RURAL ESTABLISHMENTS ENVIRONMENTAL MANAGEMENT AND INSERTION IN PRODUCTION CHAINS OF OLEAGINOUS CROPS FOR BIOFUELS

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Abstract

Building upon a set of socio-environmental impact assessments carried out in five rural territories across the country, regarding the context of increasing demand for oleaginous crops for biofuels production, this study presents the sustainability assessment of rural establishments in those territories, aiming at checking the impact results against current local agricultural settings. The main results point out that, in general, the ecological dimensions of sustainability, such as Landscape Ecology and Atmosphere, Water, and Soil quality indicators, show adequate field conditions, seemingly not yet negatively affected by inputs and natural resources pressure increases, predicted as important potential impacts. On the other hand, most valuable positive consequences expected from the socio-environmental impact assessments, such as improved Socio-cultural Values and Management & Administration indicators, are still opportunities to be realized, if sustainable local rural development is to occur under the emerging agro-energy scenario.

Key words: *sustainability assessment, rural development, indicators, APOIA-NovoRural*

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1. Introduction

The insertion of smallholders dedicated to oleaginous crops into biofuel production chains represents a new opportunity for rural development. Demand intensifications for oleaginous crops, associated with particular conditions ensuing from the provisions brought about by the 'Social Fuel Label' policy, calls for the assessment of regulatory mechanisms in place regarding the environment, as well as of socio-environmental impacts that may arise, especially regarding small family farmers targeted by current public policies in Brazil.

This scenario elicits the valorization of local institutions and initiatives to foster agricultural management and technological improvement, as bases to sustaining the participatory decentralization processes that can lead to local sustainable development (SCHNEIDER, 2003). Aiming at integrating economic, social, and environmental concerns into this local development agenda, innovative planning approaches are required, for implementation at the proper territorial scale. So focused, public policies are to be tailored towards each territorial level, rendered the Federal and State spheres the role of providing directive acts and legislation; and the local governance the definition of productive arrangements, according with environmental resources and local community capacities. Participatory social organization is essential to legitimate and commit the involved social actors with the development objectives and productive arrangements thus proposed; but a leading driver, an organizational thread is also needed, to assemble social objectives and interests.

Given its spatial scale, resources encompassment, and societal involvement, the territorial productive arrangement of oleaginous crops for biofuels production can properly be fashioned from socio-environmental impact assessments, carried out with the social actors partaking of the productive chain, who serve as mediators for contriving local sustainable development objectives. Impact assessment procedures suitably support, on the one hand, the formulation and adaptation of appropriate public policies; and on the other, the development, selection, and transference of adequate productive practices and technologies for the farmers, according with their resources and capacities (RODRIGUES & RODRIGUES, 2007).

The mediators involved in impact assessment procedures are here identified as social representations (governmental and non-governmental organizations; workers and producers syndicates; social movements; scientific and technological research, and technology transfer institutions; enterprise agents; political representations; etc.) performing social and political roles for expressing the multiple interests and claims of the local community. Conforming representative networks of mediators, democratically consigned to organizing local communities' interests, entitling partnerships, and expressing wishes and claims for local sustainable development is not a spontaneous process – a common goal, the existence of a consensual project is imperative, towards which the involved community's interests are aimed. Usually in rural areas, the underlying carrying capacity associated with the available natural conditions and resources offer the basis for convergence of productive potentials, hence, for the definition of priorities for the territorial sustainable development project (CAMPANHOLA et al, 2007). When considering oleaginous crops for biofuels production, the definition *a priori* of productive objective (that is, the agricultural dimension), within the

context of the National Program for Production and Use of Biodiesel (PNPB, Act 11.097, January 13th, 2005; ESALQ/USP, 2006) contributes also for conforming the mediators' network, as well as for pointing them out the extent of association between their local sustainable development goals, against larger national and international objectives.

Via impact assessment, and ensuing technological adequacy and environmental management of rural activities, it is possible to promote the integration of interests of local social mediators, defining practices to minimize negative socio-environmental consequences and to maximize productive efficiency and the sound use of natural resources (RODRIGUES, 1998). This study presents a series of sustainability assessments applied towards the environmental management of rural establishments dedicated to oleaginous crops for biodiesel production, as a basis for evaluating productive arrangements pointed out as solutions for local sustainable development in several territories throughout the country, and encompassing different oleaginous crop options. The assessments were carried out in selected smallholders' farms in (i) Cássia (MG) with no-till rapeseed production; (ii) São Raimundo Nonato (PI); and (iii) Irecê (BA) with castor bean production; and (iv) Belém (PA), with oil palm production; and had the immediate objective of providing farmers with Environmental Management Reports, which in their turn were the basis for the territorial sustainable development analysis.

