

## VULNERABILITY, RESILIENCE AND ADAPTATION: RURAL DEVELOPMENT IN THE TROPICAL ANDES

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*“The most profound meaning of the Andes thus comes not from a physical description, but from the cultural outcome of 10 millenia of knowing, using, and transforming the varied environments of western South America”*  
GADE 1999: 34

*ABSTRACT.– In spite of a long settlement history of the tropical Andes, rural farming communities have always been exposed to conditions of ecological and economic vulnerability, risks, and even disasters. This has resulted, at certain times and in some regions, to a destabilization of livelihoods and to a manifestation of various forms of marginalization, to poverty or outmigration. However, Andean communities, over a long time, have given admirable testimonies of resilience and adaptations in the face of adverse conditions or new challenges. This paper examines the potentials and different facets of resilience and adaptation strategies of the rural campesinado in the tropical Andes. It emphasizes the proven traditional concepts of verticality, complementarity, reciprocity, and mutual community support, which to date support the feasibility and sustainability of Andean farming and community survival. In spite of this recognition, it is argued that Andean rural livelihoods always had to adapt to new developments, to threats and challenges, as well as to opportunities and alternative potentials. In the face of an almost ubiquitous penetration of modernization, new technologies, and economic and cultural globalization, the fundamental question arises, whether this can be considered as a path to progress and development, or as a threat to the survival of small-scale farming and rural community living. The paper concludes by formulating, albeit in a tentative form, some general suggestions for ‘development’ approaches and for research priorities in the rural Andes.*

**Key words:** Vulnerability, resilience, adaptation, modernization, globalization, small-scale agriculture, rural livelihoods, tropical Andes.

*RESUMEN.*— *A pesar de una tradición muy extensa del asentamiento humano en los Andes tropicales, las comunidades campesinas siempre enfrentaron condiciones de vulnerabilidad ecológica y económica, con varios riesgos, y aun desastres. Eso ha resultado, en diversos tiempos y en algunas regiones, en una estabilización de la supervivencia humana y en varias manifestaciones de marginalización, de pobreza, o en emigración. Sin embargo, las comunidades andinas han testimoniado, desde hace muchos siglos, su capacidad admirable de resistencia frente a condiciones adversas, y de múltiples adaptaciones a nuevos desafíos. Este trabajo examina los potenciales y las diferentes estrategias de resistencia y adaptaciones del campesinado en los Andes tropicales. El objetivo es acentuar los conceptos tradicionales de 'verticalidad', de complementariedad, de reciprocidad, y de sostenimiento mutuo en las comunidades rurales. Estas tradiciones se pueden considerar como la base esencial de la supervivencia y de la sostenibilidad en los Andes rurales. A pesar de este importante rol de las tradiciones, los campesinos han manifestado también sus capacidades de responder y adaptarse a cambios, nuevas amenazas y riesgos, así como a nuevas oportunidades y potenciales. Frente a la penetración perniciosa de varias formas de modernización, de nuevas tecnologías, y de una globalización económica y cultural, la pregunta fundamental es que si estos cambios y nuevas formas de 'desarrollo' pueden contribuir a un progreso sostenible para todos los sectores de la población, o si comprometen la supervivencia de la agricultura minifundista, de la economía y la cultura de las comunidades rurales. El artículo trata de formular, aunque en una forma tentativa y generalizada, algunas sugerencias para conceptos de desarrollo rural sostenible, y para las prioridades de investigación en los Andes rurales.*

**Palabras clave:** Vulnerabilidad, resistencia, adaptación, tradiciones, modernización, agricultura minifundista, campesinado, Andes tropicales.

## 1. Introductory remarks

Rural communities and agricultural systems in the Andes, for centuries, were able to effectively exploit the multiple resources of their environment, and to enhance the potentials of the environmental and agrarian assets. On the other hand, Andean people had to cope with an array of constraints which threatened the often fragile environments and livelihoods. Many rural areas in the Andes exhibit considerable environmental degradation, multiple manifestations of poverty, and an 'erosion' of the cultural identity and of the heritage of traditional agricultural systems. Facing these conditions of 'criticality' and vulnerability, rural communities in the Andes are challenged to develop or reinforce traditional and new forms of resilience and adaptations to cope with environmental, societal and economic changes. In newer transdisciplinary concepts, the environmental stress-, risk- and vulnerability research has gained major recognition (BOHLE, 1993;

