development of the biofuels industry in Africa, through both direct private investments and transfers of technology. Several companies from Germany, Israel, India, and the United States already have signed investment agreements with several African countries and acquired land for biofuels production. According to the Ethiopian Investment Agency, more than 30 companies and state-owned sugar factories currently are registered to produce biofuels and five have already become operational.<sup>13</sup> Brazil, which plans to establish a "Biofuel town" in Nigeria "to kick start a biofuels revolution in the continent," also has links with Mozambique, Senegal, Nigeria, Angola, and the African Union.

While interest in biofuels production in Africa is growing rapidly, all parts of the world, excepting Latin America (excluding Brazil) and Antarctica, produce more biofuels annually than Africa, which indicates the infancy of the industry on the continent.<sup>15</sup>

### **African Biofuels Strategies**

Many African policy makers believe that developing liquid biofuels can transform Africa's traditional dependence on biomass energy sources, i.e., wood and dung. They believe that, unlike these traditional rural energy resources, liquid biofuels will decrease deforestation and environmental degradation. In addition to these "green" considerations, the main drivers favoring biofuel production in Africa are the high prices of fossil fuels, the need for energy security, foreign direct investment, and foreign exchange.

*Biofuels development will create opportunities for biomass providers, biofuel producers and the automotive industry. Also, the European technology will be used in 2030 in many countries in Europe.<sup>16</sup>*

Many leaders believe that biofuels will make Africa strategically important because of its abundant land and favorable climate for biofuels production. Because of its tropical climate, Africa can grow crops such as sugar cane, castor, and jatrophia that have higher fuel contents than those feedstocks cultivated in temperate zones for biofuels production.<sup>17</sup> Many argue, for instance, that because sugar cane produces more than twice the ethanol per acre as corn, it will be cheaper to produce and have little impact on future food output and demands.<sup>18</sup>

In 2006, several countries formed the Pan-African Non-Petroleum Producers Association (PANPP)—the so-called “Green OPEC”—to exchange information, share knowledge, and cooperate on the development of biofuels in Africa. Reportedly, 15 of the 25 African countries participating in the African biofuels conference in Dakar signed the Green OPEC founding treaty, which also has been endorsed by the African Union.<sup>19</sup>

*Considering the rising and volatile price of oil, ongoing efforts to revitalize the agricultural sector in the face of low commodity prices, agricultural and trade policy reforms, local and global environmental challenges, the need to create new jobs and stimulate rural development, availability of new and more efficient technologies, and increased access to information, biofuels development in Africa has become a high priority.<sup>20</sup>*

The African Union (AU) has endorsed biofuels as an integral part of the sustainable energy strategy for the continent, believing that biofuels development is one of the most dynamic and rapidly changing energy sub-sectors in the world.<sup>21</sup> Moreover, it has called for the development of an enabling policy and regulatory frameworks and guidelines to develop biofuels in Africa. The AU’s strong interest in biofuels development goes beyond promoting economic growth; the Union believes that biofuels will contribute to the eradication of poverty in the continent. It has called for the development of biofuels in order to minimize risks for small-scale farmers, encouraging individual African countries to design their national biofuels strategies based on their natural endowments, land tenures, and socioeconomic needs.

*“Our continent should have as its vocation to become the primary world supplier of biofuels,” ... “This step to development clean energy is all the more pertinent because it calls for immense areas of cultivable land, where Africa benefits from a clear advantage,” Senegalese President Abdoulaye Wade.<sup>22</sup>*

Furthermore, many African nations are creating national forums to promote and guide biofuels development. A number of governments are providing tax holidays and other incentives to investors, encouraging them to create hundreds of thousands of hectares of biofuels farms. The main assumption in the end is that there is plenty of idle land in Africa—and that the land can be used for biofuels.

#### **African Strategies and Biofuels Feedstocks**

Some argue that African countries, like Brazil, can benefit by making biofuels an important sector of their economies;<sup>23</sup> however, numerous African biofuel policy papers have been explicit about the choice of feedstocks, assuming cautionary tones that underscore the fear that biofuels could undermine the livelihoods of farmers and pastoralists and especially jeopardize their food security.<sup>24</sup> The South African biofuels strategy, for example, bans the use of corn for ethanol production in order to reduce food insecurity in the region.

