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EVALUATION OF A RURAL DEVELOPMENT PROJECT IN SOUTHWEST COCHABAMBA, BOLIVIA, AND ITS AGROFORESTRY ACTIVITIES INVOLVING *POLYLEPIS BESSERI* AND OTHER NATIVE SPECIES – A DECADE OF LESSONS LEARNED

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Resumen. Hace aproximadamente 10 años arrancó el proyecto PROSANA (GTZ/CORDECO, después GTZ/Prefectura de Cochabamba) buscando estrategias integrales para enfrentar la inseguridad alimentaria-nutricional y la pobreza humana en el sudoeste del Departamento de Cochabamba (primero en la Provincia de Arque, luego también en Tapacarí y Bolívar). Desde el comienzo se identificó la necesidad de estabilizar y restaurar los agroecosistemas que pertenecen a los más degradados del país aplicando medidas de conservación, tanto mecánicas como biológicas. En un primer paso se caracterizó la vegetación actual y la vegetación potencial natural. Como indican muchos matorrales y chaparrales una parte considerable del área podría estar cubierta por un bosque de *Polylepis besseri*. En base de esta información ecológica se elaboró un concepto agroforestal, planteando entre otras estrategias de conservación de la vegetación remanente y de reforestación aprovechando del potencial enorme de diferentes especies nativas. Luego se diseñaron e implementaron proyectos de educación ambiental y proyectos piloto de reproducción y plantación de especies nativas. El trabajo de restauración ecológica, igual como otras actividades relacionadas con el desarrollo rural en la zona, en un proceso cuidadoso fue delegado a ONGs locales. Faltando poco tiempo para la conclusión de PROSANA se presenta una evaluación de los logros, falencias y lecciones aprendidas en el área de agroforestería/conservación de suelos para que futuros proyectos puedan mejorar sus estrategias. Una conclusión lamentable es que hasta ahora no se logró un trabajo significante de recuperación o estabilización de los agroecosistemas. Las causas de esta falencia son principalmente institucionales siendo relacionadas con todos los actores y variables del complejo proyecto: el área, los campesinos, los técnicos de campo, las ONGs encargadas del trabajo agroecológico, los municipios, los recursos y políticas financieras, y PROSANA mismo. Queda por esperar que el proceso de desarrollo rural iniciado en el sudoeste de Cochabamba, a largo plazo, lleve también a éxitos agroecológicos incluyendo la conservación de los últimos relictos del bosque de *Polylepis*. El documento termina con conclusiones generales para futuros proyectos de agroforestería y conservación de bosques de *Polylepis*.

Abstract. About 10 years ago the project PROSANA (GTZ/CORDECO then GTZ/Prefectura de Cochabamba) was started in order to identify integral strategies to combat food insecurity and human poverty in the southwestern part of the Department of Cochabamba (first in the Province of Arque, and later in Tapacarí and Bolívar). From the beginning it was considered necessary to stabilize and restore the agroecosystems, which belong to the most degraded of the country, by applying mechanical and biological conservation measures. In a first step, the current and the potential natural vegetation were characterized. Many shrub areas and relicts of small open forests indicate that a *Polylepis besseri* forest could cover a considerable part of the region. Based on this ecological information, an agroforestry concept was proposed, together with other strategies, in order to conserve the remnant vegetation and to reforest by making use of the enormous potential of the native species. Later, environmental education projects and pilot projects which stressed the propagation and planting of native species were designed and implemented. The ecological restoration work, as with other rural development activities in the area, was delegated to local NGOs in a careful process. As PROSANA will soon come to an end, an evaluation of the achievements, failures, and lessons learned in the agroforestry/soil conservation sector is presented in order to facilitate the improvement of strategies for future projects. Unfortunately, it can now be concluded that so far a significant restoration or stabilization of the agroecosystems has not been achieved. The causes of this failure are principally of an institutional nature, as they are related to the actors involved and to other variables of the complex project: the area, the peasants, the technical staff responsible for fieldwork, the NGOs in charge of the agroecological activities, the municipalities, the financial resources and policies, and PROSANA itself. It is hoped that the initiated process of integral rural development in southwest Cochabamba will nevertheless lead to agroecological successes and the conservation of some of the last relicts of *Polylepis* forests. The paper ends with general conclusions for future agroforestry and conservation projects involving *Polylepis* forests.
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Key words: Agroforestry, Polylepis *forests, ecological restoration, rural development.*