KASPERSON *et al.*, 1995; LITTLE & HOROWITZ, 1987; STADEL, 1989; WIESNER, 1993): Vulnerability may be defined as the degree to which environments or human livelihoods, by internal or external factors, are put at risk by events in nature or society. Criticality, in turn, may be referred to as a critical link between environmental degradation and socio-economic deterioration. BOHLE and KRÜGER (1992) have developed a five stage model of increasing vulnerability or of a destabilization of livelihoods: a basic inherent vulnerable condition ('baseline vulnerability') may be exacerbated by new stress factors or crisis situations ('trigger events'). This may then lead to an acute distress situation, a survival disaster or collapse. At every stage through, a society may alleviate or overcome the negative impacts of vulnerability and mobilize stabilizing counterforces through appropriate strategies of adaptation or innovation.

As early as in the 1970s, HOLLING (1973) has pioneered in the transdisciplinary resilience research and has founded a resilience network. To him, the term resilience is closely related to a resistivity, adaptation and sustainability of ecological and social systems. The 'Resilience Alliance' defined in general terms resilience as:

- a) 'the amount of disturbance a system can absorb and still remain within the same domains of attraction;
- b) the degree to which the system is capable of self-organization... and
- c) the degree to which a system can build and increase the capacity for learning and adaptation' ([www.resalliance.org](http://www.resalliance.org)).

BOHLE (2008), in a recent contribution, sees resilience as a new paradigm in facing ecological and social risks. To him, a key strategy in building and strengthening resilience is to enhance the adaptive capacity of Human-Environment Systems facing stress, shocks and crises. In this way, people can develop their abilities to successfully cope with transformation processes, crises and disasters by developing new adaptation capacities, innovations, and various development options. Thus, resilience can be considered as the antipode to vulnerability as a pillar to ecological and social sustainability.

In their strategies, methods and techniques, traditional rural communities have exhibited a high degree of resilience and adaptive skills. Strategies of adaptation to the local ecological, social and political conditions have the objective of reducing the vulnerability of environments and communities. This may involve an appropriate and sustainable adjustment to local conditions and cultural traditions by alleviating potential stress factors and by mobilizing the potentials of natural and human resources.

## 2. Diversity of Andean agricultural landscapes

Andean agricultural landscapes and systems are characterized by a great diversity and heterogeneity reflecting the vast array of environmental conditions in a tropical mountain system (BRUSH 1987) (Figure 1).

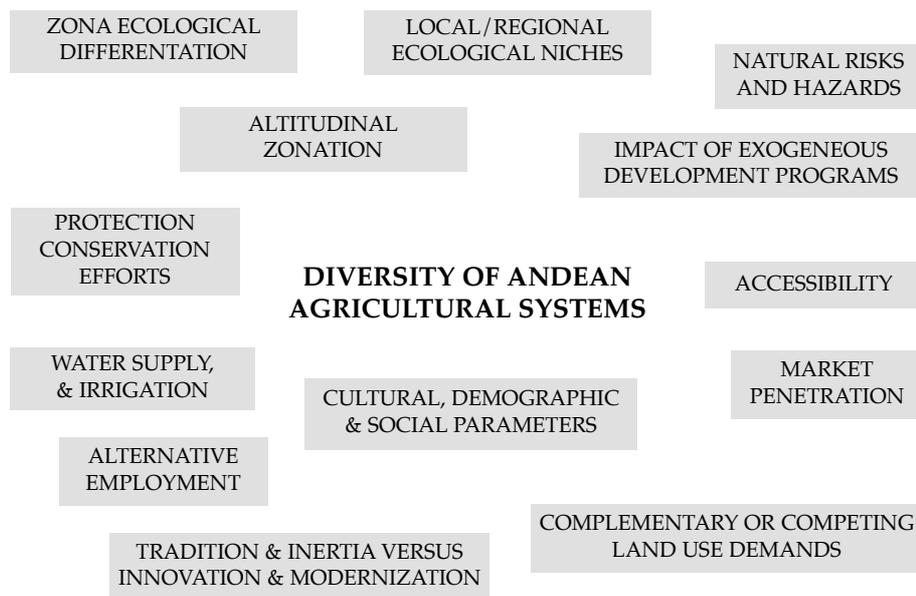


Figure 1. Diversity of Andean agricultural systems (compiled by C. Stadel).  
 Figura 1. Diversidad del sistema agrícola en los Andes (Compilado por C. Stadel).

