



Potential of Sustainable Biomass Production in Developing Countries

Case Study Kenya

Background

Methods for the establishment of biomass strategies have been elaborated for industrialized countries, while large potential for bioenergy production has been identified in Africa and Latin America due to the immense availability of “idle” areas. An agro-economic survey of Kenya (FAO 2000) estimated the total arable area amounting to 15.8Mha. At present, 4.6Mha are cultivated, leaving a total of 11.2Mha, currently used for grazing, as potential bioenergy crop land. However, no biomass strategy has been elaborated in Eastern Africa so far.

The Kenyan Ministry of Agriculture and GTZ have conducted a detailed case study to analyze the availability of land for sustainable production of different feedstocks taking into account protected areas and food security aspects.

Methodology

- Stakeholder consultation process to assess present industries (Ethanol, Sugar, Plant oil, Biogas)
- Analysis of GIS and remote sensing data for all potential feedstocks according to their ecological requirements (in cooperation with ICRAF):

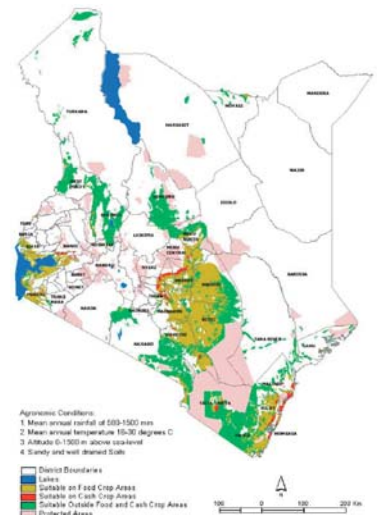
- Ethanol: Cassava, Sugarcane, Sweet Sorghum
- Biodiesel: Castor, Coconut, Cottonseed, Croton, Jatropha, Rapeseed, Sunflower
- GIS suitability mapping excluding present areas for environmental protection, agricultural food and cash crop production.
- 50% reduction of the potential feedstock area to account for land use conflicts, local conservation areas and alternative demands.

Temp (°C)	Alt. (m)	Rainfall (mm)	Maturity Time (mos.)	Soil Types	Rainfed Yield (t/ha/yr)	Ethanol Yield (l/t)
16-30	0-1500	580-1500	6-9	Light sandy loams, medium fertility, well drained.	9.6	160-180

Example of Cassava feedstock analysis:

- Step 1:** Mapping out overall suitability according to ecological requirements
- Step 2:** minus protected areas
- Step 3:** minus food crop areas
- Step 4:** minus cash crop areas
- Step 5:** minus 50% for food security and alternative uses

Cassava Suitability with Food and Cash Crops



Cassava Suitability Areas in Kenya in Hectares

Overall Suitability	Suitability w/o Protected Areas	Suitable w/o Protected & Food Crop Areas	Suitable w/o Protected, Food, Cash Crop Areas
5,161,025	4,150,316	2,191,765	2,082,978

Table: Potential Biofuel Production Scenario (GTZ & Kenyan Ministry of Agriculture 2008)

	Current Land 2006 (Mha)	Average Yield (t/ha)	New Farm Land (Mha)	Pot. Biofuel (ML)
Ethanol				
Cassava	0.069	9.60	2.08	3,395
Sugarcane	0.148	33.4	0.09	30
Sweet Sorghum*	n/a	35.0	5.90	8,260
Biodiesel				
Castor	0.013	0.23	6.82	703
Rapeseed*	n/a	2.00	0.16	125
Sunflower	0.013	0.92	3.48	1,325
Jatropha*	n/a	2.50	6.26	5,258

* Currently underexploited but prospective high potential biofuel feedstock crops

Potential Income from the Promotion of Biofuels

- Ethanol production from **11% of potential Sugarcane** land (10,000ha) plus **1% of potential Sweet Sorghum** land (64,000ha) could offset 93 Million liters or more than 10% of current petrol consumption resulting in 4.28 Billion KES (**66 Million USD**).
- Newly cultivated **50,000ha** of crops for the production of plant oil could produce 32 Million liters or could offset more than **2%** of current diesel consumption and would result in 1.18 Billion KES (**18 Million USD**).

Further Steps for the Introduction of Sustainable Biofuels

- Introduction and implementation of standard and certification schemes to guarantee social and environmental sustainability

- Screening of political framework for the purpose of energetic, agricultural, environmental and financial issues as well as of potential bioenergy markets
- Harmonization of policies to create conducive and enabling environment for biofuels
- Identification of national and international investors accepting sustainable biomass production
- Conduction of local feasibility studies with involvement of potential investors and the local administration and farmers
- Implementation of participatory land use planning and development of outgrower schemes

Sources

- FAO (2000): Land Resource Potential and Constraints at Regional and Country Levels. Rome.
- FAO (2006): The State of Food and Agriculture. Rome.
- GTZ & Kenyan Ministry of Agriculture (2008): A Roadmap for Biofuels in Kenya – Opportunities & Obstacles. Nairobi.

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