67 Biodiversity-based livelihoods in the *ceja andina* forest zone of northern Ecuador: multi-stakeholder learning processes for the sustainable use of cloud forest areas

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ABSTRACT

In the northern part of the Ecuadorian Andes, people are not profiting from the benefits that biological diversity may yield, and highland ecosystems continue to be deforested. At present, this trend is not likely to change due to a regional economy driven by an intensive potato–dairy production system. In highly populated areas, only few remnants of the uppermost forests, the *ceja andina* (a type of sub-alpine montane cloud forest), survive. Due to the implicit spatial relationship between the agricultural zone and the remaining forest area, and the disconnectedness of the rural population to the forest, a change in attitude is required toward more sustainable agricultural production systems and use of biodiversity if forest conservation is to be achieved. This chapter describes and evaluates the change in attitude of a wide range of stakeholders with respect to alternative production systems and forest conservation. Endogenous learning processes were facilitated within farmer communities through the establishment of learning centers in which two participatory learning and research methodologies were applied. The two methods resulted in acceptable participation and adoption by local farmers. Results showed a visible change toward less contaminating and more diverse production systems and the formation of institutionalized commercialization of organic produce and non-timber forest products. Local government-led inter-institutional and social learning processes were also facilitated. The process has been successful in one municipality where decision-makers and municipal staff showed high motivation and increased technical capacity, but not in another municipality where such capacity was lacking. The second municipality suffered from constant staff turnover as well as differing concepts and strategies regarding natural resource management. Outcome Mapping proved to be a useful tool for evaluation of the entire learning process and for the promotion of concerted action by different stakeholder groups.

INTRODUCTION

The northern Andes is one the most diverse eco-regions of the world due to the presence of a broad variety of ecosystems within a relatively small area (Dinerstein *et al*., 1995; Barthlott *et al*., 2005). Nevertheless, land-owners are not profiting optimally from the variety of benefits that this high biologic diversity may yield (cf. Báez *et al*., this volume). In the Province of Carchi in northern Ecuador, an economy based largely on mono-cropping has resulted in continued conversion of fragile upper montane and sub-alpine ecosystems – including the stunted forest type near the tree-line called *ceja andina* and the adjacent herbaceous *páramo* vegetation – to make way for cultivation and pastures (Crissman *et al*., 1998). The *ceja andina* (literally: Andean eyebrow) is a zonal type of tropical montane sub-alpine cloud

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forest (*sensu* Bruijnzeel and Hamilton, 2000; cf. Grubb, 1977) found originally between the tall upper montane ("Andean") cloud forest belt below, and the *páramo* above, typically at elevations between 3500 and 4000 m.a.s.l. (Hofstede, 1995; Wille *et al*., 2002).

The zonal vegetation type to which the *ceja andina* belongs once extended (practically uninterrupted) on all sides of the tropical Andean Cordillera, from Venezuela down to Perú and Bolivia (Acosta-Solis, 1977; Kessler, 1995; Kappelle and Brown, 2001). However, altitudinal expansion of agricultural activities has resulted in large-scale clearance of the upper montane forests (cf. Mosandl *et al*., 2008; Baez *et al*., this volume; Mulligan, this volume) whereas the *páramo* is frequently burned, thereby diminishing the upper limit of the *ceja andina* (Laegaard, 1992; Hofstede, 1995) and impairing local hydrologic functioning (Buytaert *et al*., 2006). Due to this pressure from both sides, only 5–10% of the original *ceja andina* now remains as small scattered fragments in Ecuador, Perú, and Bolivia (Kessler, 1995; Sarmiento and Frolich, 2002; cf. Beck *et al*., 2008).

The remaining small forest remnants do not constitute an important resource for local people. Post-forest land management is typically unsustainable. After a highly productive first year, soils suffer from fertility decline through erosion whereas harvests decline due to gradual resistance of pests, thereby causing increased dependence on agrochemical inputs. Farmers continue to clear the remaining pristine Andean forests and step up their investments in pesticides in order to maintain or increase crop yields so as to allow for the continued payment of labor and agrochemicals. However, low potato prices due to overproduction, lack of alternative income sources, and severe health problems related to the use of highly toxic pesticides have led to a search for alternative practices. Such alternatives should take both the ecological constraints of the land and the need for a decent livelihood into account (Crissman *et al*., 1998; Yanggen *et al*., 2003).