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INTRODUCTION

A decade ago a Bolivian-German development project, PROSANA, was started in order to combat human poverty in Arque Province, in the southwestern part of the department of Cochabamba (supported by the German Ministry for Economical Cooperation and Development, BMZ, and implemented through the German Agency for Technical Cooperation, GTZ, in cooperation with CORDECO, later *Prefectura de Cochabamba*). The goal of the project was food security, especially for the most vulnerable groups like women and children, because the existing undernutrition was identified as the key feature of all development problems. The action area belongs to the most severely degraded regions of the Bolivian high Andes, and in the early planning process it became obvious that food security could not be achieved without attacking the advanced degradation of the agroecosystems. Consequently, mechanical and biological measures targeting erosion control and improving the productive base were designed and applied. In an early stage of the project it was decided to support the natural vegetation, which was partially a *Polylepis besseri* mixed forest, by replanting native species as a key element of the agroecological element of the project. Now that the project is almost concluded it is time to evaluate if the agroecological measures as designed were applied and if they had a significant impact on the agroecosystems. We expect insights and lessons learned that should be useful for the planning and designing of new projects to be implemented under similar conditions. The author participated in the flora and vegetation analysis (1991-1992) and as a consultant during different steps of the conception of the agroforestry and inter-institutional strategies (1993-1994, 1995-1996), working about 25 months with PROSANA. This paper presents the results of an independent evaluation and does not necessarily represent the official opinion of PROSANA or the GTZ.

SOUTHWEST COCHABAMBA AND A DEVELOPMENT PROJECT – ONE DECADE AGO

Human poverty and environmental degradation. Ten years ago, southwestern Cochabamba, together with northern Potosí, belonged to the poorest and ecologically most degraded areas of the Bolivian Andes. In Arque Province about 18,000 small-scale farmers tried to sustain themselves with a subsistence agriculture which from year to year contributed less to the survival of their families. Additional activities, mostly related to migration to the city of Cochabamba or to the lowland rain forests of the Chapare region (for the production of the coca leaf), were necessary to earn some monetary income. The people are descendants of Aymara-speaking tribes who, in the late 15th century, were forced to speak Quechua by the Inca regime or were even moved to other areas in order to break their resistance. Several decades later, from 1540 onwards, they suffered the consequences of the Spanish *conquista*. The farmers had developed complex land-use systems with irrigation, rotation cycles, mechanical measures to control soil erosion, and an optimal use of a variety of crops domesticated from wild relatives, and had adapted to the harsh climatic conditions (e.g., bitter potatoes up to an altitude of 4,300 m above sea level).

The ecological degradation of the area was greatly accelerated by the introduction of European animals like sheep and goats, and strongly linked to fact that the indigenous farmers were forced by the Spanish *hacendados* to use even the highest steep slopes that were not suitable for agriculture. Mining and railway activities multiplied the need for firewood, which was also extracted for cooking in the home. The plant cover was dramatically diminished, which is the most critical factor for hydric soil erosion (see Derpsch & Roth 1987); gullies, downstream river sedimentation, mineral leakage, and landslides increasingly threatened production and human life (Fig. 1). Ongoing collection of firewood (2.5 kg/person/day or about 45 tons/day; Dünnwald & Vega 1998) (Fig. 2) and extensive grazing prevented the recovery of vegetation and soils. Another consequence of soil destruction is a dangerous reduction in the availability of drinking water. The health and nutritional status of the human population was alarming: e.g., 57% of the children under 5 years of age are chronically undernourished and stunted (Wontka 1993), and the nutritional recommendations are insufficiently covered (73% of proteins, 50% of energy; Ibisch, C. 1993).

The PROSANA project and the agroecological component. The Bolivian-German 10-year project started its activities in 1991. It was designed as an integrated and multidisciplinary rural development project. As Proyecto de Seguridad Alimentaria Nutricional en la Provincia de Arque (=PROSANA) the action area was Arque Province. Later, in 1995, it expanded to the

FIG. 1. Typical village in Arque Province surrounded by degraded agroecosystems.

neighboring provinces of Bolívar and Tapacarí (Programa de Seguridad Alimentaria Nutricional para las Provincias Arque, Bolívar y Tapacarí). The main components of the project tackled known problems in the sectors of nutrition, health, agricultural and livestock production, forestry, social organization, and institutional capacities.

The agroecological component included several concepts for improving irrigation, agricultural production (including agroforestry measures), use of native crops, organization of farmers, and control of soil erosion. This integrated approach was regarded as one advantage of the project because by dealing with many basic needs the acceptance of measures that are usually given a lower priority by farmers could be increased. Experiences show that forestry measures which have long-term goals do not meet with success when many of the basic needs of small-scale peasants are not satisfied (Birgegaard 1992). A holistic agroecological approach within a holistic rural development project that considers bio-ecological, technical, and social aspects promised to be more successful. The investment

FIG. 2. Peasants of Arque Province extract small *Polylepis* tree for use as firewood.

in the restoration of the productive base in this area, whose dramatic situation was widely underestimated by national and international institutions (Schulte 1994), was thought to have positive effects also in terms of rainforest protection if migration to the rainforest lowlands could be reduced. In this case the agroecological activities were directed toward intensification of land use in order to achieve – as a secondary or tertiary goal – biodiversity protection.