2. Methods

The Environmental Management Reports issued for the rural establishments involved in the present study, which results and recommendations comprise the essence of this work, were developed in two complementary research steps, namely the (i) socio-environmental impact assessment of oleaginous crops for biofuel production at the territorial scale; and (ii) the sustainability assessment of rural establishments dedicated to oleaginous crops for biofuel production. In order to carry out the first part of the research (detailed in RODRIGUES et al., 2007), Delphi-type Workshops were held in all territories, building upon the expertise and knowledge of institutional representatives about the expected and observed impacts of the increasing demand on oleaginous crops for biofuels production. For this step of the study, a "Base System for Evaluation and Eco-certification of Rural Activities" (Eco-cert.Rural System; RODRIGUES et al., 2006a; MONTEIRO & RODRIGUES, 2006) was applied for checking impact indicators, which were then integrated in territorial scenarios according with the mediators representation of views and interests of the (i) farmers and their representations, (ii) public and community managers, (iii) research and training institutions, and (iv) agro-industry agents and their representations (RODRIGUES et al., 2007).

The second step of the research, which is emphasized in the present paper, involved the sustainability assessment of selected rural establishments in each territory, to check the adherence of the territorial results with the farmer reality in the field, and to build a procedure for the environmental management of oleaginous crop production for biofuels. The sustainability assessments were carried out with the 'System for Weighed Environmental Impact Assessment of New Rural Activities' (APOIA-NovoRural, RODRIGUES & CAMPANHOLA, 2003). The APOIA-NovoRural System consists of a set of 62 integrated environmental indicators built into weighing scaling matrices (RODRIGUES, 1998), formulated towards the systemic assessment of a rural activity, according with five sustainability dimensions: i) Landscape Ecology, ii) Environmental Quality (Atmosphere, Water and Soil), iii) Socio-cultural Values, iv) Economic Values and v) Management and Administration (RODRIGUES & MOREIRA-VINÃS, 2007). The rural establishment consists the spatial scale of evaluation, which is performed analytically and quantitatively by

the assessment of the effects of the rural activity onto each and all the indicators, and automatic calculation of sustainability indices expressed in utility values (0-1.0 scale, sustainability conformity level standardized at 0.7), according with appropriate weighing factors and best fit conversion models (RODRIGUES et al., 2006b).

Data required for filling out the APOIA-NovoRural weighing matrices were obtained in field surveys (aided by GPS, maps, satellite images, and field and laboratory analysis), and information on the managerial and administrative history of the rural establishment were provided by the farmer / manager, according with a structured questionnaire. At the conclusion of each assessment carried out with the APOIA-NovoRural System, an Environmental Management Report was issued to the farmer / manager, for his/her decision making towards minimizing negative impacts and maximizing positive ones, contributing for local sustainable development.

3. Study sites, local biofuels production programs, and institutional contexts[1]

Study sites were chosen according with specific socio-environmental dynamics for oleaginous crops production for biofuels, considering two main aspects: (a) the conformation of production associated with a well defined local market (industrial consumer) demand, under a (b) consistent productive arrangement provided by some locally organized multi-lateral program or project, coordinated by local interaction among different social actors (or mediators). When such productive arrangements are organized, enterprises perform an important role in determining the spatial reach of the project or program (PAIVA, 2004), by promoting agricultural production of its feedstock and mechanisms for access to raw materials and inputs, as well as for final product distribution. Hence, the presence of biofuels production companies was a requisite for the selection of the local productive arrangement to be studied.

Cássia (Minas Gerais State): at 741 m altitude and 20°42'04" Latitude South and 46°52'24" Longitude West, in the ecological domain of the Atlantic Rain Forest, the municipality houses "Soyminas Biodiesel Derivado de Vegetais Ltda.", partner with the local Prefecture and associated family farmers, of the "Sowing Biodiesel" Project, celebrated in 2005 to stimulate no-till rapeseed crop association with the maize main culture of the region. The socio-environmental impact assessment of this project (and insertion in the biofuels production chain) with the locally involved mediators was carried out in a February 2007 Workshop held at the local Prefecture, and was followed by the sustainability assessment of two rural establishments (A and B) partaking of the "Sowing Biodiesel" Project. Establishment A (12 ha) is dedicated only to maize production (10 ha) with rapeseed rotation in no-till management. Establishment B (48 ha) produces maize (40 ha), half of which currently under no-till rotation with rapeseed. Other productive activities include some animal husbandry (poultry and milk cows) and a small orchard, for self-consumption only.

