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Roehlano M. Briones

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ASSESSMENT ON THE USE OF MARGINAL AREAS FOR CULTIVATION OF FEEDSTOCK FOR BIOFUEL

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Abstract: The Philippines has made a major push towards development of biofuel, enacting biofuels mandates and subsidies by the Biofuels Law. To maintain food security, biofuels policies currently restrict feedstock production to marginal lands. This raises its own issues related to commercial viability, small farmer livelihood, and environmental sustainability. This study conducts a field investigation of these issues, covering smallholder feedstock producers producing sugarcane, cassava, and coconut. The study finds the following: i) Biofuels development in marginal areas are potentially profitable ventures for investors, assuming stable physical and economic environment, as well as a predictable policy environment. ii) Contract growing arrangements have been largely advantageous to farmers. iii) Farmers who have entered into contract growing arrangements have a reasonable expectation of improved livelihoods. iv) Biofuels development in marginal lands are not expected to cause significant input intensification, although expansion of cultivated area for emerging feedstock such as cassava should be monitored. Rather than small holder exploitation, or environmental degradation, this study points to other major development concerns, namely maintaining policy coherence, containing costs imposed on the fuel-buying public, and rethinking the biofuel mandate, in favor of other instruments for promoting indigenous sources of renewable energy.

Keywords: biofuels development, marginal lands, rural livelihoods, environmental degradation

1. INTRODUCTION

The Philippines approved the Biofuels Act of 2006 to promote energy security, the development of renewable energy, and to increase rural incomes and employment. However, expansion of farming to produce energy raises the prospect of competition with farming to produce food, thereby threatening food security. To allay this concern, biofuels proponents advocate production of feedstock only in marginal lands. This in turn raises a number of issues related to economic feasibility, equity, and environmental impact.

Marginal lands confront several disadvantages that made them “marginal” for agriculture in the first place, e.g. remoteness from markets and population centers, high transport costs, lack of resources, poorly defined property rights, and so on. A similar set of problems may arise in converting these areas in feedstock production. On the other hand, agribusiness demand for biofuel could lead to a large-scale conversion of marginal or underutilized land for feedstock supply, displacing farmers currently residing in and cultivating these lands. Lastly, the expansion of agribusiness opportunities in marginal lands may be environmentally destructive if it promotes forest clearing, loss of biodiversity, and the spread of intensified agriculture. Precisely these effects have been attributed to rising biodiesel demand in the case of oil palm plantations in Indonesia (Friends of the Earth, 2006).

This study examines these issues in relation to the use of marginal lands for feedstock supply in the Philippines. Specifically its objectives are as follows:

- i) To evaluate the feasibility and impact of feedstock production in marginal lands on the livelihoods and food security of poor farmers in these areas;
- ii) To analyze the determinants of the impact of feedstock supply on farm household livelihoods;
- iii) To gauge the impact of feedstock supply on marginal lands on the environment through changes in land use and input intensity.

2. BACKGROUND

The Biofuels Act

The Biofuels Act, which came into effectivity in early 2007, declares a state policy of reducing dependence on imported oil, mitigating toxic and greenhouse gas emissions, and increasing rural incomes, by the development and utilization of indigenous renewable resources. At least two major forms of biofuel are recognized, namely bioethanol and biodiesel. To oversee implementation of the law, the Act creates a National Biofuels Board (NBB), composed of Secretaries of Energy, Trade and Industry, Agriculture, Finance, and Labor and Employment Departments, as well as Administrators of the Sugar Regulatory Agency (SRA) and Philippine Coconut Authority (PCA). The most important specific provisions are as follows:

For bioethanol:

- By 2009, bioethanol should account for at least 5% of the total volume of gasoline fuel sold by every oil company;
- By 2010, the mandatory minimum blend for all gasoline fuel to be raised to 10%, as recommended by the NBB.¹

For biodiesel:

- All diesel engine fuels should contain at least 1% biodiesel by volume;
- By 2009, biodiesel content increases to 2%, as recommended by the NBB.

Imports of biofuel (mainly bioethanol) are permitted only upon permission of NBB based on the finding of a shortage of domestic supply and demand. The bio-component of gasoline or diesel fuel is exempted from the specific fuel tax. The Act also contains provisions that anticipate food security concerns. In the declaration of policy, clean renewable energy is to be developed “without any detriment to the natural ecosystem, biodiversity, and food reserves of the country.” The SRA is required to ensure that sugar price remains stable and shortages are avoided.

At the global level, biofuel policies in the United States and European Union have also involved mandates and other incentives. This has caused massive demand increase for biofuel crops, as well as large-scale changes in land use, posing a real threat to food security. Mitchell (2008) attributes 70-75% of the increase in world food prices since 2002 to the direct and indirect effect of biofuel expansion.

At the domestic level, Rodriguez and Cabanilla (2008) use computable general equilibrium modeling to analyze the impact of a 10% bioethanol mandate on Philippine agriculture. They find that the price of sugar would increase by 18.3%, while consumption falls by 15.4%. On the other hand, sugar industry output rises by 13% (where output is measured by value added at the primary stage). The bioethanol mandate exerts only weak effects on output and consumption of the other agricultural sectors. In contrast to findings at the global scale, the food-versus-fuel issue is of narrow relevance for the Philippines, though it remains a valid concern.

Land use policies with respect to feedstock production

In several developing countries, a number of agribusiness interests have converted or are planning to convert large tracts of land for feedstock production. Detractors of this trend have hurled charges of “land grabbing”, a particularly emotional issue when foreign companies are investing in countries that were historically colonies of the West. If lands being acquired are already be under claim or cultivation, there is a danger that “existing land uses and claims” may “go unrecognized because land users are marginalized from formal land rights and access to law and institutions” (Cotula et al, 2009, p.6).