Vegetation studies as a foundation of agroforestry action. In a very early stage of the project botanical studies were undertaken in order to orientate restoration action. General descriptions and analyses of vegetation degradation in the Bolivian Andes have been published by Ellenberg (1979), Ruthsatz (1983), Seibert (1989), Hensen (1993), Kessler & Driesch (1993), Kessler (1995, 1998), and Fjeldså & Kessler (1996). Detailed results of botanical and zoological studies in Arque Province have been documented elsewhere (Ibisch 1993 a,b; Ibisch 1994 a,b; Ibisch & Böhme 1993, Ibisch & Rojas 1994, Rojas 1994). Below, a short overview is given.

In southwestern Cochabamba a transition is evident from the central Andean *altiplano* to the dissected dry valleys of the eastern cordillera. Mean annual precipitation reaches 500 mm in the valleys and about 700 mm in the northeastern highland area. The southwestern highlands (Bolívar province) are more arid. Precipitation is restricted to a fairly short rainy season from October/November to March/April. In the lowest valleys (2,700–3,000 m) the original dry forest, with *Schinopsis haenkeana*, *Aspidosperma quebracho-blanco*, *Jacaranda mimosifolia*, *Acacia visco*, and *Prosopis laevigata* as the most important tree species, is replaced by shrubland with few individual trees; when heavily degraded it is dominated by *Dodonaea viscosa*. The main agricultural belt is found above 3,000 m. Open shrub and grasslands (with *Baccharis* spp., *Satureja boliviana*, *Stipa ichu*) replace the original forests. Individual trees and small forest remnants at different sites and expositions lead to the conclusion that the area was/could be covered by forest vegetation. Between 3,000 m and 3,400 m *Kageneckia lanceolata* was probably an important element. Another member of the Rosaceae family, *Polylepis besseri* ssp. *subtusalbida* (see Kessler 1995), was recorded from 3,300 up to 4,100 m. Therefore the 8–10(–15) m-high *Polylepis* forest was the most important forest vegetation of southwestern Cochabamba. From about 4,000 to 4,500 m a semi-humid *puna* vegetation is dominated by *Festuca dolichophylla*. In the drier southwest a dry *puna* is characterized by *Festuca orthophylla* and *Parastrephia lepidophylla*. The small streams, up to about 3,500 m, were accompanied by *Alnus acuminata* gallery forests. In one final relict area, on the northeastern border of Arque Province (Fig. 3), some species adapted to more humid conditions were found that had become extinct in the rest of the area, e.g., the fern *Dennstaedtia glauca*. This relict area, which was characterized by a mixture of quite large and old trees of *Alnus acuminata*, *Polylepis besseri*, *Escallonia resinosa*, *Senna weddelliana*, and *Berberis* sp., degraded continuously; visits in 1991, 1992, 1993, and 1995, showed how the large trees were felled and the microclimate of the slope moved to drier conditions. This living 'vegetation fossil' showed that the *Polylepis* and *Alnus* communities were mixed forests, with some other tree species that are also known from much more humid forests on the northeastern slopes of the eastern cordillera (Yungas forests). It can be concluded that *Polylepis*, being especially resistant to drought and fire, is one of the last tree elements to survive in the semi-arid to semi-humid high-Andean forests. In most areas the impoverished drought-resistant relict flora does not adequately illustrate the original or potential natural vegetation.

At least one possibly endemic species was recorded (*Puya prosanae*; Ibisch & Groß 1993). About 600 species compose the current flora of Arque Province. About 60 species were identified as having some agroforestry potential.

The agroforestry concept. Agroforestry arose as a new science in the late 1970s and has turned out to be a very valuable tool for the improvement of land use, especially in developing countries (MacDicken & Vergara 1990, Nair 1993). Agroforestry is a new word for an old practice that includes trees and shrubs in the cultivation of crops and the management of domestic stock in the same area (von Maydell 1982). However, in development research and practice the use of agroforestry meant a new, more integrated and interdisciplinary approach to land-use systems (see editorial of Agroforestry Systems Vol. 1, 1982). Agroforestry *sensu latu* is not just the sum of agriculture and forestry but tries to achieve mutual benefit through the interaction of woody components and crops/animals. Therefore it seems to be an ideal tool to combat environmental degradation in southwest Cochabamba.