*The main concern regarding food security revolves around the use of maize for ethanol production. It is for this reason that it has been proposed that maize for the production of bioethanol should be excluded in the initial phases of the strategy implementation.<sup>25</sup>*

The most important feedstocks identified in Africa for ethanol production are sugar cane, sweet sorghum, and cassava. Nigeria is exploring the use of sweet sorghum cane to produce ethanol, using the grains themselves for food.<sup>26</sup> Additionally, many African nations are considering the production of biodiesel from jatrophia, castor, and palm oil. Jatrophia is considered by many as the most promising for biodiesel production because it can grow on marginal lands in numerous soil types and climate zones and thus would have negligible impacts on food production and the environment. Notably, research indicates that the perennial jatrophia, which has a life span of over 20 years, could prove appropriate for marginal areas, while castor could be intermingled with seasonal food

crops.<sup>27</sup>

What must be remembered is that African biofuel strategies differ across the continent both in terms of scale and diversity of feedstocks cultivated. Even though nations' strategies have similar objectives for achieving local sources of renewable energy and reducing poverty, each is being realized in different ways and, therefore, will have different economic and social development outcomes related to energy. Dictated by differing levels of available technology and skills, each state values certain links, such as seed production, oil processing, and biodiesel production, along the chain of biofuels processing.<sup>28</sup>

Several African countries that already had developed sugar cane plantation systems, for example, are planning to produce ethanol from the cane by bringing more land under plantation agriculture. Ethiopia, Kenya, Mozambique, Namibia, South Africa and Uganda are all developing such plans, and Congo, Zimbabwe, and Swaziland already have exported small amounts of ethanol to the EU. In Mali, on the other hand, the strategy is to grow jatrophia to process biodiesel. Unlike in some centralized models, however, the jatrophia is planted by small farmers specifically to provide affordable, decentralized energy services.

### **The Reality, risks and opportunities of Biofuels Development**

Based on current trends, three biofuels development strategies are emerging: (1) biofuels production on large plantations directly linked and managed by biofuels refineries; (2) contract plantations of biofuels crops by small farmers for sale to biofuels refineries; and (3) biofuels crops grown side by side with food crops by small farmers and processed at the local village level.

*The first strategy* (large-scale plantations) creates a vertically integrated production chain that bypasses traditional African farmers. This large commercial farming system is contrary to the historical role played by smallholder African farmers (except in the settler colonies) who have produced coffee, cocoa, sisal, and other agricultural products for export for generations.

By analogy, this large-scale biofuels plantation strategy follows in the footsteps of the fledgling African flower plantations that produce cut flowers for export and has been dominated by modern urban and foreign entrepreneurs.

One of the potentially disconcerting consequences of large-scale biofuels farms is that displaced and impoverished farmers and herders could lose their land. About "30 percent of the land in Africa is jointly held by members of a group or community,"<sup>29</sup> and

the lack of constitutionally guaranteed and legally registered community land deeds makes many communities vulnerable to land alienation with the introduction of new farming systems as large biofuels estates. Furthermore, most of these plantations are being created with few land-use or environmental impact assessments. Indeed, there are no indications that either herders or farmers whose lands are being used for biofuels plantations will benefit from them.

*The second biofuels production strategy*, now being considered in African countries like Kenya and Ethiopia, allows farmers to cultivate biofuels crops by entering into contractual supply agreements with refineries. This strategy might benefit farmers who produce feedstocks for biofuels, especially in marginal areas where traditional export crops such as coffee and cocoa are absent.

Yet, without government oversight and insurance mechanisms to protect incomes, farmers become vulnerable to uncertainties in or failures of biofuels markets as well as to the unscrupulous actions of investors, both domestic and foreign. If biofuels companies go bankrupt, it is a recoverable business failure, but farmers who enter into such contracts might be confronted by severe food shortages or even famine and the complete loss of their livelihoods.