Previous studies in the Ecuadorian Andes have shown that supporting biodiversity-based livelihoods by creating alternative, more diverse production systems present a viable opportunity to curb negative social, environmental, and economic impacts on the forest as well as the local population (Kenny-Jordan *et al*., 1999). Differentiation of crops decreases the dependence on the high investments typically associated with intensive agriculture and unstable market prices. Low-investment crops may improve public health and lessen environmental contamination, whereas less expansive production systems may decrease the pressure on the last remnants of *ceja andina* forests (Yanggen *et al*., 2003). To plan and promote alternative production systems such as agro-forestry, family orchards, value-added production chains, and organic horticulture, two key factors need consideration: (i) local stakeholders need to learn what are the unsustainable factors of their present production systems, and to recognize the strategic value of the natural vegetation, and (ii) farmers, in collaboration with other key actors (local government, NGOs, researchers, and citizens in general) need to change their attitudes toward such production systems (Kenny-Jordan *et al*., 1999; Braun *et al*., 2000; Rist *et al*., 2003; Yanggen *et al*., 2003).

The goal of the current study was to examine the behavioral changes of farmers, from the current intensive potato–dairy-based production system toward alternative forms of livelihood, including biodiversity-rich forms of agriculture and sustainable use of forest remnants. To facilitate this behavioral change, the project developed: (i) a knowledge base of people's dependence on biodiversity and on their interest to preserve and recover the High Andean forests (Báez *et al*., this volume), (ii) endogenous learning processes based on biodiversity-rich production systems including sustainable use of forest remnants, and (iii) an inter-institutional social learning process, led by local governments. These were considered key features for establishing a dialogue among key actors, for achieving engagement in and consensus regarding natural resource management and forest conservation, as well as the creation of policy instruments to support such action.

The present chapter concentrates on the intermediate results of the endogenous learning and inter-institutional processes. It demonstrates concerted action and allows some conclusions regarding behavioral change of the stakeholders after one year of project implementation. The more complete results presented by Ambrose *et al*. (2006) are incorporated to demonstrate the outcomes of the process once the initial behavioral change was consolidated.

STUDY AREA AND METHODS

This study was carried out in the Life Zone originally covered by *ceja andina* at elevations of 2800–3700 m.a.s.l. in the Andean region of Carchi Province in northern Ecuador (Figure 67.1). General background information on the climate, vegetation, and biodiversity of this area is presented in Báez *et al*. (this volume). Several *ceja andina* forest remnants of considerable extent have been preserved in the Carchi area. In addition, there are farmers willing to experiment with natural resource management whereas there is previous experience with community-based natural resource management initiatives (Frolich and Guevara, 1999; Poats, 2001). This provided an apt and attractive context in which to explore and develop biodiversity-based livelihoods that could complement or even replace non-sustainable, high-input production systems.

The project's strategy was two-fold: (i) participatory research initiatives in learning centers which allowed for endogenous learning, and the exploration of various production alternatives through hands-on experience with biodiversity-rich forms of