Fundamental insights. Based on floristic and vegetational studies, an agroforestry concept was developed. The main assumption was that the study results would define the need for action and its ecological feasibility but no more. Obviously it was necessary to understand the environmental perception of the farmers and their motivation to implement agroforestry measures. It was very clear that any recommendation could not be successful if not based on social or socioeconomic insights – man is the determining factor in the stability of agroecosystems (Ibisch 1995, Ibisch *et al.* 1998). In the context of different 'action-research' activities, like construction of small terraces, visits to forest remnants, and certain forestry practices, it was possible to understand the social difficulties of any forestry measures. The intention was not to introduce foreign technology but to strengthen the traditional knowledge and capacities of the farmers. However, an agricultural practice which continues to degrade the environment cannot be optimally adapted and therefore needs some external inputs to leave the one-way road to destruction.

Selected tools and strategies. Land use planning: Successful land use concepts integrate agricultural activities, livestock production, forestry, and the use of other natural resources in one system (Lusigi 1994). However, that does not mean 'everything everywhere at the same time'. Modern concepts of regional natural resource conservation and sustainable use are based on differentiated use in distinct areas, taking bioecological and socioeconomic criteria into consideration (protection areas, extraction areas, mixed areas; McNeely 1994). Differentiated land use was proposed as a strategy for PROSANA. In order to increase the harvest of firewood, fodder, and crops it is important that incompatible uses do not take place at the same site. PROSANA developed interesting tools for participatory land use planning that were called PLUSCOs, community land use plans elaborated by the peasants and facilitated by the project advisers (using aerial photographs, drawings, etc.).

Environmental education and motivation: A variety of media were developed in order to motivate the peasants to invest in natural resource conservation. The hope was to show that the combination of traditional knowledge and external project inputs could break the vicious circle of environmental degradation and poverty. An important educational tool was the horizontal exchange between peasants of different regions who had had some specific experiences.

FIG. 3. Last important *Alnus acuminata-Polylepis besseri* forest remnant in northeastern Arque in 1991.

Plant production in institutional nurseries: Considering the constraints and obstacles already outlined, the installation of communal nurseries was not recommended. Some institutional nurseries were to combine production, experimentation, and demonstration, concentrating activities especially on native tree and shrub species (e.g., *Polylepis besseri*, *Alnus acuminata*, *Acacia* spp., *Schinus molle*, *Buddleja* spp.). It was recommended that very large-scale plant production be achieved in order to establish large demonstration areas which could have a significant visual impact.

Management of the native vegetation: One recommendation was that work be done with the management of livestock. This is a very difficult task as the peasant economy depends heavily on animals, the only savings that can be more or less immediately converted into monetary income when required, and also important for the dung that is used for soil fertilization. The livestock is raised practically without costs on the communal lands, fed with the native and ubiquitous vegetation, and managed by those not otherwise occupied in agricultural production, like children or older persons. Any management recommendation cannot be implemented without increasing the costs of livestock production (extra fodder production, fences, etc.). A second recommendation was made to manage the relicts of *Polylepis* forests in order to increase firewood production (improved techniques for cutting, protection of seedlings, etc.).

Delegation of the implementation process: From a very early project phase an effort was made to delegate the implementation of the agroecological measures to local institutions in order to promote capacity building and sustainability of execution. A complete system of inter-institutional accompaniment was proposed. In addition, help was provided to nine NGOs to develop and implement projects. Special attention was given to the development of planning and fund-raising capacity.

SOUTHWEST COCHABAMBA AFTER ONE DECADE OF A DEVELOPMENT PROJECT

Successes. Generally speaking, PROSANA has generated many successful results. The project supported and accompanied the implementation of 'popular participation' and helped to establish new organizational structures. Interesting participatory planning processes have started at the community level. Many villages have obtained access to drinking water facilities. Several roads have been constructed, improving access to main villages. The health situation has very likely improved, especially in the case of young children, partly due to the vaccination programs (evaluation not yet concluded). The availability of food has improved, especially in terms of diversity; the important irrigation measures made possible the cultivation of more crops and vegetables. In general there is very probably an increased knowledge and consciousness of development problems. One important success could be that the area that had been rather neglected and overlooked a decade ago has been opened up to development activities carried out by different actors.

With regard to the agroecological component, one important achievement is related to the development of innovative tools for communal land use planning. The communal land use plans (PLUSCO = *Plan de Uso de Suelo Comunal*, prepared for more than 170 villages) allow the peasants to visualize an improved land use and to translate it into concrete planning as required in the context of municipal development. It is noteworthy that the PLUSCOs are part of the annual municipal operation plans. The process of micro-land-use planning was accompanied and supported by the Bolivian superintendent for agrarian affairs.