In the Philippines, land use regulations for feedstock production are contained in Joint Administrative Order (JAO) 2008-1: *Guidelines Governing the Biofuel Feedstocks Production and Biofuels and Biofuel Blends Production, Distribution, and Sale under Republic Act No. 9267*. According to the JAO, certification of the Department of Agriculture (DA) is required before a biofuels feedstock producer can operate. DA certification may be given conditional on the following:

- The feedstock is not a cereal crop which may also be consumed as food;
- Area to be used is consistent with zoning plan of the local government unit (LGU), and “is not the only remaining food production area of the community”;
- The area is not covered by government-funded irrigation facilities, or have idle irrigation facilities that are programmed for rehabilitation by DA and NIA;
- Area is not an irrigated alluvial flood plain planted to rice or corn;
- For coconut and sugarcane lands, the area complies with existing guidelines of the Sugar Regulatory Administration (SRA) and Philippine Coconut Authority (PCA);
- Area is “underutilized and marginal” (Section 4.2).

The SRA guidelines permit the use of sugarcane for ethanol upon certification, to be issued to bioethanol producers (feedstock producers do not require prior certification). Sugarcane areas outside sugar milling districts are allowed to produce cane for ethanol. For areas within sugar milling districts, the Sugar Board shall determine an overall e-cane quota (OEQ), permitted for feedstock production; the OEQ would be based on preliminary crop estimates, and assessment of the sugarcane supply situation. This is to ensure compliance Biofuel Act provision on the mandate of SRA to ensure that domestic demand for sugar is met and the price of sugar remains stable.²

The JAO however does not define “marginal” land. Technical classification of land is the domain of the Bureau of Soils and Water Management (BSWM) of DA. Under a previous classification scheme (up to the early 2000s), the BSWM measured the area of “marginal/agroforestry” lands, pursuant to the wider objective of delineating Strategic Agriculture and Fisheries Zones (SAFDZs) as mandated by the Agriculture and Fisheries Modernization Act (AFMA) of 1997 (Table 1).

Table 1: Marginal Agroforestry areas by region, based on SAFDZ reports

	Marginal/Agro forestry (ha)	Share of marginal in total land area (%)
Philippines	2,868,951	6.4
CAR	421,963	21.7
I Ilocos	169,269	1.5
II Cagayan Valley	169,269	6.0
III Central Luzon	37,259	1.7
IV-A CALABARZON	222,971	13.2
IV-B MIMAROPA	219,528	7.4
V Bicol	6,315	0.3
VI Western Visayas	26,410	1.3
VII Central Visayas	255,099	16.1
VIII Eastern Visayas	52,019	2.2
IX Zamboanga Peninsula	148,660	10.4
X Northern Mindanao	225,646	11.0
XI Davao Region	77,208	3.8
XII SOCCSKSARGEN	248,325	11.0
XIII Caraga	350,709	16.3
ARMMM	238,301	6.3

Source: BSWM.

Marginal/agroforestry lands account for just over 6% of total lands. The regions with the largest shares are CAR, Caraga, and Central Visayas, while the largest absolute areas of marginal lands are in CAR, Caraga, and SOCCSKSARGEN.

The identification of potential areas for feedstock supply was further refined by BSWM upon ratification of the Biofuels Act. Table 2 presents a provincial profile of lands under the following classifications:

- (i) Suitable to biodiesel crops
- (ii) Suitable to sweet sorghum, sugarcane, cassava and jatropha
- (iii) Suitable to sweet sorghum, sugarcane, cassava, coconut and oil palm
- (iv) Suitable to jatropha only
- (v) Suitable to coconut and oil palm only
- (vi) Suitable to bioethanol crops

In Table 2 we report only items (ii) and (vi). The areas largely overlap. The region with the largest potential for feedstock production, according to Philippine Agricultural Development and Commercial Cooperation (PADCC) of DA, is Eastern Visayas; the suitable area is concentrated in Western Samar. This is followed by Western Visayas, the largest concentration being in Iloilo and Negros Occidental. Central Luzon, SOCCSKSARGEN (South Cotabato, Sultan Kudarat, Sarangani, General Santos), and ARMM (Autonomous Region of Muslim Mindanao) have the lowest amount of suitable areas.

Table 2: Agribusiness lands suitable for biodiesel or bioethanol feedstock production

Region	Province	Biodiesel	Bioethanol
CAR		39,085	39,085
	Abra	13,105	13,105
	Apayao	7,021	7,021
	Benguet	518	518
	Ifugao	10,375	10,375
	Kalinga	7,070	7,070
	Mt. Province	995	995
I		62,711	64,828
	Ilocos Norte	22,038	22,867
	Ilocos Sur	15,327	15,327

Region	Province	Biodiesel	Bioethanol
	La Union	9,427	9,427
	Pangasinan	15,919	17,208
II		46,875	46,875
	Cagayan	37,836	37,836
	Isabela	5,362	5,362
	Nueva Vizcaya	3,235	3,235
	Quirino	442	442
III		23,561	24,083
	Aurora	2,177	2,699
	Bulacan	21,384	21,384
IV-A		61,888	61,764
	Batangas	15,107	15,090
	Cavite	580	473
	Laguna	5,889	5,889
	Quezon	33,364	33,364
	Rizal	6,948	6,948
IV-B		129,908	129,908
	Marinduque	4,145	4,145
	Mindoro Occidental	47,653	47,653
	Mindoro Oriental	17,849	17,849
	Palawan	57,132	57,132
	Romblon	3,131	3,131
V		132,190	132,190
	Albay	13,229	13,229
	Camarines Norte	15,099	15,099
	Camarines Sur	29,897	29,897
	Catanduanes	2,403	2,403
	Masbate	55,063	55,063
	Sorsogon	16,498	16,498
VI		185,832	185,832
	Aklan	7,337	7,337
	Antique	10,229	10,229
	Capiz	5,852	5,852
	Guimaras	29,437	29,437
	Iloilo	71,094	71,094
	Negros Occidental	61,884	61,884
VII		86,339	86,339