*The third strategy* in biofuels production involves the cultivation of biofuels crops by small farmers to be processed at the local level for their own use. The addition of new cash crops as biofuels feedstocks to small farmers' crop rotations provides an opportunity to increase income and reduce poverty. Such a practice also provides people with new farming and processing skills, that is, biofuels production becomes a village cottage industry. Such an approach works within the framework of local needs without disrupting the local ecology, and farmers are not alienated from their land or forced to wait until the benefits of biofuels trickle down to their level. The only fear of this approach is that if it proves very profitable, farmers might shift more and more cultivation away from food production to biofuels.

As noted above, local-level and small-scale biofuels production is being practiced in Mali as a pilot project based on jatrophia cultivation. Jatrophia is traditionally used in Mali to make soap. Now, biodiesel produced from jatrophia nuts fuels engines that power affordable household energy and irrigation needs.<sup>30</sup> This project has increased women's annual income and freed up several hours of their daily time, and girls are receiving higher levels of schooling. The project has stimulated micro-level business activities for village men in blacksmithing, carpentry, and mechanics.<sup>31</sup> Such a decentralized, smallholder-focused, people-oriented policy

has the possibility of benefiting the agricultural sector and raising rural incomes and energy security.<sup>32</sup> If smallholders are given the opportunity to produce biofuels, they still would need inputs and extension support in the planting and processing of biofuels. Ideally, farmers would grow and locally process the biofuels for their own consumption and for sale when surpluses are available.

Unfortunately, the dominant trend of biofuels development in many African countries is toward large plantation systems. Even though different nations' biofuel policies contend that small farmers are the main beneficiaries and serve as an opportunity to transition from dependence on traditional biomass fuels, how these benefits will be realized in practice remains unclear. Capital-intensive large biofuels farms are vulnerable as well to collapse due to global demand and price fluctuations.

*In Ethiopia the gross available potential land for production of feedstock for biodiesel is estimated about 23,305,890 hectares and the total irrigable land for sugarcane production for ethanol production is about 700,000 hectares. Thus, Ethiopia has a potential to produce one billion liters of ethanol within available suitable land. Alemayhu Tegenu, Ministry of Mines and Energy, Ethiopia.<sup>33</sup>*

### **Expected Benefits of Biofuels Development in Africa**

The three biofuels strategies in Africa reflect the development challenges and priorities of each country. Many policy makers believe that there will be benefits from biofuels, when they finally are fully developed. The motivations for biofuels development in the non-oil-exporting African countries are to reduce dependency on imported oil, to diversify energy sources, to increase rural access to locally available energy and income, and to develop new markets for agricultural commodities. African leaders also believe that the export of liquid biofuels by their nations will reduce the wealth transfer to imported fossil fuel and balance existing unequal terms of trade and price fluctuations in each country's traditional export crops. But, as the recent investment in ethanol in the United States has shown, biofuels industry development is still in a state of flux that can lead from boom to bust with significant consequences.

Many observers further believe that Africa will benefit from the biofuels trade boom that is expected to result from the mandated use of biofuels in developed countries. Some hold that if the production of global biofuels is raised above 15 percent of fossil fuel demand,

the volume and value of the global biofuels market could double or triple, leading to the elimination of farm subsidies to the benefit of African farmers.<sup>34</sup> Clearly, African governments are interested in securing a share of global investment in biofuels and in diversifying the commodity base of their exports by adding biofuels.

Moreover, many consider biofuels as an opportunity to revitalize the agricultural sector and increase rural income. Trade in biofuels might create opportunities for poor farmers to diversify their crops, to improve their income, and to redistribute wealth, especially to those in the marginal areas who, for the first time, will grow commodities for export. They assert that biofuels will create new jobs and market opportunities to help African farmers.

