

審査の結果の要旨

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Dissertation Title: SUSTAINABILITY ASSESSMENT OF BIOFUEL FEEDSTOCK OPTIONS IN GHANA

Biofuel feedstock production has been promoted across different areas of Sub-Saharan Africa to boost socioeconomic development and energy security. However, biofuel crop production can have important implications for land use change, biodiversity loss, poverty alleviation, livelihoods and food security at the local level.

Ghana was one of the countries that experienced a large expansion of the biofuel crop jatropha between 2008 and 2013. Hundreds of thousands of hectares were allocated throughout the country to large-scale jatropha projects that were mostly foreign-led. By 2013, most of these projects had collapsed having had important environmental and socioeconomic impacts locally. Since then there have been scattered discussions about the future of biofuels in the country either using jatropha or other feedstocks such as sugarcane and oil palm.

To inform such discussions it is important to understand what have been the drivers of the widespread jatropha collapse and the local sustainability impacts of different feedstock options. However, despite some scattered literature, no study has undertaken a comprehensive assessment of the different reasons that led to jatropha collapse around Ghana or elsewhere in sub-Saharan Africa. Furthermore, few studies have adopted a holistic approach for the assessment of the local impacts of biofuel feedstock production across the three pillars of sustainability (environment, social, and economic), in Ghana or other parts of sub-Saharan Africa.

This study aims to assess the local sustainability impacts of different biofuel feedstock options that have either been promoted or hold potential for biofuel production in Ghana. The study specifically seeks to (a) understand the drivers of biofuel feedstock production in Ghana and map out the current institutional arrangements, (b) identify the reasons for the widespread collapse of the jatropha sector and document the land acquisition processes, (c) understand and quantify the local sustainability impacts of different feedstock options in Ghana, (d) identify and explain how different local conflicts emerge in areas of feedstock production, and the local acceptability of biofuels

feedstock options in Ghana.

To address these complementary objectives, the study adopts a sustainability science approach to synthesize existing knowledge and frame the empirical assessment at local scale using various case studies. These include six collapsed large jatropha plantation (in Kadelso, Ahinakom, Kobre, Lolito, Adidome and Kpachaa) and three operational feedstock projects: a large jatropha plantation (in Yeji), a smallholder sugarcane project (in Dabala) and a hybrid oil palm project that contains a large core plantation surrounded by smallholders (in Kwae).

For objective (a), an extensive literature review and policy analysis were undertaken to understand the structure of the biofuel sector in Ghana and the interactions between key stakeholders.

For objective (b), 21 expert interviews, six focus group discussions, three participatory community mapping exercises, and 201 rapid household surveys were conducted around the six collapsed jatropha projects to understand the drivers of jatropha expansion, institutional arrangement, land acquisition processes, reason of collapse and local sustainability impacts.

For objective (c), a sustainability assessment framework was developed to assess the local impacts of current operational feedstock production projects. The selected study projects reflected the main feedstock options (i.e. sugarcane, jatropha and oil palm) and modes of production (i.e. smallholder, plantation and hybrid systems) across the country's three agro-ecological zones. In total around 850 household surveys captured a series of social and economic impacts (food security, poverty, livelihood and energy poverty). Remote sensing analysis and ecological surveys were undertaken to assess key environmental impacts related to carbon stock change and biodiversity loss.

For objective (d), community perspectives were elicited through 80 local interviews and 15 focus group discussions around the three operational projects to understand the different local conflicts related to feedstock production across the collapsed and operational projects.

For objective (a), the study verifies the actual land acquired for biofuel projects, the amount of foreign direct investment for biofuel projects and the connections between the main stakeholders in the sector.

For objective (b), the study identifies a number of reasons behind the failure of the jatropha sector such as poor business planning, poor land administration, low jatropha productivity, local community conflicts, and obstacles posed by civil society. The findings indicate the systemic nature of jatropha collapse, as these factors often worked synergistically to catalyze the collapse of many jatropha projects in Ghana. However, land-related issues are central to almost all of these drivers of collapse. The unconstructive involvement of chiefs during the land acquisition processes was a common theme behind the collapse of many projects.

For objective (c), the impact assessment of the collapsed projects suggests that a significant increase in jobs and income occurred during the operational phase of these projects. At the same time,

many of the communities reported a significant loss in the availability of (and access to) different ecosystem services such as medicinal plants, wild food and fuelwood/timber due to the loss of woodlands following land conversion to jatropha plantations. After the collapse, there were significant decreases in rural employment and income in all six sites. Loss of access to ecosystem services still persists due to ongoing restrictions to access the sites.

For the operational projects, at the landscape level, most feedstock options impact negatively the environment in terms of carbon stocks and biodiversity, albeit to different extents. The only single exception is a net carbon gain associated with the cultivation of oil palm in the Kwae site. For socioeconomic impacts at the household level, feedstock producers (i.e. smallholders) in oil palm and sugarcane sites are better off than other groups in their respective sites in terms of food security, poverty and livelihood. In addition, workers are either worse off or at similar status with non-involved groups at their respective sites. Positive impacts are yet to be observed in the jatropha site as the surveyed control group not involved in jatropha production as workers reported better food security, energy access and lower poverty levels than permanent and seasonal jatropha workers.

For objective (d), plantation modes of feedstock production are characterized by land-related conflicts in terms of land rights disputes and compensation. Such issues manifested both around the operational and collapsed plantation sites. While there is currently considerable skepticism among stakeholders about the future of biofuel feedstock production in Ghana (and especially of jatropha), there is still some interest especially for oil palm and sugarcane as reflected in community surveys and recent government policies.

From a policy perspective, any interest in reviving the collapsed jatropha sector or promoting other feedstock options must give considerable attention to: (a) addressing the impediments of land administration, (b) conducting agro-ecological zoning and proper site selection, (c) understanding and assessing the expected sustainability trade-offs, (d) establishing viable feedstock markets, (e) improving community participation in project design, and (f) developing appropriate guidelines for certification,

A part of this thesis is a joint collaboration of Dr. Alexandros Gasparatos and Mr. Abubakari Ahmed. Mr. Ahmed, however, designed the methodology, collected and analysed the data, and wrote the joint publications under the supervision of Dr. Gasparatos.

This committee unanimously agreed to award the degree of Doctor of Sustainability Science.

(1159 words)