São Raimundo Nonato (Piauí State): this section of the study included actions in Teresina Municipality (biofuels production chain socio-environmental impact Workshop) and São Raimundo Nonato (rural establishment sustainability assessment). The mediators' Workshop was held at Embrapa Meio Norte Unit in February 2007, and was followed by the sustainability assessment (establishment C) in S.R. Nonato, located at 403 m altitude and 08°56'18" Latitude South and 42°45'12" Longitude West, in the ecological domain of the semi-arid Arboreal Caatinga. The context of this section of the study is the Project "Integrated

[1] A Territorial Workshop was also carried out in Catanduva (SP), but no rural establishments were included in that stage of the research (see RODRIGUES et al., 2007).

and sustainable development of castor-oil agribusiness in the Piauí semi-arid", coordinated by Embrapa Meio Norte Unit and involving the family farmers of a Bank of Northeast's rural colonization project, and the Micro and Small Enterprises Support Service of Piauí (SEBRAE-PI). Most of the castor-bean production from this area is destined to Brasil Ecodiesel Ltda. in Floriano (PI) and Crateús (CE). The rural establishment selected for the sustainability assessment (23 ha) currently cultivates castor beans in association with bush beans in 3 ha as the main activity, with some maize and cattle raised in the collective area of the colonization project. Most of the area consists of fallow and caatinga secondary growth, without economic production.

Irecê (Bahia State): the socio-environmental impact Workshop in the context of the local biofuels production chain was held at the CODEVASF Headquarters in March 2007, considering the "Castor Bean Varieties and Crop Rotation / Association Coordinated Program", carried out by Embrapa Cotton, CODEVASF-BA, and the "Cooperativa de Produção e Comercialização da Agricultura Familiar" (COOPAF). Most of the regional castor bean production is sent to Brasil Ecodiesel Ltda. in Iraquara (BA). The rural establishment (D) selected for sustainability assessment of castor bean production for biofuels, representative of this aforementioned Program, is located in the neighbor municipality of América Dourada, at 798 m altitude, 11°21'48" Latitude South and 41°33'42" Longitude West, in the ecological domain of the semi-arid Arboreal Caatinga. The rural establishment studied is a 50 ha tenancy (under long term, shared production and risk contract) without any infrastructure, sown with castor bean associated with bush beans or maize, crops annually defined according with market demand. The current crop situation studied consisted of castor bean only, with atypical spacing, for the bush bean crop had been lost to the season's severe drought. The plot shows no natural habitats (or Legal Preserve).

Belém (Pará State): this study area included Belém and Santo Antônio do Tauá municipalities, focusing the production chain of palm oil for biofuels, under the institutional arrangement of the "Programa Paraense de Incentivo à Produção de Biodiesel – Parábiodiesel". The socio-environmental impact assessment Workshop in this territory was held at Embrapa Oriental Amazon Headquarters in March 2007, involving the most important institutional mediators concerning the management, research, rural extension services, and production of palm oil in the region. The sustainability assessment was carried out in a diversified rural establishment (E), with around 70% of its area under oil palm plantation, located in Santo Antônio do Tauá, at 54 m altitude, 01°06'13" Latitude South and 48°07'34" Longitude West, in the ecological domain of the Equatorial Amazonian Rain Forest. The rural establishment studied (275 ha) has 192 ha under oil palm plantation, with a diversified productive base, including black pepper (28 ha), açaí palm (28 ha), lemon (5 ha), papaya (5 ha), cupuaçu (2 ha), pineapple (2 ha), noni (5 ha), and woods (5 ha distributed among neem, teca, mahogany and Gliricidium). Only 2.5 ha correspond to native forests in the establishment, notably occupying the permanent preservation areas shoring a small stream. Some small animals production is carried out for self-consumption.