There is a high expectation in Africa that biofuels could foster energy independence by reducing oil imports for urban transport. Nigeria, Sudan, Uganda, Ethiopia, and Kenya already have started selling ethanol-added gasoline in response to increasing gasoline prices. It has been asserted that that biofuels will increase access to clean and affordable energy for rural inhabitants. Some countries already have plans to provide tax incentives to import flex fuel vehicles designed to run on gasoline and a blend of up to 85 percent biofuels.<sup>35</sup> This is an important initiative, but the issue of infrastructure capacity might delay the implementation of the plan.

Significantly, the Clean Development Mechanism (CDM) that supports greenhouse-gas-reducing projects following the Kyoto Protocol have not yet supported any biofuels project; however, several nations like Kenya are developing plans to benefit from biofuels through CDMs.<sup>36</sup> Kenya envisages that the Ngima ethanol production project will qualify for 217,000 tons worth of certified carbon credits.<sup>37</sup> As of now, however, African countries are not yet beneficiaries of the CDM in other areas. Some concerns remain, nonetheless, that biofuels cultivation might actually increase the rate of deforestation and increase carbon dioxide concentrations in the atmosphere unless certification mechanisms are developed that quantify the carbon footprint of the biofuels production chain from cultivation to production.

### **Toward Community-Based Biofuels Development**

One concern of biofuels production, especially at a large scale, is its potential to “divert agricultural production away from food crops and drive prices up.”<sup>38</sup> However, there is a potential for biofuels to contribute to rural development if its production and processing is based on smallholders. Farmers can be made the drivers of socially responsible biofuels development by encouraging them to grow

biofuels alongside their food crops. They can process biofuels into biodiesel locally, within their village economies, and replace imported kerosine, which remains the common fuel for home lighting in rural areas. They could even use biodiesel to produce electricity locally and sell surplus oil.

As noted, small in scale and locally sustainable, village-based biofuels development has been undertaken on an experimental basis in Mali through work by nongovernmental organizations and entrepreneurs and with government support. The *New York Times* reports that, unlike those growing feedstocks on huge plantations, the Malian experiment is based on several small-scale projects seeking solutions to village-level energy and income problems.<sup>39</sup> Contrasting sharply with the experience in other African countries, the Malian experiment is designed to benefit small farmers by realizing the micro-economic possibilities of the jatrophia that traditionally was used only to fence off crops and gardens.

Other African countries could learn from this unique and innovative example of the potential of biofuels to provide energy and income security to small farmers. The only fear, again, is that a potential land-use shift to biofuels could undermine food security if farmers find biofuels' production to be significantly more profitable than the production of food crops. Such a threat, however, might be minimized by introducing pro-food production land-use policies that limit biofuels production land ratios. The experience in Mali is, indeed, a "teachable moment," a timely instructive lesson that serves to strengthen the goal of an African energy independence that is equitable and can be characterized as a win-win-win situation to all sectors of society, the environment, and the government.

### **Potential Unintended Consequences of Biofuels**

The law of unintended consequences states that public policies always have effects that are inadvertent or unanticipated.<sup>40</sup> Concerns always exist about the potential impacts of large-scale new technologies on any society. Such new technologies, including the introduction of new crops as biofuels, might be viewed as successes if they are measured only in terms of monetary returns; according to E. W. Russell, the introduction of new crops requires attention to their potential impacts on "related ecological, social and nutritional disorders."<sup>41</sup>

*"In none of these places are the needs of local residents taken into account. In Ghana, BioFuel Africa wrested away land clearing and usage rights from a village chief who could neither read nor write...The weekly newspaper Public Agenda felt reminded of the 'darkest days of colonialism.' ...In Tanzania, while there are hopes, there is also plenty of reason to be skeptical about promises that everything will improve."*<sup>42</sup>

Biofuels feedstocks as new cash crops and their related production systems are being introduced to Africa on a large scale. The success or failure of these introductions has to be measured based on their impacts on society and on ecosystems at all levels, but especially on the livelihoods of the people. As the U.S. ecologist Barry Commoner said, “There is no such thing as a free lunch.”<sup>43</sup> In other words, biofuel investors may see empty lands in Africa awaiting biofuels development, but they must realize that there are no such things as truly empty lands; everything has to come at the expense of communities or environmental resources. For good reasons, some African scientists are petitioning for a moratorium on new biofuels projects.<sup>44</sup> They question the official strategies and state that biofuels development in Africa functions under the rules that mainly benefit the energy needs and strategies of the industrialized countries.<sup>45</sup>