Region	Province	Biodiesel	Bioethanol
	Bohol	8,332	8,332
	Cebu	38,925	38,925
	Negros Oriental	36,692	36,692
	Siquijor	2,390	2,390
VIII		187,017	187,017
	Biliran	3,444	3,444
	Leyte	6,013	6,013
	Southern Leyte	12,552	12,552
	Western Samar	117,904	117,904
	Eastern Samar	29,141	29,141
	Northern Samar	17,961	17,961
IX		37,730	37,730
	Zamboanga City	3,471	3,471
	Zamboanga Del Norte	21,476	21,476
	Zamboanga Del Sur	11,033	11,033
	Zamboanga Sibugay	1,582	1,582
	City Of Isabella	168	168
X		38,893	38,893
	Bukidnon	14,862	14,862
	Camiguin	120	120
	Lanao Del Norte	2,892	2,892
	Misamis Oriental	21,020	21,020
XI		38,956	38,956
	Compostela Valley	9,182	9,182
	Davao Del Norte	13,104	13,104
	Davao Del Sur	12,234	12,234
	Davao Oriental	4,435	4,435
XII		23,555	23,555
	North Cotabato	856	856
	Sarangani	11,412	11,412
	South Cotabato	9,264	9,264
	Sultan Kudarat	2,022	2,022
ARMM		25,689	26,409
	Basilan	171	171
	Lanao Del Sur	9,840	9,840
	Maguindanao	386	386
	Shariff Kabunsuan	1,696	2,416

Region	Province	Biodiesel	Bioethanol
	Sulu	3,728	3,728
	Tawi-Tawi	9,866	9,866
Caraga		82,941	83,341
	Agusan Del Norte	20,222	20,222
	Agusan Del Sur	47,104	47,104
	Dinagat Islands	400	400
	Surigao Del Norte	15,040	15,441
	Surigao Del Sur	174	174
Philippines		1,203,170	1,206,806

Source: PADCC (2009).

For the purpose of biofuels feedstock certification, land is deemed suitable if it is idle or underutilized, yet cultivation of feedstock is practicable (i.e. not prevented by inherent soil or other land characteristics). Failure to cultivate is attributed rather to inaccessibility of the area to markets and population centers. For instance, these areas may be in remote uplands, without adequate road access, irrigation, or utilities. The role of BSWM in the DA certification process is to: a) provide a preliminary identification of areas suitable for feedstock production; and b) verify the suitability of an area being proposed for feedstock production by issuing a Land Use Assessment and Crop Suitability Report.

Similarly, according to PADCC, land may be considered “marginal” if it is unproductive – a good example is grassland. The land itself may be suitable for plantation, but the investor must first incur a high establishment cost. Profitability would be left to the calculation of the investor – the government’s role is simply to facilitate any investment options being explored by a private entity. The PADCC also guides the investor through the thicket of government regulations related to biofuel investment, which have been imposed to protect farmer livelihoods and the environment.

The country’s hinterlands are mostly under tenure, typically informal. The type of tenurial arrangement frames the type of contract that can be arranged between farmers and investor. For example, in Community Based Forest Management (CBFM), areas, farmers are grouped into a people’s organization (PO), whose terms of tenure are governed by a CBFM Agreement between the PO and Department of Environment and Natural Resources (DENR).

3. METHODOLOGY

Hypotheses

The foregoing discussion suggests that the “land-grabbing” scenario is rather far-fetched in the context of the Philippines. Furthermore, it is plausible to assume that biofuels investors would only invest in areas where expected private rate of return is at least equal to that of other business options. On the other hand, farmers in command of land assets would not knowingly permit land use that offers them inferior net returns. However in the quest for higher returns, farmers may be exposed to greater capital risk, as in the case of a decision to expand farm area or to cultivate land more intensively.

We may therefore conjecture the following:

1. Biofuels investors would select feedstock production areas, suppliers, and contract terms that would best realize profit opportunities under the Biofuels Law.
2. Given limitations on land ownership and legal protection to cultivators, contracts offered to farmers would need to be advantageous to the latter.
3. Hence, farmers who are contracted by a biofuels investor to shift to feedstock cultivation gain higher income, lower risk, or both. Due to improved livelihood, farmers also enjoy better food security.
4. Due to high costs and limited feedstock demand, farmers do not significantly expand area planted or intensification in underutilized areas, muting the environmental impact of feedstock expansion in marginal lands.

Note that the hypotheses are all conditioned on a supply chain set-up from production to processing, where lines of contract or purchase agreement from producer to processor are clear to both parties. This set-up is essential to establish “traceability” from feedstock grown on marginal land to biofuel production. In other words, the hypotheses are inappropriate for an industry in which a spot market mediates the supply line; e.g. farmers sell to traders, which pool the produce for sale to a variety of purchasers, among which include a biofuel processor (or its buying agent).

Survey design

By documenting actual investments in feedstock production, we are able to evaluate in a simplified manner the economic feasibility of sourcing feedstock supply from marginal or underutilized lands (Hypothesis 1). The study is therefore focused on

Hypotheses 2 to 4, which are evaluated by field visits and a survey of farmers in marginal lands who are actual or potential suppliers of feedstock.

