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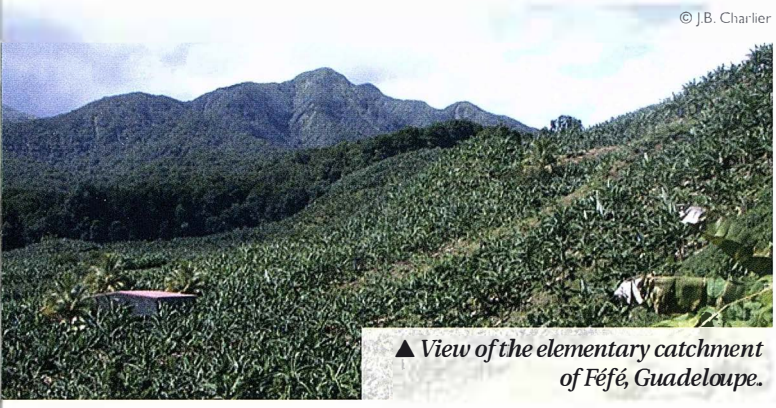
Persistent soil pollution and health safety of horticultural pesticides–a case study of chlordecone in the West Indies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▲ *View of the elementary catchment of Féfé, Guadeloupe.*

Chlordecone is an organochlorine pesticide that was used from 1971 to 1993 in the West Indies. This molecule is stable and continues to persist in the environment, resulting in chronic contamination of the environment and certain crops. Little is known about the dispersion mechanisms of this pesticide, which is highly adsorbed on soils with elevated organic matter contents under humid tropical climatic conditions. The first part of this study deals with factors determining the release of the molecule in the soil profile and its transfer into groundwater. Chlordecone adsorption and desorption have been analysed for different types of soil according to the quality of their organic matter contents and characteristics of the mineral phase. The intensity and dynamics of chlordecone migration into groundwater were modelled according to the soil properties and climatic events.

The second part of the study investigates key factors in the contamination of rivers on a catchment scale. In Guadeloupe, *in situ* measurements (rainfall, river flow, piezometry) define the hydrological functioning of elementary and resource catchments. These are complemented by the analysis of soil pollution and pollutant monitoring in water resources (groundwater and rivers). Pollutant transfer pathways and dynamics will be simulated by modelling. Finally, transfer of the molecule from the soil into crops is measured on different scales in order to gain further insight into the pathways and factors responsible for such transfers within plants. Data integration has led to the development of management tools to predict health risks and identify the main areas of origin of this pollution, and changes in the pollution pressure over time. They enhance environmental management by all stakeholders in the region, thus reducing exposure risks for inhabitants. These studies are being carried out by the CIRAD research units HortSys and Banana, Plantain and Pineapple Cropping Systems, INRA Guadeloupe, UMR LISAH, IRD Martinique and the Agrosphere Institute (Jülich, Germany), within the framework of the French *Plan National Chlordécone et de Chlordexco (Contaminants, Écosystème, Santé project of the Agence Nationale pour la Recherche,* France).

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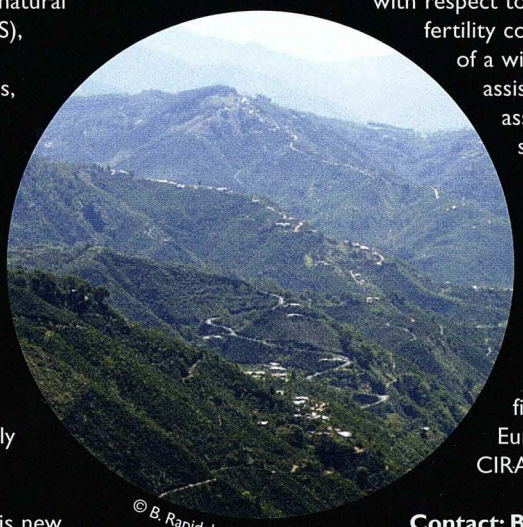
Impact of coffee-based agroforestry systems on water quality and in reducing erosion phenomena

Cropping systems have been widely assessed for their production capacity and impacts on natural resources. Agroforestry systems (AFS), in which several plant species are intercropped in a plot, including trees, can successfully meet these two challenges. Generally AFS, especially those based on tree crops like coffee, are very widespread in Central America. Many research studies have aimed at improving their agricultural performances, while many others have also now focused on the environmental services provided by AFS.

In coffee-based AFS, shade is generally planned and managed according to its interaction with the coffee crop. The challenge is thus to integrate this new feature (and possible associated funding) in AFS decisionmaking processes to enhance environmental service provision. In a small valley where coffee plantations prevail in the best coffee production area in Costa Rica, research is under way to pinpoint areas for improving coffee production, interactions between coffee plantation practices and erosion and, finally, between compromises and complementarities with respect to coffee production, erosion and soil fertility conservation. This research should be part of a wider negotiation between stakeholders, assisted by computer models to enhance the assessment of quantities of environmental services provided by coffee growers, the willingness of users to pay for services, and the willingness to provide services according to incentive schemes (SEPIA project submitted to the *Agence Nationale de la Recherche*, France). The hydrological system modelling is based on the research of INRA and CIRAD. The coffee system modelling is based on findings of the CASCA* project, a former European project conducted jointly by CIRAD, CATIE** and CEH***.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* Sustainability of coffee agroforestry systems in Central America; coffee quality and environmental impacts / ** *Centro Agronómico Tropical de Investigación y Enseñanza* / *** Centre for Ecology and Hydrology

▲ *Llano Bonito valley, Tarrazú region, Costa Rica.* Trees are generally intercropped with coffee, in highly variable proportions.