This diversity and complexity of Andean agriculture results from the following parameters:

- regional variations: in terms of geomorphology, soils, climate, vegetation cover and human environments;
- altitudinal zonation of land use and agricultural potential (Figure 2);
- the occurrence of a great variety of local or regional ecological and agricultural niches;
- impact of degradation processes, as well as of conservation efforts;
- influence of hydrographic conditions, water tenure, water supply and irrigation methods;
- accessibility to roads and markets, degree of market penetration;

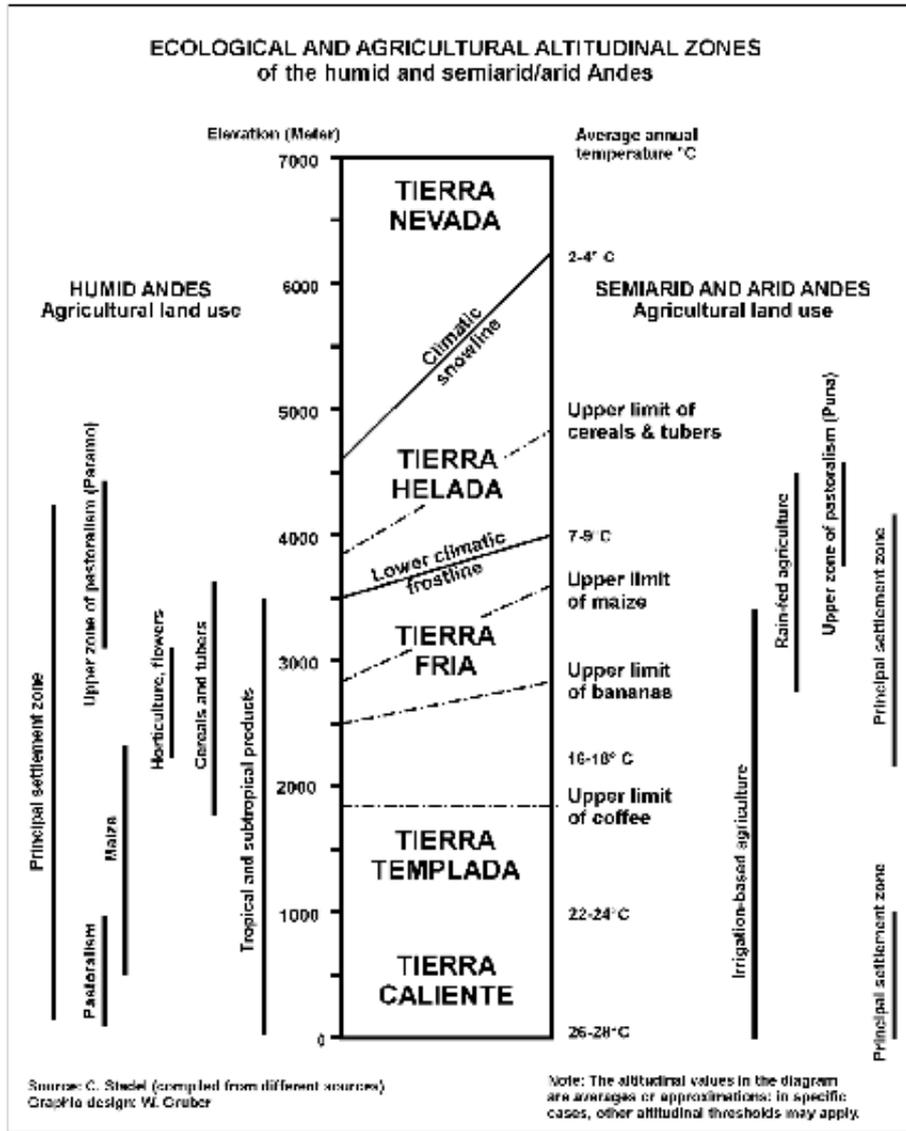


Figure 2. Ecological and agricultural altitudinal zones. NOTE: The altitudinal values in the diagram are averages or approximations. In specific cases, other altitudinal thresholds may apply.

Figura 2. Zonas ecológicas y agrícolas en función de la altitud.

- cultural, social and demographic parameters;
- perceptions and attitudes of the local population, in particular towards an adherence to tradition or an adoption of innovation and modernization;
- complementary or competing land use demands in the region;
- impact of exogenous actors, policies or programs.