As shown earlier, the introduction of large-scale biofuels in Africa denies sustainable benefits to smallholders. The plans of policy makers that push for biofuels development are not clear as to how they will implement their stated goals of transforming the energy needs of rural people. Actually, if current investment trends continue, the beneficiaries of biofuels in Africa primarily will be those who use urban transportation. The dominant strategy of large-scale biofuel production will have unintended consequences including, but not limited to, the following.

### **Biofuels Land-Use Changes**

Based on current knowledge, biofuels production is land intensive, and this makes Africa one of the attractive regions to grow feedstock. Some observers estimate that almost 400 million hectares of land are available for biofuels in 15 African countries,<sup>46</sup> a figure that supports earlier colonial assumptions “free” (e.g., empty) land exists in Africa, which is still prevalent in many quarters. Importantly, this assumption, based on neoliberal economic assumptions of ownership and privatization, is likely not true, as much land in Africa is communal with no traditional private rights or registrations.

The high level of interest in use of land in tropical countries for biofuels production is manifested in the rush by private investors in

Africa to “grab” fertile land, a land acquisition unseen since the days of colonialism. A number of companies from Europe and Asia are now scouting to acquire land in Africa.<sup>47</sup> In fact, African environmentalists claim that African “governments are handing over huge tracts of fertile land to private companies aiming to convert biomass grown on large plantations into liquid fuels for export markets and not necessarily for domestic consumption.”<sup>48</sup>

Some of the potential unintended consequences of land transfers for biofuels include landlessness, environmental degradation, conflicts, increased rural poverty, increased malnutrition and hunger, and decreased biodiversity. Contrary to official pronouncements, fears are mounting that biofuels will shift land use away from sorely needed enhancements in food production and that this shift would increase the vulnerability of farmers and herders to the vagaries of climate. African policy makers must address this issue of land-use changes and how it might affect the livelihoods of households and communities—and they must introduce safeguards to protect their most vulnerable constituents.

### **Biofuels and Food Security**

Food supply in many African nations depends on imports and the extensive use of land to grow food and raise herd animals. Being a food-deficit continent, the use of food crops to produce biofuels is unacceptable ethically; and, in democratic societies public opinion strongly opposes such prioritizing of land use.

Indeed, when African policy makers shift their attention away from solving food insecurity in order to produce biofuels, an opportunity cost is incurred. Arguably, if African leaders were to give food production half the attention they are giving to biofuels development, Africa might become food secure. Biofuels shift land use, water use, and human and capital resources away from food production. There is a need for a secure land tenure system in Africa so that farmers do not become landless peasants as a result of biofuels expansion. Unfortunately, this already has happened in some parts of Africa and South America.<sup>49</sup>

The shift in the use of corn from human consumption to biofuels consumption in the United States and the subsequent agro-inflation at a global level are lessons to be learned on the impact of biofuels on food security.<sup>50</sup> For example, the planned production of ethanol from cassava in some African countries could lead to local food shortages.<sup>51</sup> It was for fear of this outcome, that the South African government development strategy specifically banned corn as a feedstock for ethanol.<sup>52</sup>

Land is communally owned in many African countries, which makes it easier for African governments to transfer land away from its users. Just as the establishment of national parks pushed many nomadic peoples from their traditional grazing lands, extensive acquisition of land for biofuels development similarly might lead to domestic displacements and food shortages, especially in rural areas.

African policy makers have not yet made a convincing argument that biofuels will not contribute to food insecurity in the continent. Before moving forward with development plans, they must devise methodologies that assess the impacts of large-scale biofuels production on food production, especially in relation to the transfer of land from its traditional uses.