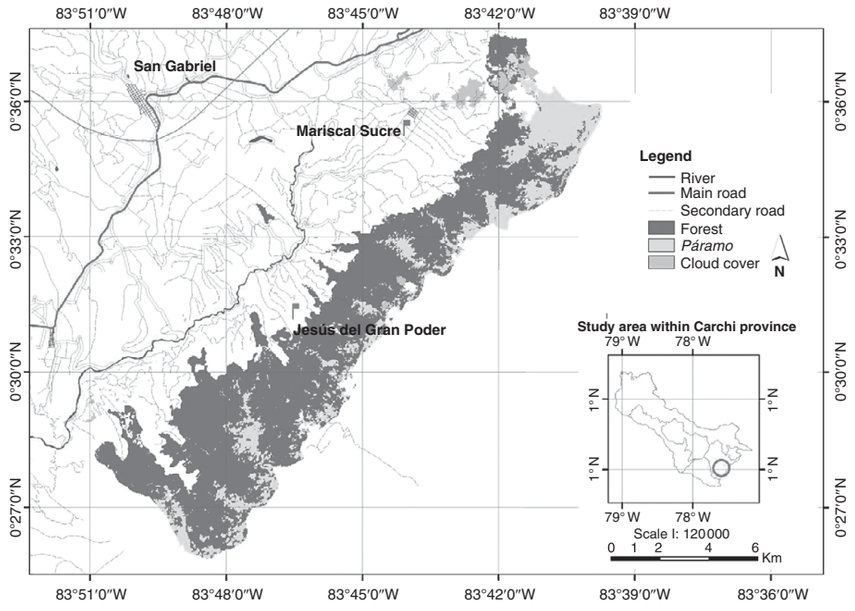

Figure 67.1. Map of the study area in northern Ecuador (Eastern Andean Cordillera, Carchi Province), indicating the present cover of *ceja andina* and *páramo* on the inter-Andean side of the Andes. (See also color plate.)

agriculture; and (ii) facilitation of social learning platforms for inter-institutional dialogue and concerted action, with a focus on local government and the construction of policies focusing on natural resource management. Because the examination of behavioral change toward the sustainable use of the *ceja andina's* agro-biodiversity was the primary goal of the study, Outcome Mapping (OM) methodology and tools were applied to measure such change among various stakeholders. OM is an innovative monitoring and evaluation tool that incorporates learning and reflection into development programs to analyze – through open and closed interviews, surveys, and focal groups – behavioral change in stakeholder groups and their relationships to their natural, social, and cultural surroundings (Earl *et al*., 2002; Watts *et al*., 2003).

Since unsustainable agricultural practices form the main threat to the *ceja andina* forest, farmers and farmer groups were considered key stakeholders in the promotion of sustainable resource management. In addition, it was recognized early on that learning processes must extend to a wider audience of stakeholders and decision-makers, and that each group should have their own social learning spaces. A stakeholder analysis (Conway *et al*., 1998; Biggs *et al*., 2004) was carried out to identify the interrelations between all local governmental and societal groups and their direct and indirect relationships with the *ceja andina* forest. Next, the project identified the various stakeholder groups that were to participate actively and whose behavioral change was to be studied (the so-called "boundary partners"; Earl *et al*., 2002). These included two municipalities and the provincial council, as well as the non-governmental municipal assembly. Furthermore, two farmer associations, two rural environmental clubs, one rural farmer youth club, three entire communities (involved in community management plans), six groups of farmers from six watersheds, two Water Boards, two parish boards, four locally-based NGOs (including one regional network), two rural schools and one urban school, one mixed-community group (group of community trainers), and one large land-owner were involved.

Social learning spaces were identified and facilitated for each individual stakeholder group. These spaces could be formal or informal meetings, field events associated with implementation and evaluation of the participatory methodologies for farmer experimentation, gatherings of youth clubs, etc. The main condition for defining an effective learning space for each stakeholder group was that it should allow the development of dialogue, consensus, and strategic action with respect to natural resource management within the *ceja andina* Life Zone (cf. Maarleveld *et al*., 2002; Röling, 2002; Rist *et al*., 2003).

Learning centers to facilitate different participatory methodologies for farmer experimentation and research were developed in two villages: Mariscal Sucre, a parish of the municipality of Huaca, and Jesús del Gran Poder, a parish of Montúfar (Figure 67.1). Participatory methodologies included Farmer Field Schools (FFS) and Local Agricultural Research Committees (commonly known by their Spanish acronym, CIAL). The focus of FFS is on ecological literacy: farmers engage in problem-oriented discovery with the support of facilitators, who base

learning on a diverse range of activities, as farmers exchange ideas, share experiences, and make their own decisions regarding crop production (Braun *et al*., 2000; Borja, 2004; Van den Berg, 2004). In the CIAL participatory research methodology, participants decide what they want to test and apply this in an experimental plot, including replica and control (Ashby *et al*., 2000). During the process, participants at each learning center identified their interests and learning goals, and chose their research methods. Because of the initial focus of local interest in agricultural systems, the process started with learning to develop more biodiverse and less chemical-dependent agricultural systems. This was considered a first step toward more diverse livelihoods options on the one hand, and toward less direct pressure on the forest on the other (through diminished need for expanding intensive agricultural systems). After this initial phase, participants started to experiment with agro-forestry and the use of non-timber forest products as the next step toward better valuation of biodiversity and forest conservation (Ambrose *et al*., 2006).