A structured questionnaire was developed for the farmer interviews, covering the following information (see Annex 1):

- Respondent details: Demographic data (respondent, household), Farm profile (physical, cropping pattern, tenure), and non-farm activities/assets
- Contract terms and conditions
- Cost and returns for on-going and previous crop year: feedstock crop, other crops

Feedstock suppliers are found by tracing them from the selected biofuel producers. Due to field constraints, the sample design is purposive and oriented towards avoiding systematic bias in selection of respondents. In the case of biodiesel, discussions with the PCA indicate that feedstock is mostly supplied by traders, who in turn purchase from farmers as part of their regular marketing activity. Hence, the case of a vertical supply chain with traceability back to the farm level is rare. Further reconnaissance pointed to a suitable case of a cooperative in Romblon province directly supplying to a biodiesel processor. This became the last survey site.

In the following, *feedstock crop* is the crop that can be used for feedstock; in this study this is confined to sugarcane, cassava, and coconut. This is to be distinguished from *feedstock supply* which is the quantity of the feedstock crop that is sold to the biofuel processor, as well as *feedstock income*, which is the income earned from selling feedstock crop to the biofuel processor. Upon its completion, the survey covered 104 respondents, with the breakdown by feedstock crop shown in Table 3.

Table 3: Number of respondents and reference period by feedstock crop

	Number	Reference period
Sugarcane	30	Sugar planting year 2008 - 2009
Cassava	34	Calendar year: 2010
Coconut	40	Calendar year: 2008

Analytical techniques

The share of feedstock supply in crop production is a proxy for the importance of biofuel in the livelihood of the farmer. Hypothesis 3 suggests that, as biofuel becomes a more important source of livelihood, livelihood outcomes improve. To refute the hypothesis we need to make the appropriate comparisons. One way to do this is before-after analysis, i.e. previous and current cropping season, where presumably the previous cropping system did not involve any feedstock supply. However the assessment may be incomplete as extraneous factors unrelated to biofuel development may be differentiating the current from the previous period.

Another form of comparison is cross-sectional. Assuming that farmers are exclusive suppliers to a particular biofuel company (at least with respect to the feedstock crop). Then impact assessment may be conducted as a treatment-control set-up, in which exclusive suppliers are the treatment, and non-suppliers with similar characteristics are the control. However, in some cases farmers allocate only part of the feedstock crop for feedstock supply (the rest of the crop going to the supply of food). A treatment-control set-up may therefore be inappropriate, as it regards all feedstock suppliers as a single group of “treatment” farmers, though the actual exposure to feedstock supply may vary. The appropriate comparison may be between farmers with low exposure and those with a high exposure to feedstock production. Comparisons may use standard techniques, such as regression analysis.

Limitations of the study

Based on the foregoing, the following limitations may be noted: First is the purposive nature of sample selection. In particular, the identification of feedstock suppliers is limited by traceability, which eliminates a significant portion of the supply chain related to coco-biodiesel. Second, despite the furor surrounding biofuels, the biofuels industry is at an emergent phase, proceeding erratically in many areas, with its attendant problems. In one (Isabela) the cost and returns figures had to be extrapolated, whereas in another (Romblon) the cost and returns required remote recall. Third, owing to time and resource constraints, the type of information gathered is of restricted scope. We did not collect direct information about projected costs and returns of biofuels investors, owing to confidentiality issues. Furthermore, information on environmental impact is more qualitative rather than rigorous or systematic. These limitations should qualify the interpretation of the results reported here.

4. RESULTS

Profile of biofuel investors

The selected sugarcane feedstock buyer is San Carlos Bioenergy Inc. (SCBI), located in San Carlos City, Negros Occidental. Prior to its establishment, there was a San Carlos sugar mill, which had closed in 1997. Following its closure, sugarcane planters in the mill district were forced to deliver to distant mills outside the mill district. The SRA has therefore approved of diverting sugarcane in the San Carlos mill district to be used as bioethanol feedstock, as the bioethanol plant would be more located closer to the district's sugarcane planters.

The company secured its supply initially by calling farmer meetings and organizing interested farmers. These farmers are organized into a the GHI Farm Workers Multi-Purpose Cooperative, whose members include numerous land reform beneficiaries. SCBI offered a ten-year contract for regular suppliers, in exchange for stable, predetermined prices, technical assistance, and planting materials (consisting of improved varieties suitable to the area). The company also accepts deliveries from walk-in suppliers, who are paid a spot price. The regular suppliers are intended for the core throughput of the ethanol plant; however as operations only started in September 2010 at the time of interview the regular suppliers are yet to make their first harvest.

For cassava feedstock, a major producer is Eastern Renewables and Fuels Corporation (ERFC), a subsidiary of Eastern Petroleum, one of the new petroleum industry players in the country. ERFC intends to supply the bioethanol requirements of their parent company, and (when supply expands), supply other companies as well. Their feedstock supply area is in Isabela, deemed suitable for growing cassava. ERFC had earlier identified 29,000 ha as potential area, of which 11,000 have been negotiated for growership agreement. (Contrast this to the 5,000 ha figure in Table 2, which suggests that the government estimate of available lands for biofuels development may be on the conservative side).

The company prefers to deal with cooperatives, either existing or organized for the project. They offer three-year growership contracts, in which prices are fixed, but they guarantee purchasing the entire harvest, advance planting materials, advance land preparation, and on-going technical assistance. ERFC entered into contract with the Epiphany Multi-purpose Cooperative (EMC). EMC is composed of over a thousand members, most of whom grow rice, along with other crops such as tobacco, corn, and

coconut. Prior to contract growing for ERFC, none of the EMC members planted cassava. ERFC offered to utilize their idle farm parcels for cassava feedstock. The parcels are typically in remote upland areas, where roads are bad to non-existent, discouraging cultivation.