4. Results and Discussion

Integrated territorial and oleaginous crops socio-environmental impact assessment

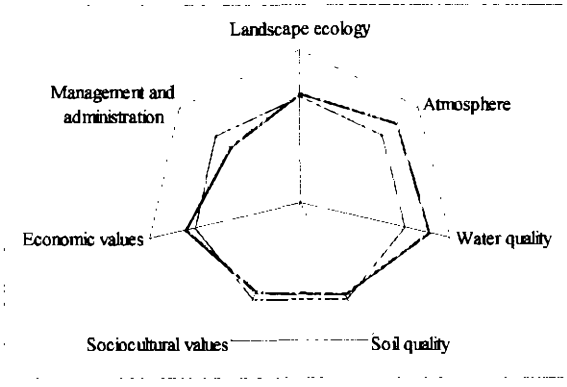
When the results of the socio-environmental impact assessments were integrated, combining all the territories and oleaginous crops studied, considering the context of expected expansion in oleaginous crops demand for biodiesel production, a similar trend was evident for all territories, concerning the set of Criteria and Indicators of the Eco-cert.Rural System, especially when the direction of impacts (whether negative or positive) was regarded.

Exceptions comprised only (i) a positive impact on the use of inputs and resources for rapeseed production in Cássia (due to rotation integration with maize in no-till management system); (ii) some divergence regarding impacts on the atmosphere; and (iii) a negative impact on soil quality in Irecê, due to the higher level of input application already in place in this technologically more intensive region (RODRIGUES et al., 2007).

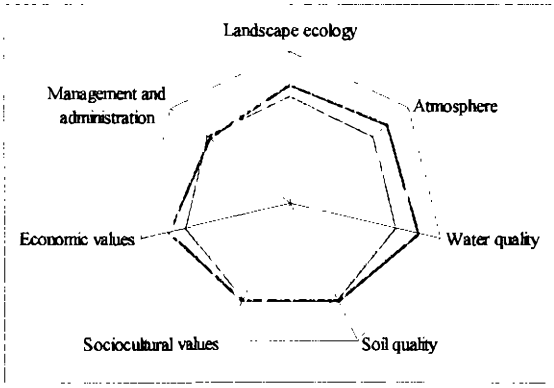
According with the assessment provided by the territorial mediators, the increasing demand imposed by the biofuels production chain is to engender important management intensification in all the studied oleaginous crops and territories, boosting consumption of inputs (with associated risks onto water quality), natural resources, raw materials, and energy. Some controversy occurred among mediators regarding impacts on the atmosphere. On the one hand, greenhouse gases emissions may increase at the establishments scale, due to machinery use intensification; but on the other hand, positive impacts may ensue from fossil fuels substitution by biofuels. Important improvements in soil quality are associated with the oleaginous crops, given the productive integration / crop rotation / adoption of good management practices / degraded soils reclamation, which may have favorable effects on recovery of degraded areas and biodiversity conservation. It must be taken into account, nevertheless, that both the recovery of degraded areas and the incorporation of new ones (be those marginal or not) must be conditioned to acceptable levels of productivity, warranted by adequate management and technology adoption (BINDRABAN & CONIJN, 2007), with special consideration to inputs application and associated potential risks on waters, soils, and natural habitats (GILLER et al, 2007). Concerning the socio-economic and managerial Criteria and Indicators, the expected productive intensification shall cause very favorable impacts, improving farmers training and professional dedication, income generation and distribution, investment levels and land valorization, better work qualification, and improved working conditions and employment quality; even though increased input application calls for care regarding workers occupational safety and health. Especially positive impacts are to be related with improvements in the management and administration indicators, such as farmer profile and dedication, commercialization conditions, and institutional organization (RODRIGUES et al, 2007). These prospective impacts at the production chain scale, whether negative or positive, were then examined against the current field situations observed at the smallholders rural establishments, in all studied territories.

Sustainability assessment of rural establishments dedicated to oleaginous crops for Biodiesel production