RESULTS AND DISCUSSION

Endogenous learning processes

The learning centers proved to be a promising platform that enabled small-scale farmers to lead the development of alternative production systems. Prior to the start of the participatory process, a few young farmers that were still helping out on their parents' farms showed an interest in crops other than potatoes or were open to production systems involving lower pesticide usage. However, adult farmers were reluctant to change. During stakeholder analysis in the town of Mariscal Sucre, only two farmers out of 25 were interested in changing their production system. On their farms, two participatory research plots were established; one FFS and one plot with a CIAL. Once these two farmers had decided to set aside a piece of land for on-farm investigations, other farmers became interested in participating as well. After the FFS was implemented, 21 (adult) farmers participated actively in its implementation, whereas a local previously existing environmental group of 10 (young) farmers participated in the CIAL. In the village of Jesús del Gran Poder, 14 members of a farmer youth group participated in a CIAL that explored the production of native Andean crops and agro-forestry systems. At a later stage, the project developed an FFS in agro-forestry with a total of 18 participants from both communities.

Farmers initially decided to investigate integrated pest management (IPM) during potato cultivation, so as to better determine alternatives for the prevailing high-intensity management of certain pests and diseases. Some 21 farmers had an interest in IPM, a number that remained more or less stable during the first cropping cycle of 6 months. A field day organized by the project for the exchange of experiences with other farmers, other communities, and other stakeholders was attended by approximately 50 people. The FFS methodology was useful in that it continuously involved farmers in alternative production systems, sparked regular reflection, evaluation, and discussion, and led to the adoption of alternative practices by other groups. After two production cycles, at least 15 farmers from the village were observed to apply IPM in large parts of their potato fields, and outside the FFS plots. In addition to the people's perception of having a cleaner production system, the observation that IPM required less financial investment and gave a higher economic return (1.69) than did conventional practice (1.46) was decisive for the adoption of the improved practice (Ambrose *et al*., 2006). A drawback of the FFS approach in the present case was that its initial objectives were not very novel and its goals formed only a minute contribution toward the development of a more biodiversity-based livelihood. Rather, it should be considered a small initial step toward a long process toward attaining "ecological literacy," which would finally lead to awareness of the values of, and concrete action toward, the conservation of the cloud forest remnants.

The CIAL approach was initially used to test various non-traditional fodder and food crops, such as legumes, native Andean tubers, grains, and fruits, household crops (vegetables and fruits), and medicinal and aromatic plants. This methodology proved to be most successful with younger farmers (who, in contrast to their parents, generally had secondary education), mostly because of the relatively quick results. Some of the tested food and fodder crops were immediately adopted in the family orchards of 60% of the participants (e.g. *Vicia* for small household animals, medicinal plants and native potato varieties for own consumption). Compost made of the organic waste of these crops was applied for potato field recuperation during the second year of experimentation (Ambrose *et al*., 2006). During a second stage, the CIAL plots included native trees and medicinal and aromatic plants extracted as seedlings from the forest. Although the CIAL initially also focused on farming systems – rather than on the actual use and conservation of the forest – the change toward more diverse agricultural systems was more explicit than in the FFS approach whereas progress toward actual forest conservation goals might be more realistic.

After three years of implementation of the learning centers, farmer participation reached a constant level and there was a lively interchange of ideas between the CIAL and FFS participants (Ambrose *et al*., 2006). Innovative ideas for alternative production systems were implemented at the household scale. Specific attention was paid to post-harvest practices and market access. As a tangible result, a cooperative (APRONOR) was formed by the participating farmers which processed and commercialized organic crops (vegetables, fruits), consumer products (marmalade, handicrafts), and medicinal and aromatic plants

(dried mixtures, teas). These products originated from the participants' fields (vegetable and fruit) as well as from the forests (non-timber forest products). The municipality of Montúfar collaborated by providing free space at the weekly market in San Gabriel (the local capital town). Motivated by these positive results, the young farmers group volunteered to involve local schools in the learning centers. Environmental education in relation to organic farming and forest conservation is now a reality in all schools of the two villages and in San Gabriel (Ambrose *et al*., 2006).