### **Biofuels and Rural Poverty**

Nearly all African governments state that one of the objectives of moving toward biofuel production is to reduce rural poverty and contribute to rural access to affordable and clean energy. The development of biofuels in Africa thus far, however, is following the urban-biased development paradigm inherited from colonialism, a paradigm that expects economic benefits to trickle down to the rural poor. Many rural communities are losing their valuable biological resources—their farms, forests, and pasturelands to make way for biofuels plantations—but they are not receiving any substantial nor sustainable benefits.

Most of the cultivation of biofuels is based on large-scale plantations that historically have been rare in African farming systems. Such large-scale developments have generated great uncertainty in how biofuels will actually contribute to rural prosperity. If these trends continue, in fact, biofuels production might lead to increased rural poverty as small farmers increasingly lose their pasture land and forests to investors.

Theoretically, the assertion that adoption of biofuels will increase rural income is reasonable. In reality, however, the benefits of biofuels may very well bypass small holders and pastoralists unless their interests are specifically protected.

If African policy makers are serious about increasing the income of the rural poor, they must stem the current trend that focuses on developing large plantations. Policy makers must craft a framework whereby biofuels-processing technologies can be accessed by villages to supply their energy needs and to sell any surplus to increase their incomes.

The government also has to protect farmers who provide feedstocks through long-term contracts with biofuels refineries so

they do not fall into poverty from the malicious actions of firms or because of unforeseen bankruptcies. One policy that could protect farmers is an insurance mechanism that provides some protections from failures associated with biofuels companies.

### **Biofuels and the Environment**

One of the potential implications of biofuel development is its impacts on the environment. In Africa, where populations are already water stressed, new demands for water for irrigation and refining would have unanticipated consequences, especially because biofuels production is very land and water intensive. Furthermore, the cultivation of feedstocks such as jatrophia in marginal areas could adversely affect the livelihoods of pastoral peoples. Nomads, for example, are typically socially autonomous and often politically disenfranchised. They usually are not consulted when the state and other actors use their community resources (e.g., land and water) for “development activities” that bypass their interests.

Even though there has been some progress, the environmental impact assessment (EIA) of development projects is weak in many African countries. Numerous observers believe that the “lack of coherent legal frameworks and guidelines” and a “low level of public awareness of environmental concerns, and limited expertise have compromised EIA quality in Africa.”<sup>53</sup> Weak or non-existent EIAs of biofuels projects in particular have led environmentalists in Africa to question the unbridled promotion of biofuels. They cite threats to wildlife habitats and the possible negative impacts on the livelihoods of small farmers and herders.

In many African nations, environmental impacts assessments for biofuels are voluntary, though related environmental and social impact assessments sometimes are mandated by funding agencies such as the World Bank. Some observers also fear the impacts of chemical pollution on populations and an interference with ecosystem functioning, such as the cultivation of wetlands. Some countries are acting, however. In Kenya, for example, a court recently temporarily blocked a biofuels sugar cane development project because of environmental concerns.<sup>54</sup> In Ethiopia, the Environmental Protection Agency intervened to solve a conflict between a biofuels farm that wanted to expand and the environmentalists who wanted to stop it from encroaching into an elephant sanctuary in the eastern part of the country.<sup>55</sup> Controversies have arisen in Uganda because of plans to clear the Mabira Forest Reserve to grow sugar cane for biofuels production.<sup>56</sup>

These examples illustrate how governments must identify the

potential impacts of biofuels development on flora and fauna before awarding huge tracks of land for development. The Africa Biodiversity Network warns the continent can learn from the Indonesian and Malaysian experiences where palm oil plantations for biodiesel led to massive deforestation.<sup>57</sup> The Network fears that Africa's biodiversity will be destroyed by the trend toward monocropping to expand the best feedstocks for biofuels.<sup>58</sup>

Even though there is shortage of local expertise to undertake environmental impact assessments, a need for occasional audits of verbal and written commitments help to assure social and environmental justice. This achievable step could help control the potentially negative impacts of biofuels on the environment.