In the case of agroforestry, it was possible to demonstrate the potential of several native species and enrich this knowledge on specific propagation protocols (Figs. 4, 5). Demonstration plots validated the feasibility of a variety of biological and mechanical measures in stopping degradation.

About 100,000 individual shrubs and trees were planted in agroforestry demonstration fields, benefiting more than 70 hectares and more than 3,500 families. Some peasants were able to slow down erosion on certain fields, recovering soils that would be otherwise lost to agricultural production.

Failures and their causes. PROSANA is keen to analyze and document the failures of the agroecological component in order to provide a planning basis for future projects that might work under similar conditions. The main failures or their consequences are:

- In general, the agroecosystems of the action area have not been significantly stabilized.
- The degradation of the natural vegetation and soils has advanced in most regions of the action area.
- Some of the last forest remnants are disappearing.

- Consequently, more native species have come close to local extinction.
- Most problematical habits of the peasants have not been changed.
- There are no large-scale models that demonstrate the positive impacts of biological and mechanical conservation measures (e.g., restoration of a micro-watershed).
- There is no concept or experience that permits solving the overgrazing problem.

The question is: was it realistic to believe that all this was achievable in one decade? Clearly, the agroecological component did not accomplish its goals as defined in the first phase of the program. However, if PROSANA is considered as a project whose main aim was to develop concepts and build institutional and organizational capacities then the results are less negative. Obviously the hope exists that the process which has begun will generate more concrete results related to combating environmental degradation. However, many (ex-) members of the technical staff involved are frustrated at not having achieved something more significant. In a meeting with some of them it was possible to begin a critical analysis of the causes of the failures or delayed results. What are the lessons learned? First of all, it is important to acknowledge that the agroecological problems and the development project itself represent a very complex system with many actors on different hierarchical levels. It is important to analyze all these system components separately.

The difficult action area. The action area is a high-risk region for any development and production activity. The semi-arid climate with a high probability of irregularities (e.g., extreme drought during 'El Niño' years) means that the vegetation is very sensitive to any disturbance; the soil easily becomes exposed. The annual precipitation is not evenly distributed in the rainy season - a small number of heavy rainfalls can result in severe erosion. The topography with many very steep slopes makes this worse.

Finally, any restoration measure faces a history of several centuries of degradation. The natural potential of the area has diminished dramatically. Soil impoverishment and vegetation destruction are very ad-

FIG. 4. Training of peasants in plant production for agroforestry.

vanced and omnipresent in almost the entire area. It is not realistic to compensate for these historical processes over a few years.

If the action area and its history did not make it impossible to restore degraded agroecosystems, they did automatically require a certain level of intervention that might not be easily available in the context of rural development projects aiming mainly to establish replicable models rather than do all the work.

The poor peasants and their agrocentric short-term approach. Of course the farmers understand that their situation is worse every year, that the women have to walk more to gather firewood, that the pastures degrade and allow less grazing, etc. Nevertheless, several factors prevent them from applying natural resource conservation measures. First of all, the Aymara and Quechua cultures are agrocentric and respect for Mother Earth *pachamama* does not guarantee protection of non-usable species of plants and animals, and does not liberate the peasants to regard the earth as their main resource to be cultivated; they are not pantheistic as many authors claim (e.g., Grillo 1990, Rocha 1991, Romero 1992). Furthermore, it is important to acknowledge that the farmers are trapped in a vicious circle of environmental degradation and poverty. Lack of resources forces them to overexploit the last remaining resources which leads to more degradation and consequently to more poverty (Ibisch 1995, 1998; Ibisch *et al.* 1998). The continual labor on the multitude of tiny fields at different altitudes and the necessary migration activities mean that the farmers live mainly in the present and can hardly consider investments in the future (Mustonen 1990, Birgegaard 1992). The protection of soils with a high production risk cannot be a priority when more intact fields that promise to assure the next harvest are still available.

FIG. 5. Massive production of saplings of *Polylepis besseri* ssp. *subtusalbida* in institutional nursery of PROSANA.