In general, both methods applied in the learning centers proved to influence awareness of local farmers and helped to involve them in alternative production systems. The participation level was average but constant: 21 farmers during the first round of FFS (potato) and 18 in the second round (agro-forestry). A typical FFS usually involves between 15 and 25 farmers vs. 8–10 for a CIAL (Van den Berg, 2004). However, the type of participants differed between FFS and CIAL: adult farmer–landowners were more attracted to the FFS and its study object of potato crop protection, whereas young farmers without a family of their own tended to get more easily involved in alternative cropping systems and the faster results associated with the CIAL. A drawback with both methods was that they required a relatively long period to actually change the daily practice of the farmers. Nevertheless, change was actually observed already during the first year of implementation, something which should be considered as being a critical indicator of the potential of the two methodologies with respect to changing the behavior of local farmers toward more final conservation goals. The final result of the process showed that this change was continued and expanded to other farmers, another municipality and other schools. These participatory research and training approaches proved to be a necessary element in establishing endogenous knowledge creation processes, and therefore a key element and a first step toward more sustainable natural resource and forest management. However, due to their slow effect on tangible change, complementary activities for conservation should be considered, including academic studies on natural resource management, policy debate, and development, forest restoration strategies, direct and indirect financial incentives for forest conservation, and stimulation of market opportunities for diverse produce.

Inter-institutional social learning process led by local governments

Complementary to the local processes with farmer "boundary partners," formal support for conservation of the *ceja andina* forest remnants was obtained by taking advantage of existing platforms as social learning spaces. Two of these were the *Mancomunidad de Carchi* – the joint meetings on environmental issues of the local governments – and the municipal assembly, a platform of non-government entities. In addition, new opportunities were created in collaboration with local actors in the form of an informal monthly multi-stakeholder platform to discuss issues regarding *ceja andina* management (the so-called *Plataforma Ceja Andina*) with the local government, NGOs, and farmers.

One of the key stakeholder groups were local governments, particularly the municipalities to which the villages of the study area pertained. In Huaca (Carchi's youngest municipality), no official Environmental Unit had yet been created and it proved difficult to change attitudes within the municipality toward conservation strategies, also because of constantly changing personnel and differing concepts and strategies regarding the natural resource management. Conversely, in Montúfar – a more established municipality with a well-functioning Environmental Unit – the project was received immediately, and the municipality became its strongest ally throughout the implementation process. Municipality staff actively collaborated in the selection of communities and farmers, field studies in forest and farm areas, and decision-making on project activities. Within one year, they started to support the organization and financed the *Plataforma Ceja Andina*.

Initially, the decision-making bodies like the Mayor and the Municipal Council of Montúfar did not show an active interest in the conservation process. However, when the Municipality became aware that small but significant activities were being successfully executed, it began to assist official community meetings and visit learning centers. In doing so, the Mayor and Council became aware that environmental activities indeed received public support and as a result they began to prioritize conservation projects within their municipality. After one year of contact with the Municipality of Montúfar, a *ceja andina* conservation strategy was applied to all the forests under their jurisdiction and direct investments were made to protect a communal forest reserve (*Bosque de Arrayanes*, one of the only surviving *Myrciantes* stands in Carchi). In general, there has been a positive response of farmers and citizens toward the Municipality's environmental actions and strategies.

Parallel to the activities at the municipal level, the Provincial Government of Carchi proceeded independently with a regional *ceja andina* strategy. They developed a provincial decree aimed at protecting the last remnants of forests and *páramo*, aiming at protecting vital water resources (Gobierno Provincial de Carchi, 2004). This decree, although demonstrating a positive indication of change in an important stakeholder, proved ineffective because farmers felt restricted in their freedom of the use of the land and resentful for not having been included in the process of developing the decree. In certain areas, even a decrease in interest in environmental protection was encountered after publication of the provincial decree.

Besides local governments, several other stakeholders were identified, including their perspectives on and actions toward

the forest. These opinions and proposals were brought together in social learning spaces where different actors were able to engage in dialogue and debate, working toward consensus and concerted actions regarding the sustainable use of agro-biodiversity (Poats, 2001). The *Plataforma Ceja Andina* is one such space, which disseminated relevant information to community members, urban citizens, youth groups, women's groups, educational institutions, the municipal assembly, parish boards, and other local government entities. It provided a space for facilitated discussion around issues of interest related to natural resource management in general, and planning of concerted action for restoration and conservation activities. In the initial stages of the project, the project team took a lead role in facilitating this monthly platform. Later on, the Municipality of Montúfar took over the responsibility of the sessions.