### **Biofuels and Social Conflict**

Development projects that depend on the use of a limited supply of natural resources often have their own unintended social consequences. There are many resource-based conflicts in Africa, especially over resources in short supply like water and pasture. The development of biofuels with the intention of resolving urban energy problems actually might lead to increased or new conflict between groups vying for limited lands and resources. In such conflicts, many herders will lose their ancestral grazing areas without compensation, which will lead to increased vulnerability to climate variability and to an increased probability of conflict. Large-scale biofuels plantations that do not protect the interest of the rural inhabitants might lead to rural-to-urban migration, which could feed unrest and conflicts.

Indeed, large-scale biofuels development could lead to conflicts similar to those that occurred in the post-colonial period when wildlife nature reserves and parks in several African countries were established to promote tourism. Parks often were developed with little local consultation and at the expense of the communities that depended on the land for their survival. Biofuels development has to take historical experiences into account and design frameworks that reduce potential conflicts and benefit local communities.

African policy makers must better identify the strengths and investigate the challenges, opportunities, and weaknesses of biofuels. The measure of their success will be ensuring that the socioeconomic constraints faced by rural people are overcome.

### **Concluding Remarks**

Many observers appreciate the promises made by African policy makers about realizing the potential role of biofuels as renewable energy and the opportunities they present for increasing rural

incomes and reducing poverty. These observers assert that the development of biofuels will not hurt the environment nor jeopardize food security.

In reality, many activities in current strategies undermine the social and environmental equity promises of biofuels development. Others fear that such development could undermine ecological systems and traditional egalitarian land use in many African countries, which could lead to greater vulnerability for the majority of the population.<sup>59</sup>

Even though African policy makers state that biofuels will invigorate the farming sector and improve rural income, the creation of large biofuels commercial farms realistically might lead to increased rural poverty, energy and food insecurity, and landlessness. African decision makers are stating in their policies what ought to be, but the reality is different.

To realize its potential, biofuels investments in Africa need to define objectives clearly and must include environmental and social impacts assessments. African nations need to map and conduct an inventory of land uses before allocating hundreds of thousands of hectares for biofuels cultivation. Furthermore, African leaders should pass laws that provide land tenure security to small farmers and protection of farm and pasture land to avoid illegal land alienation and displacement. Such policies of biomass and land inventories as well as legal protections of the smallholders and herders will safeguard the interest of the farmers while protecting the farmers from unintended consequences.

For biofuels to contribute to economic development and rural revitalization, it must be managed carefully from the perspective of environmental sustainability to include the interests of people whose livelihoods depend on the land. Promisingly, biofuels can be produced locally to satisfy the needs of local communities. Community-based biofuels output has potentially beneficial outcomes both for the environment and for rural populations. Diversifying income sources of rural people also can improve their resilience to climate-related impacts.

African energy policy makers should give attention to all renewable energy sources and not overly focus on biofuels. Focusing only on biofuels, which comprise a new and transitional energy source, might lead to bankruptcy as happened to some U.S. ethanol companies in 2008. With adequate planning, clearly identified development outcomes, and environmental and social impact assessments as well as a commitment to improving the lives of the rural poor, biofuels might become an appropriate opportunity

to pursue in order to revitalize rural economies. Importantly, a biofuels development strategy that favors the poor also requires provisions for small farmers to gain access to markets and training.<sup>60</sup>

If effectively implemented, biofuels (liquid and gas) can transform the dependence of rural communities in Africa on traditional biomass that undermines the quality of land and the environment. Smallholder-based biofuels also can offer new diversification opportunities to farmers who are not involved now in cash crop production. The success of biofuels in Africa should be measured by its ability to transfer technology, develop rural areas, increase rural incomes, and enhance both food and energy security but not to undermine environmental resources. Therefore, African policy makers should implement sustainable small-scale liquid or gas biofuels development within the context of local and national economic, social, environmental, and technological dimensions.

## Notes

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The authors wish to acknowledge Jonathan Adams, Alessandra Giannini, Patti Parisi, Gregory Pierce, and Prof. Tsegaye Wodajo for their comments and ideas. The CCB is supported by the Rockefeller Foundation and is a Clinton Global Initiative commitment.

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