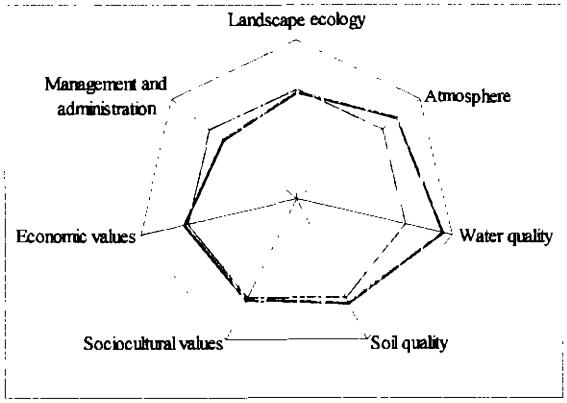
The field results obtained in the sustainability assessment of rural establishments in all studied territories, and concerning all oleaginous crops comprised in the present study, were shown to be in contrast with the tendencies pointed out in the impact assessments carried out at the biofuels production chain scale. Clearly, neither intensification nor demand pressure have yet materialized themselves onto the selected smallholders quotidian. With results equal to or above the conformity sustainability level defined by the APOIA-NovoRural System (0.70), all establishments showed important contributions of the oleaginous crops to sustainability, as well as evident opportunities for improvement, regarding the several sustainability dimensions and indicators evaluated. The general 0.73 mean sustainability index (Figure 1) resulted from near absence of negative impacts on the atmosphere, quite adequate water quality and generally favorable soil fertility improvements, and overall positive economic values. On the other hand, the Management and Administration indicators were below the sustainability conformity level for all establishments, pointing out where major opportunities are for performance improvement.



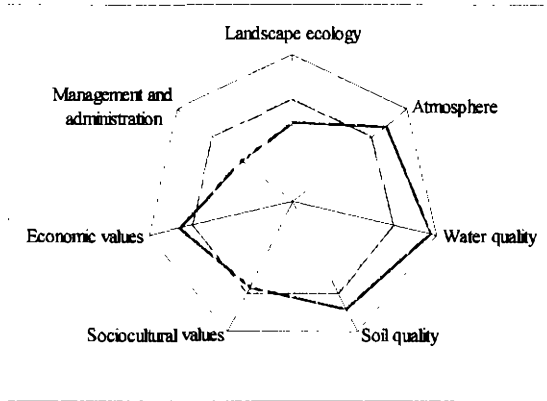
Establishment A, Cássia (MG)



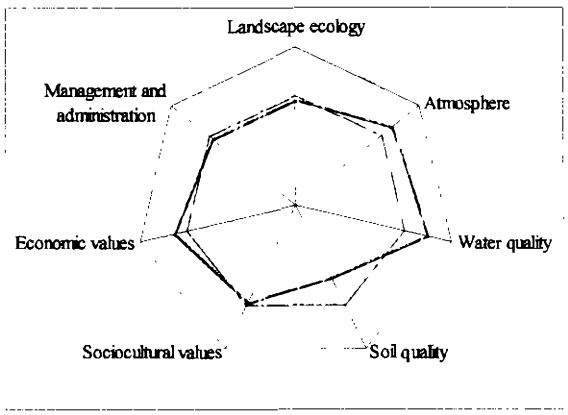
Establishment B, Cássia (MG)



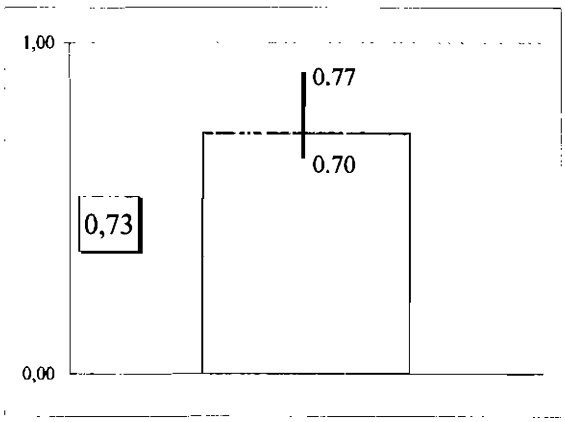
Establishment C, São Raimundo Nonato (PI)



Establishment D, Irecê / América Dourada (BA)



Establishment E, Belém / S. A. Tauá (PA)



Mean sustainability index, all establishments

Figure 1. Sustainability assessments of rural establishments dedicated to oleaginous crops for biodiesel production, according with evaluation dimensions of the "System for Weighed Environmental Impact Assessment of New Rural Activities" (APOIA-NovoRural).
Note: Results are mean values of indicators for each dimension. Red lines represent the (0.70) sustainability conformity level, blue lines represent assessment result indices, in a utility values (0 – 1.0) scale.