Although the farmers observe and understand the consequences of the destruction of natural resources, the younger people in particular are mostly ignorant of the historical processes. They have never experienced how intact forests protect soil, water, and other useful resources like medicinal or edible plants. They have grown up in their desert-like surroundings and assume that the environment always was like that. The fact that a degraded environment is so normal and omnipresent hinders the search for alternatives. Furthermore, a common attitude – a consequence of the severe constraints of life in the degraded environment and not at all favorable for restoration measures – is fatalism. Their own resources are increasingly underestimated and traditional knowledge decreases from generation to generation. Many benefits and advantages of native plants (e.g., medicinal plants) cannot be learned once the species are gone; soil and natural resource erosion is followed by cultural erosion (Ibisch *et al.* 1998). Consequently, any foreign, non-native resources are preferred.

In this context we must analyze the species selection process for agroforestry measures. Agroforestry tries to integrate multiple-use trees into productive systems and generally uses native species that can be integrated much more harmoniously into the agroecosystems than the well known and widely distributed *Eucalyptus globulus* from Australia and *Pinus radiata* from Mexico. However, farmers tend to prefer exactly those exotic species when involved in the planning of forestry measures. The native species are under-

estimated and are normally not even given the chance to demonstrate their growth potential. The 'multiple purpose tree' (see Bastian & Gräfe 1989, Wood & Burley 1991) *Alnus acuminata* grows as fast as *Eucalpyptus* does and has very beneficial characteristics. But a farmer who has not seen this won't believe it. The demonstration effects of real actions cannot be replaced by theoretical environmental education, especially when we consider that most farmers in the action area are illiterate. The farmers want to talk to a neighbor who has had a positive experience with his terraces, harvesting more than the year before. A *Polylepis* forest will be protected and managed when it can be immediately shown that more firewood is thus available.

The technical staff and their work under difficult conditions. Many professionals who are responsible for technical assistance in the field are not well prepared for the work to be done in those rural communities where cultural principles are different from those in the cities, where living and production conditions are harsh, and where the peasants have been betrayed and exploited for centuries, evolving a strong distrust of outsiders who say that they want to help and have no interests of their own. Some try to compensate for their understandable insecurity with overbearing attitudes. One should not underestimate the burden of producing visible short-term results. Thus many project workers concentrated their efforts on mechanical infrastructures like terraces, which have a more immediate visual impact than tree plantations. If they have learned how to propagate *Eucalyptus* and *Pinus* they will try to do so instead of experimenting with unknown native species, especially when the experiments can fail and the peasants themselves have asked for the exotic species.

Another important problem is related to the lack of capability and willingness to learn from written sources and to sit down and document what has been done. This means that many lessons learned elsewhere are learned again and again. This deficient documentation has critical consequences for any monitoring and self-evaluation activities and further affects the possibility of implementing the necessary strategy adaptations. If there is no close contact between the leading project staff/concept workers and the technical staff in the field (as the project workers repeatedly complained) then the motivation of the latter decreases and the fieldwork becomes more and more superficial. This is even more dangerous since many project workers in the field tend to respond more to their superiors' demands than to the peasants they are working for. Finally, it can happen that project workers feel burdened by traveling to and from the action area revisiting a few successful models that are frequently presented to project superiors and guests.

The weak non-governmental project executors. The nine NGOs that were eventually invited and accompanied by PROSANA to work in the action area were the main hope for the agroecological component. However, it has to be stated that these selected NGOs did not develop and perform as expected. A technical problem which needs to be mentioned is that staff members mostly learned little about the concepts of PROSANA (see above: lack of interest in reading documents). The NGOs were accompanied, but more in institutional terms than in technical ones. However, institutional capacity-building was also insufficient. Finally, the key deficiency was found to be the economic problem. On the one hand, the NGOs felt too protected by PROSANA and failed to develop the necessary capacities to raise funding for projects. Because of the politicized situation of the municipalities, where the decisions are made as to how funding will be allocated in the area, the technically best suited NGO is not always chosen for a particular task. On the other hand there is a lack of funding sources. The national funding sources in particular are quite inaccessible (see below). Practically speaking, there is no experience of fund raising on the international level.

The politicized municipalities. The municipalities arose as the new and decentralized main actors in rural development when the legislation on popular participation came into force. This legislation tries to distribute federal funds in the country according to the number of inhabitants in each municipality. On the one hand, this meant an important step towards a more adequate and balanced application of economical development resources, which formerly tended to be spent mainly in the capitals of the departments and not in the countryside. On the other hand, however, important monetary resources now have to be managed at the municipal level by people without much experience or technical capacity. Obviously, the threat of corrupt use of governmental resources is

transferred from the departmental level to the municipality. The danger is especially high in areas like southwest Cochabamba where local people have serious difficulties in guaranteeing a significant control of the use of the money spent by the municipality. Municipal elections now carry significant weight and the consequence of decentralization is a politicization of the municipalities and rural development. One consequence is that for some NGOs the work became more difficult because they had to execute their projects in agreement with the municipal government. As important funding is sometimes involved, it is not necessarily the technically best qualified NGO that wins the invitations to execute a project tender. Following new legislation (SAFCO), any project invitation must be public and it is impossible to contract an NGO directly which means that it is almost impossible for NGOs to become geographically specialized.