For biodiesel, the biofuel facility has been put up the farmer cooperative itself, namely the St. Vincent's Multi-purpose Cooperative (SVMC). The SVMC is composed of a few hundred farmers, mostly small coconut growers, located in the town of Odiongan, Romblon. The farm parcels are in fairly "typical" locations and are not in especially remote and inaccessible areas. Prior to setting up the biofuel facility, the SVMC had been running several businesses, but was not otherwise involved in marketing nor processing of copra. Rather, in common with other coconut farmers, members would sell their copra to traders, who are mainly based in the nearby municipality of Looc.

The coconut methyl ester plant was put up as a project of the regional Department of Science and Technology (DOST), which provided the grant and technical assistance, in cooperation with the local representative (who provided a P1 million grant using congressional development funds), as well as with in-kind and in-cash counterpart from SVMC. Initially the cooperative purchased copra from farmers and processed biofuel for retail to diesel users (such as local jeepney operators). After a few months of doing biofuel retailing, the cooperative came to the attention of the National Power Corporation (NAPOCOR). The cooperative and power company soon entered a contract in which the latter becomes the exclusive buyer of the biofuel produced by the former, at a fixed price, over a three-month period. The contract was not however renewed; subsequently, biofuel production for sale to the local market became erratic, owing to rising prices of copra.

A major lament of biofuels investors is the policy environment. In the case of bioethanol, the SCBI claims the NBB has failed to provide clear policy guidelines on ethanol tariffs, allowing imports to displace domestic production. There are on the other hand no controversial policy issues in the case of biodiesel, where the blend requirement is lower (GAIN-USDA, 2010).

Evaluation of growership arrangements

Contract features. The assessment of the growership agreement is simplest in the case of coconut; the cooperative would source copra feedstock from farmers and pay a one-peso premium over the going market price. Any surplus from processing and

selling biodiesel to NAPOCOR would accrue to the cooperative, which is an entity owned and controlled by the coconut farmers. In the case of cassava feedstock, most of the farmers agree that the growership agreement is *ex ante* an opportunity to raise income. The land allocated for feedstock production is usually idle property in the uplands, for which the biofuel company shoulders initial input and establishment cost.

Evaluation is somewhat more complicated for the case of sugarcane. Initially, SCBI had made milling agreements with suppliers. However in practice these agreements were not enforced. Hence, SCBI was thereby compelled to offer terms competitive with those offered by sugar mills, converting the feedstock purchase into a spot market. Payment for feedstock is computed by ton of cane purchased, adjusted by sugar content.

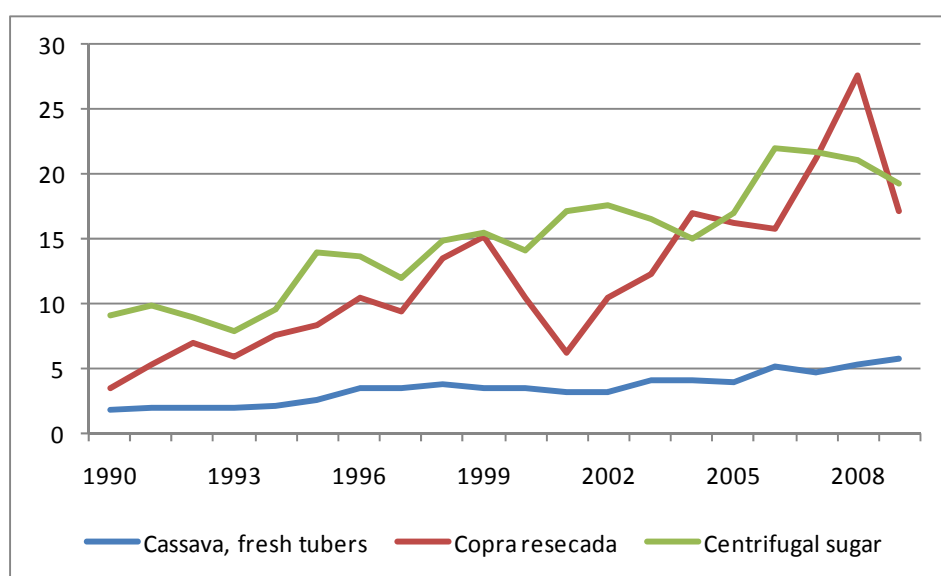
There are however two important differences between purchase for sugar and purchase for bioethanol. First, purchase for sugar involves a sharing scheme in which the mill keeps a 30%-35% share (regulated by mill district) to defray its costs, while the farmer keeps the remainder. Second, the farmer's share is divided by the SRA into several market segments, according to *quedan*. Class A sugar is reserved for the domestic market; class B for the US market, and class C for the world market. (For the reference year, class C is about 6% of milled sugar). While Class A and B can be sold weekly, class C is paid for only at the end of the milling season.

The reason why farmers choose to supply feedstock, given that feedstock and sugar provide approximately the same price, is that feedstock production generates full cash payment on a weekly basis. An additional attraction is proximity to the plant. A few favored suppliers get added perks, such as free organic fertilizer (a by-product of the bioethanol processing), as well as purchase of cane trash (as fuel for the power generation plant of the SCBI). Farmers also approve of the entry of the bioethanol investor, as it offers competition and market discipline against the sugar mills, against whom some traders were raising complaints (e.g. biased sugar content reading from their laboratory).