Establishment level analysis

Cássia, establishments A and B: both studied establishments reached positive final sustainability indices, with 80 and 88% of the APOIA-NovoRural indicators showing results above the baseline conformity level defined in the method, respectively for establishment A (sustainability index = 0,73) and B (sustainability index = 0,77). The local productive arrangement constructed under the 'Sowing Biodiesel' Project has been providing, on the one hand, improvements at the field level, contributing to productive efficiency by lowering the dependence on external inputs and resources, and favoring the recovery of soils and habitats, thus abating water contamination risks, while raising the living standards and economic security of participating farmers. On the other hand, by providing the institutional setting for cooperation among the several links of the biodiesel production chain, from the farmers to the agro-industry, the Project has strengthened the relationship of the different groups of interest, fostering the territorial sustainable development. Adding to these results, three general difficulties have been pointed out by the farmers, concerning their productive capacity: i) severe wild bird attack onto germinating seeds; ii) lack of certified seeds; and iii) severe losses (up to30 - 40%) during harvest, due to inadequate machinery.

São Raimundo Nonato, establishment C: the association of castor bean with the bush bean crop traditionally grown by the farmer, brought about by the "Integrated castor bean agribusiness Project", has contributed most favorably (and perhaps most importantly) for improvement of the Economic performance indicators (mean index = 0.73) of this very modest producer. With a whole 40% of all indicators below the conformity sustainability level (general index = 0.71), however, many opportunities are in place for improving this farmer performance, especially concerning the Management and Administration set of indicators (mean index = 0.60), with special reference to the Farmer profile and dedication indicator components (index = 0.50). Namely, the implementation of accountability (to manage resources) and planning practices should be emphasized in the technology transfer actions of the Project. Three main difficulties were named by the farmer: i) low value and excessive fringe costs (for minimum processing of the harvested beans) of the product; which engenders ii) inaccessibility to mechanization; and iii) to temporary workers for cultivation and harvest. An adequate solution could be access to credit directed towards acquisition of implements for animal traction, to be offered under the Project.

Irecê (América Dourada), establishment D: with 71% of all indicators above the conformity sustainability level of the APOIA-NovoRural System, this establishment presented important limitations regarding the Landscape Ecology dimension (mean index = 0.54), owing to its lack of any natural habitats and null productive diversity (castor bean production only); and Management and Administration dimension (mean index = 0.44), bringing the mean general sustainability index to a lower value (0.72), however above the conformity level. Both dimensions feeble performance were constrained by the land tenancy situation found in place, which discouraged the farmer's engagement to solve those particular deficiencies. This situation also influenced negatively some Socio-cultural Values important indicators (mean index = 0.65), such as deficient Employment quality (informality and lack of any fringe benefits, index = 0.30). These negative impacts were offset by excellent Soil quality and Economic performance indicators (mean indices = 0.82 and 0.79, respectively). Two main difficulties were pointed out by the farmer: i) the uncertainties of regional climate and ii) complete absence of credit lines.

Belém (Santo Antônio do Tauá), establishment E: this establishment presented the most homogeneous performance among the assessed sustainability dimensions (mean index = 0.70), with the smaller amplitude of variation for the indicators. Even though a whole 40% of

all indicators were below the conformity level of the assessment System, no less than six of the ten Soil quality indicators were well below the conformity level, biasing the results downward. This result owes itself to the orchards x oil palm plantation comparison for indicators assessment, which was justified because it is onto these orchards that oil palm is to be eventually expanded in the farm. High Productive areas management (0.97) and Productive diversification (index = 0.67) followed not from equitability of land use (70% under oil palm plantation) but from a valuable complement of other perennial crops (Shannon-Wiener index = 0.48), which favored other Landscape Ecology indicators, such as Natural habitats, Permanent Preservation Areas, and Threatened species protection. That same diversification was associated with good Economic Values performance (0.78). The farmer listed two important productive difficulties: i) very high costs for oil palm implantation, compared with current product value; and ii) severe losses imposed by the heart-of-palm-rotting disease.

Sustainability dimension analysis

When considering the environmental performances for the whole set of studied establishments, results show indices above or very close to the conformity level for the Landscape Ecology dimension of sustainability, except establishment D (Figure 1). Most favorable indicators for those other establishments were related with Conservation of natural habitats and Permanent Preservation Areas (APP), Productive areas management, and Degraded lands recovery. On the other hand, mandated Legal Preserve (RL) conservation was a problem for all except establishment C, for the Legal Preserve in its case is collective, legally defined for the whole colonization project. Also, Landscape diversity and Productive diversity were low for all except establishment E. This latter indicator is a measure of the farmers' capacity to face prices instabilities, in the potentially volatile market of plant oils.