Furthermore, it is a general tendency in Bolivia that rural municipalities prefer to invest in their capital town and in visible infrastructure. Today many villages have nicer *plazas*, more health centers, more schools, bridges, etc. Of course, investing in this type of infrastructure is important for rural development but it is not more important than the restoration of the productive base through control of soil erosion and/or agroforestry. Even in the case of the agroecological projects, those that include the establishment of built infrastructure are predominant: 70% of 109 implemented, planned, or designed agroecological projects (in all 'PROSANA' municipalities) were dedicated to the construction or maintenance of irrigation infrastructure (canals and/or basins for water storage).

Small-sized projects, lack of economical resources, and problematic funding policies. The normal projects implemented with public funding have limited economic resources. Consequently, most agroecological projects that were executed were too small and too short-lived. As mentioned above, restoration of the agroecological potential of southwest Cochabamba, destroyed over decades and centuries, needs significant monetary input to be successful. First, it is necessary to restore whole watersheds, or at least slopes, in order to earn visible benefits that can convince all peasants to repeat the measure elsewhere. Second, the degradation is very advanced, needing massive mechanical and biological intervention to be stopped.

The economic problem starts in the project design phase. When dealing with government funds the municipalities or NGOs are expected to design measures with very reduced budgets of around 10,000 Bolivianos (about US$1,600). This means that the projects end up being developed in the office by copying some known project patterns and not, in a participatory way, with the peasants. Consequently the projects do not precisely meet the needs of the rural population, or the peasants do not identify themselves with the proposed measures, which is one step towards failure. The strategy whereby local NGOs should take over the implementation of rural projects from PROSANA using nationally funded resources seemed to be sustainable at first glance. However, it was not taken into account that some funds, like FIS – Fund for social investment or FDC – Fund for peasants' development, do not differentiate sufficiently between very distinct areas of Bolivia. The funding criteria do not favor the most degraded and least developed areas. Other national funds such as FONAMA, National fund for the conservation of nature and environment, practically vanished for political reasons. Unfortunately, in most cases alternative conservation money is not available for agroecological projects in areas as degraded as southwest Cochabamba.

One problem for all project sponsors, including government agencies, is the tendency to expect rapid and conspicuous large-scale impacts. This policy stimulates mechanical infrastructure measures, like irrigation systems, and puts long-term agroforestry that may produce visible benefits after 5, 10, or even more years at a disadvantage. The above-mentioned problem of possible suspected misuse and embezzlement of public funds makes the availability of the money required for agroforestry measures more difficult.

Wrong projections and negligence of the PROSANA project. The efforts of PROSANA to develop a variety of concepts and tools in the first orientation phase, and also subsequently, were considerable. However, technical follow-up and implementation were not optimal, mainly due to priority being given to other important issues arising in the context of new legislation and organizational matters. Documentation, monitoring, and evaluation of the agroecological measures were deficient. Some important interventions, like pasture management and influence of livestock

on the natural vegetation, were covered by some studies but finally not treated in the implementation phase.

Also neglected were the dimensions of the agroecological measures. Although restoration of microwatersheds was targeted in several projects, this never led to any really massive and significant intervention, but rather dispersed small-scale model plots. The quantity of planted trees is low in relation to the real needs of the severely degraded ecosystems. Probably the extrapolation of the action area from Arque Province to the whole southwest of Cochabamba came too early, before having implemented and sufficiently tested the concepts of the orientation phase. Especially with regard to the agroecological component, the measures were spread around like drops from a watering-can without allowing a 'critical mass' to form, a necessity when it comes to having a visible and significant impact on restoration. When the main objectives of PROSANA were concept- and capacity-building, early extrapolation was unnecessary or even harmful. On the other hand, extrapolation meant long-term benefit for the areas not considered in the first project phase (Tapacarí, Bolívar).

The idea of delegating the implementation work in the field to nine local NGOs in an early phase of PROSANA was a wise and good step towards institutional sustainability. A technical problem arose when the diversity of institutions made it more complicated or even impossible to implement the PROSANA concepts because each institution had its own experience and more or less inflexible philosophy. The transfer of PROSANA know-how to the NGOs was inadequate. The main problem was, however, that the potential of local organizations was as overestimated as the possibility of financing rural development through national funds like FONAMA, FDC, or FIS. The idea was to help some technically qualified NGOs to specialize in sub-regions of southwest Cochabamba. Finally, the whole political-structural context, with changing laws and authorities, made it impossible to guarantee that certain NGOs remained in a determined geographical area. As mentioned above, the NGOs were debilitated and unable to get sufficient funding for significant action in the area. Consequently, several NGOs lost many professionals educated by PROSANA.