Sustainability of growership arrangements. As with any business arrangements, sustainability partly depends on external market factors. Feedstock production for coconut and sugarcane faced severe challenge from the soaring prices of copra and sugar for food. Figure 1 shows farmgate prices for cassava, copra, and sugar since the 1990s up to 2009. There is an obvious surge in sugar and copra in the late 2000s, pushing prices to historic highs. For coconut the spike began in 2006, with subsequent

correction in 2009; for sugarcane the price peaked in 2007 and stayed at an elevated level. This mirrors world market trends. Based on FAO data, the price of sugar increased by an average of 21% p.a. over the period 2005-2010; by 2010, the price was 82% higher than in 2005. Similarly the average annual increase over 2006-2010 for coconut was 25%; within this period, price fell by 40% (2009) but quickly recovered in 2010 with an increase of 54%. Hence, SVMC temporarily ceased operation of their processing plant; likewise, ethanol production using sugarcane has struggled with the escalating cost of feedstock.

Figure 1: Farmgate prices of cassava, copra, and sugar



Source: BAS.

Cassava feedstock faced a different problem. Figure 1 shows that cassava did not undergo price spikes at the farmgate, unlike copra and sugar. Sustainability was however threatened by vagaries of the weather, namely the drought induced by the El Niño event. The El Niño affected the country over the first nine months of 2010, and was a significant cause of the 0.12% contraction of the real agricultural GDP the past year (BAS, 2011).

Profile of respondents

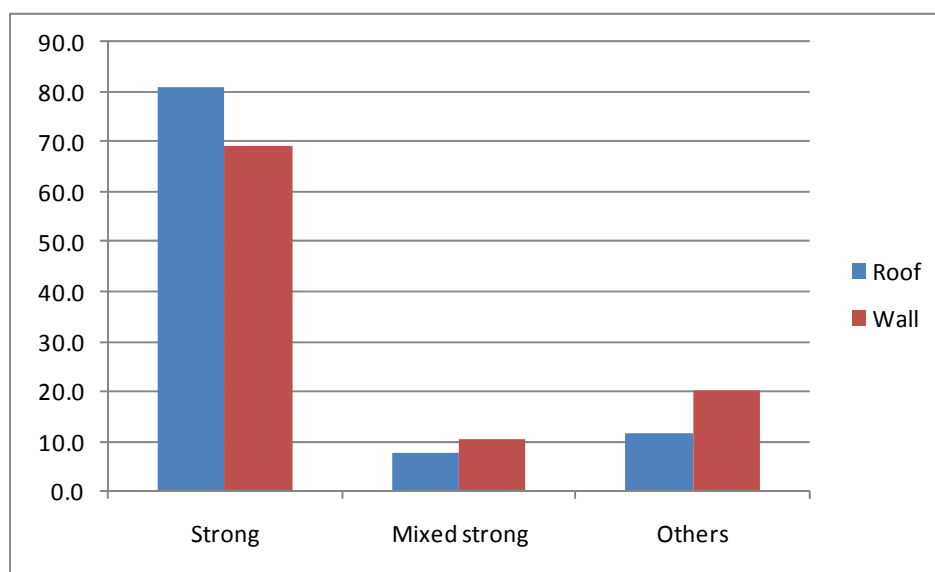
All feedstock suppliers interviewed are individual farm proprietors, with the exception of one corporation supplying SCBI. The farmers interviewed are typically in their late forties, have secondary schooling, and are mostly male (accounting for 72%).

Average households size is 5, of whom only one or 2 are working on the family farm (Table 4). There is however fairly large variation in family size and number of family workers (both ranging from 0 to 8 in a family). Most of the respondents live in decent housing made of durable materials (Figure 2).

Table 4: Demographic characteristics of proprietors

	Mean	Minimum	Maximum	CV
Age, in years	49.4	16	80	0.25
Years Of Schooling	9.1	1	18	0.42
Household Size	4.7	1	15	0.51
Dependents	2.2	0	8	0.80
Number of family workers	1.6	0	8	0.96

Figure 2: Percent of proprietors by category of housing material used (for roof and wall)



Average farm size is 9.5 ha (Table 5). On average, most of the farm area is owned and operated by the farmer. Owner-operated farms dominate in Isabela, while a significant share of farms in Romblon are under share tenancy. Sugarcane farms are a special case. The bulk of the farmers fall in the medium category (5-50 ha); only 7 are in the small category (5 ha and below), while 5 are in the large category (above 50 ha). On average the owner-operated area is 15 ha, above the land reform cut-off of 5 ha. Planters are able to gain possession of parcels by lease, or by extending credit, i.e. land

is offered by borrowers as guarantee (essentially, a land pawning agreement). These forms of land consolidation were less common in the other survey sites.

On average, 60% of farm area is planted to the feedstock crop. Concentration of total farm area in the feedstock crop is highest in Negros (87%), followed by Romblon (60%). Concentration is lowest in Isabela, as the only parcels devoted to the feedstock crop were erstwhile idle parcels.

Table 5: Farm assets of respondents, average by site

	All	Negros (Sugarcane)	Isabela (Cassava)	Romblon (Coconut)
Farm area				
Area, in ha	9.5	23.9	5.7	1.9
Area under owner-operation (%)	61.2	59.5	73.8	51.7
Area planted to feedstock crop (%)	59.5	86.8	35.4	59.5
Other farm assets (number)				
Draft animal	1.1	2.4	0.7	0.5
Machinery (tractor, truck, pump)	1.0	1.6	1.5	0.1
Other assets	0.5	0.6	0.3	0.6

The most common type of farm asset owned by the farmer is a draft animal (either a carabao or a cow), followed by machinery, which includes: farm tractor; truck (for hauling produce); and irrigation pump. Negros and Isabela farmers have similar number of machineries, but Negros farmers tend to own more draft animals. One reason is that the biofuel producer was compelled by competition from sugar millers to range into the uplands of Negros Oriental to obtain their supplies; in these areas draft animals are more suitable for cultivation compared to tractors.