After three years of the inter-institutional process, the *Plataforma Ceja Andina* was still functioning with continued municipal support. The Municipality of Montúfar not only supported the APRONOR farmers association, but also implemented a management plan for two watersheds that included most remnants of the *ceja andina* forest within the Municipality's territory. To achieve this, the Municipality established an effective working relationship with the Environmental Department of Carchi Province to apply the regional *ceja andina* conservation decree in collaboration with the farmers. The *Bosque de Arrayanes* was made the emblem of ecotourism promotion and its facilities for visitors were considerably improved. In the other municipality (Huaca) the process never received priority, although other municipalities in Carchi (particularly Bolivar, which shares several watersheds with Montúfar) started several activities aimed toward better conservation of the *ceja andina* (Ambrose *et al*., 2006).

Outcome Mapping

The project used Outcome Mapping (OM) not only as an evaluation and monitoring tool, but also for initial and continued stakeholder analysis. Outcome Mapping proved useful because it actually measured behavioral change of target group members, and not just tangible products (cf. Earl *et al*., 2002). Thus, it was possible to monitor the level of collaboration and awareness of farmers, the attitudes of local governments and other key actors, as well as the actual value of field information. Outcome Mapping also helped to identify initial perception, and therefore behavior of farmers toward the *ceja andina* (Báez *et al*., this volume). It clearly demonstrated the small steps of change: farmers first needed to come to a meeting, then participate in a discussion, get involved with a CIAL, produce, harvest, sell, and then replicate and advocate the case with others. It also allowed continuous adaptation of activities and indicators of progress, which is useful for action research that combines both ecological and social foci. At the end of the three-year project, stakeholders (farmers and local governments) concluded that whilst development strategies could not be fully planned, if the process is guided by OM there is more concentration on monitoring and evaluation rather than on impacts only. All stakeholders agreed that OM promoted concerted action (Ambrose *et al*. 2006).

A challenge in the application of OM in the present case was that the goals of the process and their indicators (outcomes and progress markers; *sensu* Earl *et al*., 2002) were defined by stakeholders rather than the executors of the project. This forced the project to adapt to current demands (from the local community) without sacrificing previously established objectives and project governance (by the executors of the project). Another complication encountered was that while there are certain advantages to the methodology being open and flexible, it also makes for a complex and time-consuming method of project monitoring. This complexity was overcome by putting emphasis on the measurable added value of OM: in the end, stakeholders considered monitoring and evaluation not as an extra activity but as a critical and useful ingredient of the process of learning, planning, decision-making, and collective action.

CONCLUDING REMARKS

This study in the *ceja andina* Life Zone of northern Ecuador has confirmed that for forest conservation to occur, the attitudes of people, including their activities, relationships, and interactions, toward sustainable agriculture and the use of biodiversity need to change. Involving farmers in participatory research activities increased awareness of certain actual environmental problems (e.g. pests) and encouraged a change in behavior in a pilot group of farmers that became interested in more diverse farming systems, including the use of native crops and agro-forestry. The applied participatory methodologies proved to be promising tools for different target groups (especially established farmer families and younger farmer groups), and concrete changes in attitude and behavior toward environmental protection were attained. In general, the Farmer Field Schools and Local Agricultural Research Committees introduced by the project contributed to a re-established connection of the participating farmer community to environmental issues and to a basic understanding of the relationship between better, more diverse farming techniques and the conservation of the remaining forest. However, the change in behavior through these methodologies was slow and it may take much more time before alternative and more diverse production systems will actually contribute to forest conservation.

Stakeholder analysis and Outcome Mapping helped to reveal the different needs, interests, behavior, and alliances existing between different interest groups in the area. Corresponding

platforms for dialogue and concerted action were established. However, halting deforestation completely remains a challenging goal, which depends not only on participatory methodologies, but also on the technical and analytical capacity and motivation of municipal staff. In particular, supporting activities are needed to provide the necessary additional incentives for environmental protection. Such activities include studies on natural resource management (cf. Pohle and Gerique, 2008), policy development, and forest restoration strategies (cf. Weber *et al*., 2008; Günter *et al*., 2009; Williams-Linera *et al*., this volume), as well as financial incentives for conservation and sustainable production systems (cf. Yaguache *et al*., 2004; Tognetti *et al*., this volume).

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