Of course there is still hope that some of the trained NGOs may be able to make good use of some additional funding that was recently made available, and that the process initiated by PROSANA may lead to this 'critical mass' starting a powerful chain reaction. Perhaps other organizational models of project implementation without involving NGOs but working more directly with municipalities and rural communities could be more successful. This alternative is still to be tested, which requires more time and more resources. Obviously, a lesson learned is that it is impossible to build strong institutional capacities within only a few years. As Alberto Vega, former project manager with GTZ, says: 'Let us be patient and give some more time and space to the small sapling planted by PROSANA'.

CONCLUSIONS ON THE VIABILITY AND NECESSITY OF NATURAL RESOURCE CONSERVATION AND MANAGEMENT IN CENTRAL BOLIVIA

The restoration of the agroecological potential of the heavily degraded and poverty-stricken areas of central Bolivia is a complex challenge. All traditional (agro-) forestry and rural development approaches have a certain chance of being temporarily and locally successful; however, they are much more liable to fail on larger time or spatial scales. By necessity, the development concept for southwest Cochabamba and neighboring regions like northern Potosí must be holistic and interdisciplinary. But without massive and cost-intensive agroecological interventions targeting soil erosion and loss of native biological potential like the *Polylepis* forest remnants (vegetation cover, floristic resources!), which have not been achieved to date, the development will not be sustainable. To stop and reverse the degradation of this region will cost many times the amount the peasants earn in many years. Without serious support the future of the central Bolivian peasants will be in the rapidly growing cities and in the eastern rainforest regions of the country. Money is a central problem. Large-scale and long-term projects (15–20 years) concentrating on integral watershed management, including massive measures in soil conservation and reforestation with native species and management of natural vegetation, are required. The technical problem should not be underestimated. It will be necessary to develop special capacities in agroforestry and restoration institutions. It should not be expected from the rural communities that they do large parts of the work themselves

without being paid for it. It could be an interesting model to hire the peasants as 'soil and vegetation guardians'. Restoration of the degraded Andean valleys is an enormous and historical long-term task to be paid for with subsidies. It is not sufficient to appeal to the peasants that they should think of future generations if their immediate needs and priorities are not covered. Furthermore, projects that aim at the 'ecologization' of the municipalities and the strengthening of local communities are highly desirable so that they might be able to put more power behind their requests to the municipal government for the conservation of their agroecosystems.

Conservation and development institutions and funds should seriously consider if a certain portion of their money is not being well spent in areas where conservation priorities are low because biological values have been degraded and human population density is high. In Bolivia, an important contribution to tropical lowland biodiversity conservation can be achieved by supporting poor (infra-) subsistence farmers in typical emigration areas in order to avoid immigration to sensitive and mostly untouched rainforest. Bufferzone projects, such as those supported for some years by CARE in the area bordering on the Bolivian Amboró National Park, can easily have negative impacts if they support development in colonization areas near biodiversity 'hot spots' because they stimulate immigration into those areas (see also Ibisch & Karlowski 1996). In this context, PROSANA, in trying to attack poverty at its roots in an emigration area, was a step in the right direction. It also helps to conserve the important cultural values of people who still care about their traditions. However, the agroecological component of PROSANA was, in economical and technical terms, too weak. A more intensive, more ambitious, longer, better documented and monitored action was required.

German development cooperation investing in an ecologically and socio-economically very similar area: northern Potosí. Probably a new approach will be tried, including promoting emigration. In the short term it might be more successful, although in a way it means surrendering to the terrible situation in the area. It is to be hoped that the project will also consider benefiting from the lessons learned by PROSANA in fighting against environmental degradation and saving, among other things, the last remnants of the important *Polylepis* forests. Promoting migration to other rural areas means shifting and multiplying an ecological crisis. The temptation to fight the poverty of Andean peasants by bringing them to the vast and sparsely populated forest regions of eastern Bolivia is enormous. Recent government suggestions to move many thousands of high-Andean families to the Chiquitano lowlands would create an environmental and cultural situation best described as 'explosive'. Of course a moderate promotion of migration to urban centers, through converting young peasants into professional drivers, bricklayers, or mechanics, can be positive in environmental terms, lowering the pressure currently suffered by the agroecosystems, and ensuring that the human population falls to the level that corresponds to the carrying capacity.

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