Table 6 presents figures to describe the size and importance of feedstock production and feedstock supply. Output ranges from 0.8 t per farmer for copra (or about 4.6 t of coconut harvest), to as much as 969 t per farmer for sugarcane. This translates to an income of as high as 1.6 million per farmer in the case of sugarcane; lowest income came from coconut production, below P10,000 per farmer. Average net income was likewise highest for sugarcane at about P869,000 per farmer. Cassava production however inflicted a loss on the Isabela farmers owing to drought; on cash basis though this loss has been mostly absorbed by the biofuel investor, with the understanding that recovery is forthcoming in future harvests as good weather returns in 2011.

In terms of productivity, coconut yield is at 0.7 t/ha, which is close to the national average of 0.75; cassava feedstock yield is higher than the national average of 9.5 t/ha, although this is not sufficient to generate positive net income because of high fertilizer and land preparation cost. Sugarcane yield is lower than the national average of about 51 t/ha (PY 2009-2010). Net income per ha is lowest (but positive) for cassava, followed by coconut, and hits P30,000 per ha in the case of sugarcane, despite low yield.

Table 6: Farm and nonfarm income

	All	Negros (Sugarcane)	Isabela (Cassava)	Romblon (Coconut)
Feedstock crop:				
Output (tons)	NA	969.2	20.0	0.8
Gross income (pesos)	559,851	1,623,781	53,711	9,440
Net income (pesos)	293,434	869,439	-8,361	7,104
Feedstock crop per ha:				
Output	NA	41.3	13.9	0.7
Gross income	559,851	1,623,781	53,711	9,440
Net income	13,613	30,062	1,027	8,353
Feedstock supply (%)				
Share in feedstock crop	84.6	57.4	100.0	95.7
Share in farm income	53.3	57.4	25.2	64.6
Household income:				
Per capita	120,275	304,433	67,671	31,473
Of which nonfarm (%)	60.4	42.7	60.9	73.2

Feedstock supply accounts for all of income from the feedstock crop in the case of Isabela, and nearly all for coconut; however the share is much lower for sugarcane, with about 43% of sugarcane output of the sample farmers being sold to sugar mills. Similarly, feedstock income accounts for less than a fifth of farm income of Negros farmers, about half of farm income for Romblon farmers, and nearly two-thirds of farm income of Isabela farmers.

Household annual income per capita is ranges from a low of P31,000 in Romblon (which is still comfortably above the poverty line) to over P300,000 per capita in Negros. Romblon and Isabela farmers basically escape poverty by relying mostly on nonfarm

income sources. Negros farmers tend to derive a greater share of their income from farming, but this is understandable given their larger landholdings.

Livelihood impact

We begin the assessment of livelihood impact of biofuels by a simple before-after comparison regarding income from the feedstock crop. This is possible only for Negros and Romblon (as Isabela farmers did not farm the feedstock crop in earlier years). In both cases, both gross and net income from the feedstock crop increased. However, before-after comparisons are possibly confounded by external factors, such as price changes; this requires cross-sectional analysis.

Table 7: Change in income from the feedstock crop, before and after feedstock supply (%)

	Negros (Sugarcane)	Romblon (Coconut)
Gross income	+14.5	+13.1
Net income	+7.4	+12.8

We run a least squares regression with dependent variable being *Net Farm Income*, normalized by farm size (abbreviated as *NFYH*). The explanatory variable is *Share of Feedstock Supply in Feedstock Crop* (abbreviated *FDSHCR*). Controls are introduced by way of demographic and asset variables, as follows:

Variable	Definition
NEGROS	Negros Oriental dummy
ROMBLON	Romblon dummy
AGE	Age of proprietor
FEM	Female dummy (male omitted)
YRSCH	Years of schooling
FAMWRK	Number of
AROWOP	Area of farm under owner-operation
FMAST	Number of farm assets

Results of the least squares regression is shown in Table 8. Among the control variables, only the location dummies as well as *FMAST* are statistically significant and have the expected sign. *AGE* and *AROWOP* are of expected sign but not statistically

significant. *YRSCH* and *FAMWRK* neither conform to the expected sign, nor are statistically significant.

Obviously the sign, statistical significance, and magnitude of the *FDSHCR* variable is most critical for this study. It turns out that the coefficient is positive as hypothesized, and statistically significant at the 5% level. Every percentage point increase in the share of feedstock supply in the output of the feedstock crop, raises net farm income per ha by P218.

The least squares regression is admittedly prone to the problem of simultaneity bias: possibly, *FDSHCR* is endogenous, and the same set of variables affecting it simultaneously affect net farm income per ha. The standard correction would be through instrumental variable estimation; unfortunately, our data set does not have a suitable instrument for *FDSHCR*.

