Management of *natural resources*

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A note by

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THE THEMES social responsibility and environmental conservation are gaining increasing importance at various levels in institutional development agendas. In this context, it seems increasingly necessary to create, select, adapt, transfer and evaluate environmental management procedures. This dynamics of innovation in management processes should be focused first of all on farming activities, given their impacts at the spatial level and on all natural and human resources.

With the aim of attaining this sustainable development objective, society must make use of and reward farmers and agricultural production sectors that perform steering adapted to natural resources and the productive environment. This must be considered as an incentive for the promotion of sustainable development, a reward for the environmental services rendered by these growers and production sectors with awareness of environmental protection.

Environmental management systems for farming activities must make it possible to recommend suitable agricultural practices for improving social and environmental performance. In order to encourage producers and representatives of agricultural production sectors to promote technological conversion and the adoption of sustainable steering practices, environmental impact systems have been developed along two lines of research used by the Labex Europe team for environmental impact assessment:

- The modelling, analysis and understanding of interactions between management practices and environmental quality: models have been developed to calculate the vegetation indices of deciduous crop plants using remote sensing.

- Evaluation of the performance of rural activities as regards environmental management: an environmental management method combined with a sustainability index has been developed for palm oil production. Mention can also be made of the design of a performance indicator system for agroforest management in humid tropical zones and the setting up of a methodological platform for evaluating energy and economic performance of the banana sector in Guadeloupe.

These two lines of research are summarised below through descriptions of the main cooperation initiatives, the results obtained and the scientific and technological prospects of the theme.

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INTERVIEW

'The results have been very positive'

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Marc Voltz, *Director of the Laboratoire d'étude des Interactions Sol-Agrosystème–Hydrosystème (LISAH, Laboratory for the study of soil– agrosystem – hydrosystem interaction), a joint research unit that hosted a Brazilian researcher for three years, gives us his opinion of Labex Europe.*

1. Did you work in collaboration with Brazil in general and with Embrapa in particular before a Labex researcher joined your team?

We had previously hosted Brazilian doctoral students and visitors, including an Embrapa researcher. But this was not organised within a formalised framework like that of the Labex.

2. What conclusions do you draw from the experience? What has this collaboration contributed to your team?

José Madeira, the Embrapa researcher, spent more than two years with LISAH. He came with a precise idea that he explained to us and that we developed with him. This concerned the spectral reflectance of soils that can be observed by remote sensing to map soil properties, knowledge of which is extremely limited at the world level— Brazil and France included.

Environmental management: the activities of Labex Europe

■ Modelling 'Management practices – Environmental quality' interactions
Models were developed to calculate vegetation indices of deciduous crops (vines) using remote sensing. They can simulate complex systems (micro-basins with intensive agricultural use of land) to describe and characterise water flows, the associated inputs and the impact of management practices.

■ Integrated index of the sustainability of palm oil crops
An environmental management method integrated with a sustainability index was developed for palm oil cropping in the form of collaboration between CIRAD and Labex: APOIA-Dendê (support for palm oil growing). The system incorporates 62 indicators with five sustainability dimensions: i) landscape ecology, ii) environmental quality, iii) sociocultural values, iv) economic values, and v) management and administration. This evaluation tool was tested in the Belém region in Brazil and then in large estates and smallholdings in Indonesia to verify its appropriateness in contrasted production contexts. The system has been presented at various workshops as a decision aid for preparing holdings for certification *(Round Table on Sustainable Palm Oil)*. This sustainability index is the subject of international negotiation for the improvement of the palm oil sector. It could be used for similar initiatives and other production sectors (e.g. soybean).

■ Performance indicator system for traditional agroforestry (TAPIS)
Agroforests form complex agro-sylvo-pastoral formations in humid tropical zones. Agri-environmental indicators can help producers to take management practice and technology decisions in order to improve these farming systems. The TAPIS indicator system was developed (CIRAD-Labex collaboration) within the ATP-Caresys project on 'Characterisation and evaluation of the agroecological performance of associated cropping systems in the humid tropics' using data from 38 Cameroonian agroforestry systems. The system incorporates eight agroeconomic performance indicators and eight agroecological indicators; these are used to classify holdings and to make recommendations designed to improve sustainability (priorities as regards investments, working time, etc.).

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▲ *Participants at the workshop on the environmental management of palm oil growing (PT Smart Research Institute, Libo, Indonesia, November 2008).*

■ Methodological platform for the evaluation of sustainability (SAMeFrame)
H. T. Odum's 'environmental accounting method' provides a systemic approach in which productive inputs (materials, energy, labour, etc.) are evaluated in their respective units and integrated in a common unit (joules of solar energy). The costs and impacts resulting from the deterioration of resources are converted into indices that describe the overall sustainability of the system. The methodological platform *SAMeFrame* was developed as part of the programme *Environmental Accounting, Sustainability Indicators and Environmental Management of Rural Activities* (Labex/INRA collaboration) to study the energy and economic performance of the banana sector in Guadeloupe. The environmental and economic determinants of farming systems in Guadeloupe were found to be excessively dependent on imported industrial inputs. Improving the environmental performance of banana production in Guadeloupe therefore requires the adoption of innovations in environmental management (e.g. the recycling of nutrients).

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The results were very positive and stimulated the continuing of this line of research. While José Madeira was posted in Montpellier, we also organised the first international workshop devoted to digital soil mapping, an event attended by several Brazilian researchers.

3. Now that the Brazilian scientist has returned home, is there any follow-up and/or consequences in terms of partnerships between your team and Brazilian institutions?

After José Madeira's stay, we planned to develop a joint project with Embrapa on the environment assessment of the impacts of growing sugar cane, an activity that is increasing world-wide and in Brazil as a result of the need for biofuels. Several preparation missions have been conducted and have resulted in the construction of a first version of the project, including an Embrapa and Campinas University (São Paulo state, Brazil) laboratory.

However, the project is currently on hold as it is difficult to find an experimental site that corresponds to all the scientific and operational criteria desired.

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The Brazilian scientist hosted

José Madeira (Embrapa) stayed for nearly three years at the LISAH (April 2002-February 2005) to study the contribution of the spectral reflectance of soils in the mapping of soil properties.

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The host laboratory

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