Regarding both Atmosphere and Water quality indicators, quite favorable results were obtained in all establishments, while Soil quality was adequate, and improving under oleaginous crops management, for all except establishment E. All these indicators immediately directed to ecological performance (Landscape Ecology and Environmental Quality dimensions of APOIA-NovoRural) attested an adequate field situation (for the selected sample), opposed to the expectancy obtained in the socio-environmental impact assessments carried out in the territorial workshops, which expected productive intensification to be imposed onto oleaginous crops for biofuels, with ensuing increased use of inputs and natural resources, with negative environmental consequences. This apparent favorable situation calls for attentive management, to avoid imposition of expected negative impacts.

Feeble results for the Socio-cultural indicators pointed out the quite modest living conditions observed in most studied territories and establishments, only two showing results just similar the sustainability conformity level. Access to education, especially for the farmers; Opportunities for local employment, even if nonqualified; Employment quality, especially due to formality and social security observance; and Access to public services weighed favorably for this general result, while Consumption standards were modest.

The Economic Values dimension showed quite favorable results for all studied establishments, especially due to good performance relative to Income generation (considering security, stability and amount), Income sources diversity, and Land value, which concerned improvements in productive conditions and infrastructure, even if associated with increased Indebtedness level, the main negative indicator for the studied establishments in this sustainability dimension.

Contrarily to social actors expectancies, raised in the socio-environmental impact assessment workshops in all territories, the Management & Administration dimension of

sustainability showed the main performance weaknesses in all studied establishments, strongly so for A, C, and D. Here rest the most valuable opportunities for improvements to be brought by increased demand for oleaginous crops under the agro-energy context, for in general no heavy cash investments are required to obtain solutions – potentially low cost managerial, capacity building, and organizational ameliorations suffice.

For example, the Farmer profile and dedication indicator showed deficiencies as basic as total lack of any accountability and of any planning systems, indispensable items if smallholders are to find their insertion into market settings. The Commercialization conditions indicator pointed out deficiencies regarding current almost widespread dependence on middlemen, and lack of processing, storage, and productive integration conditions. The Residues management indicator showed common problems, mostly for domestic wastes; while residues from production are, for the best cases, just incorporated as soil amendments, without treatment, composting, or conditioning.

The Institutional relationship indicator showed as main deficiency the absence of continuous professional training for the farmers, possibly where the best potential for a performance shift lies. This is especially confirmed by the main positive results obtained in this same indicator, attesting the presence of technical assistance and extension, as well as research and development institutions with close ties with all farmers studied, registering the presence of several local Producers Associations, Municipal Secretaries, Embrapa, Emater, and Sebrae.

5. Conclusions

Regarding production of rapeseed, the positive socio-environmental impacts are corroborated by several known attributes of the plant: (i) fast and abundant growth even under winter conditions, out competing weeds; (ii) extensive, acidity resistant root system (up to 2 m), favoring deep recovery of soil nutrients (especially N and P); (iii) good acceptability as forage and fodder for ruminants, and early and abundant flowering, excellent for bee feeding; and (iv) tolerance to most pests and diseases (PEREIRA, 1998; BIODIESELBR, 2007).

In what concerns castor-oil, the high value for the fine chemistry industry, and the relatively low level of technology still present in Brazilian producing areas are important constraints to be circumvented to make the crop really viable for biodiesel production (MENDES, 2005; SEVERINO, 2006).

All favorable conditions contributed by the oil palm crop expressed by the social actors are also fully corroborated in the literature (MONTEIRO et al., 2006), whereas the positive points regarding degraded lands occupation and recovery by oil palm plantations must be resolved, in conjunction with incorporation of new areas and native forest felling in many regions of the world (ANNVELINK et al, 2007).

Even though each specific assessment has been constructed under its own environmental, managerial, and productive context - abating the meaningfulness of comparisons - the mean Sustainability Index obtained for the sample is a measure of the influence of the territorial projects' to the environmental performance of the establishments. This general conclusion, applicable to all regions and crops studied, has been corroborated in the literature (HAVERKORT et al., 2007) by the argument that, more than a matter of which crop or environmental setting, it is the local productive arrangement that defines the tendency of impacts caused by integration of oleaginous crops into agro-energy production chains.

6. Acknowledgements

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