Table 8: Results of least squares regression (Dependent variable: *NFYH*)

Variable	Coefficient	t-value	Pr(t>t_{critical})
<i>FDSHCR</i>	217.6	2.13	0.036
<i>NEGROS</i>	27,649.9	3.12	0.003
<i>ROMBLON</i>	11,432.1	1.76	0.082
<i>AGE</i>	76.2	0.39	0.695
<i>FEM</i>	-1,595.5	-0.31	0.757
<i>YRSCH</i>	-947.4	-1.55	0.126
<i>FAMWRK</i>	-1,808.8	-0.97	0.334
<i>AROWOP</i>	281.4	1.29	0.202
<i>FMAST</i>	1,699.3	2.4	0.019
<i>CONS</i>	-18,566.2	-1.09	0.279

However, the regression results should be seen not in isolation, but in the context of other, more qualitative evidence from the respondents themselves. We have already discussed the explanation from the farmers as to why the terms of the contract were attractive. Moreover, 44 respondents mentioned additional help from the buyer, in the form of the following:

- Provision of training and seminars
- Provision of technical assistance and modern varieties/quality planting materials
- In the case of sugarcane: purchasing bagasse, and providing free organic fertilizer

- Advancing machine rental and other inputs
- Transport or trucking subsidy

It is difficult to see therefore in what way the biofuel supply would be disadvantageous to the farmer. Admittedly, after the fact, the Isabela farmers may have become indebted to the buyer, but only because of the way the weather risk turned out. In any case, debt collection is contingent on future profitability of feedstock supply. *Ex ante* the contract may still be considered advantageous to the farmer.

Environmental impact

Lastly we examine environmental impact, as gauged by *expansion* of cultivated area, and *intensification* of existing cultivated area. Responses are coded simply “yes” or “no” to the relevant questions (omitted “not applicable” responses), which pertain to the respective reference periods. Expansion of farmed area was the norm for Isabela farmers, but was rather infrequent for Negros and Romblon farmers.

Table 9: Number of Yes and No responses to expansion an intensification questions

	Was there expansion?		Was there intensification?	
	Yes	No	Yes	No
All	38	35	7	67
Negros	9	21	3	27
Isabela	21	1	1	24
Romblon	8	13	3	16

The reasons behind the “yes” responses in the latter areas are as follows:

- Additional land became available for farming (e.g. through lease or land pawning);
- Expansion/intensification was undertaken as a result of high price of the feedstock crop;
- In the case of coconut: additional trees were planted to take advantage of good economic environment and government fertilizer subsidy

These reasons suggest that feedstock supply was coincidental to the decision to expand. While the biofuels industry may itself have been a market driver, this is arguable only at the world market level, rather than at the national level, given the small proportion of feedstock supply in the national supply of the feedstock crop.

For intensification meanwhile the negative responses overwhelmingly dominate the positive responses. The reason is simple; erstwhile producers of the feedstock crop in Negros and Romblon are simply reacting to the output price signals, which act indirectly on input intensity. Input application is more sensitive rather to input prices; during the reference period the effect of output price was confounded by rising fertilizer prices (reducing fertilizer application in the case of sugarcane) and government fertilizer programs (raising fertilizer application in the case of coconut). Again, any trends in input intensity appear largely independent of biofuels development.

5. SUMMARY AND IMPLICATIONS

We summarize the key findings as follows:

Biofuels development in marginal areas are potentially profitable ventures for investors, assuming stable physical and economic environment, as well as a predictable policy environment under the Biofuels Act. Despite the remoteness and lack of infrastructure in marginal areas, investors can still realize profit opportunities assuming stable prices of the feedstock. However in the past few years after enactment of the Biofuels Law, prices of the sugarcane and coconut have soared, owing to world market developments. Furthermore the policy environment, at least for ethanol, has been uncertain owing to lack of clear guidelines regarding import tariffs and the mandatory blend.

Contract growing arrangements have been largely advantageous to farmers. The biofuels investors have had to compete with traditional food markets in order to obtain their feedstock; to persuade the farmers to shift their market, investors have had to basically offer a better price and other terms of payment. In the case of sugarcane, the buyer generally matches the price per cane ton, but offers benefits by payment in cash, and by technical and other assistance. In the case of coconut in Romblon, the buyer paid at a premium over the copra trader's price; in the case of cassava in Isabel, the buyer offered to utilize only idle land, and provided input advances, land preparation, and technical assistance.

Farmers who have entered into contract growing arrangements have a reasonable expectation of improved livelihoods. Our analysis suggests that farmers who

tend to sell proportionately more to the biofuels processor tends to earn a higher farm income (normalized by farm size). This is consistent with the preceding key result, in which the favorable contract offered by the biofuels processor raises the expectation of improved livelihood from farming.

Biofuels development in marginal lands are not expected to cause significant input intensification, although expansion of cultivated area for emerging feedstock such as cassava should be monitored.

In short, the concerns raised about the food security and environmental sustainability, and economic feasibility find weak support in the case of the Philippines. The country implements safeguards in favor of domestic farmers and food production, relegating biofuels development to underutilized and marginal lands. Expansion of cultivated area in the uplands can be significant, but not alarming so; input usage in the uplands show no signs of intensification. Biofuel producers are able to offer contracts that would improve livelihood opportunities of farmers; under stable and predictable economic and policy environment, such business transactions would have remained profitable to buyers.

On the economic front, there is admittedly limited leeway for policy to address recent movements in global food markets. If the medium term outlook is for real prices to hold steady at approximately current levels, then government would probably need to rethink a key pillar of the Biofuels Act, which is the biofuel mandate. Perhaps other policy instruments (such as direct subsidies and other support) can be established for promoting indigenous sources of renewable energy, without inflicting undue costs on fossil fuel consumers. This would help resolve the various conflicting goals of the national biofuels program, laying the basis greater predictability and coherency in biofuels development policy.

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¹ Currently NBB exempts high octane fuels, but by February 2012 all gasoline fuels shall fall under the 10% requirement.

² SRA Circular Letter No. 30 Series of 2008-2009, dated July 1, 2009; and Sugar Order No. 14 Series of 2008-2009, dated July 1, 2009.