ZIMMERER (1999) has characterized the variety of Andean agricultural landscapes, as 'overlapping patchworks of mountain agriculture'. He emphasized not only their spatial diversity but also the dynamic nature and changes of bio-physical and socio-cultural factors over time'. BEBBINGTON (1997) underlines the importance of those 'islands of sustainability' of mountain agriculture and rural livelihoods which serve as diffusing promoters for a sustainable regional development'. Table 1 summarizes the assets and constraints of Andean agriculture. The variety of these assets or positive stimuli and constraints or stress factors (STADEL 1995) illustrates that the Andes are characterized by a mosaic of niches of sustainability, as well as of patchworks of vulnerable spaces.

Table 1. Assets and constraints of Andean agriculture (Compiled by C. Stadel).  
*Tabla 1. Atractivos y limitaciones de la agricultura en los Andes (Compilado por C. Stadel).*

<b>ASSETS OF ANDEAN AGRICULTURE</b>
<ul style="list-style-type: none"> <li>• FAVORABLE CLIMATIC AND SOIL CONDITIONS</li> <li>• GOOD WATER SUPPLY</li> <li>• FERTILE SOILS</li> <li>• LOCAL EXPERIENCE AND EXPERTISE OF FARMERS AND THEIR ATTACHMENT TO THE SOIL</li> <li>• GENETIC POOL OF SEED AND BREED VARIETIES</li> <li>• DIVERSITY AND COMPLEMENTARITY OF AGRICULTURAL PRODUCTS</li> <li>• GOOD POTENTIAL OF MANY PRODUCTS FOR REGIONAL; NATIONAL AND INTERNATIONAL MARKETS</li> </ul>
<b>CONSTRAINTS FOR ANDEAN AGRICULTURE</b>
<ul style="list-style-type: none"> <li>• MULTIPLE NATURAL RISKS AND HAZARDS (EARTHQUAKES, VOLCANISM, ARIDITY, FLOODING, FROST, PESTS, EROSION AND LAND DEGRADATION, CONTAMINATION)</li> <li>• ADVERSE RELIEF CONDITIONS; ALTITUDINAL THRESHOLDS, ACCESSIBILITY BARRIERS</li> <li>• POOR OR DEGRADED SOILS</li> </ul>

- RURAL POPULATION PRESSURE, BUT ALSO DEGRADATION OF AGRICULTURE AND ABANDONMENT OF FIELDS RESULTING FROM OUT-MIGRATION
- ADVERSE AND UNJUST LAND TENURE AND WATER DISTRIBUTION SYSTEM
- LIMITED MARKET ACCESS, INADEQUATE TRANSPORTATION SYSTEM
- INADEQUATE CAPACITATION AND FORMATION OF FARMERS, INSUFFICIENT TECHNICAL SUPPORT
- INADEQUATE RURAL FINANCIAL GRANTS AND CREDITS FOR AGRICULTURAL DEVELOPMENT
- ATTITUDES OF INERTIA, PASSIVITY AND PESSIMISM WITHIN FARMING COMMUNITIES
- NEGATIVE IMPACTS OF OUTSIDE INTERFERENCES

### 3. Vulnerability, resilience and adaptations of Andean agriculture

A principal objective of Andean agriculture is to cope with ecological, economic and social crisis situations which result in various manifestations of vulnerability. Examples for ecological crises and vulnerability include a resource scarcity, a deterioration of resource quality, an unsustainable exploitation of the environment, or inadequate conservation efforts. Social crises and vulnerability may result from inadequate social security and a collapse of social networks. Economic crises and vulnerability may emanate from impoverishment, insufficient income, food, and in general marginal livelihoods (Figure 3). The Figure also portrays potential survival strategies of Andean communities in their attempt to cope with a critical situation. Ecological strategies may include resource protection and conservation efforts or the recurrence to alternative forms of resource use, with the objective of enhancing the environmental quality in a sustained fashion. Social survival strategies seek to improve the forms of social organization and networking, with the goal of strengthening the local social and political power. Economic survival strategies aim at improving the economic situation of families and village communities, for instance by securing an adequate subsistence and market-oriented agricultural production, or by resorting to alternative employment opportunities and income. The prime goal of *campesinos* is to minimize the risks and uncertainties of farming and to develop survival strategies to secure and promote their livelihoods.

One of the pillars of the traditional concept of *Lo Andino* (GADE, 1999) to maintain the agricultural and rural viability is the principle of Complementarity (*Complementariedad*). In agriculture, it includes the 'Vertical Control' (MURRA, 1975), the optimal use of altitudinal zones and the exchanges of the products between them, regional market exchange networks (RIST, 2000); polyculture and different crop and field rotation systems,

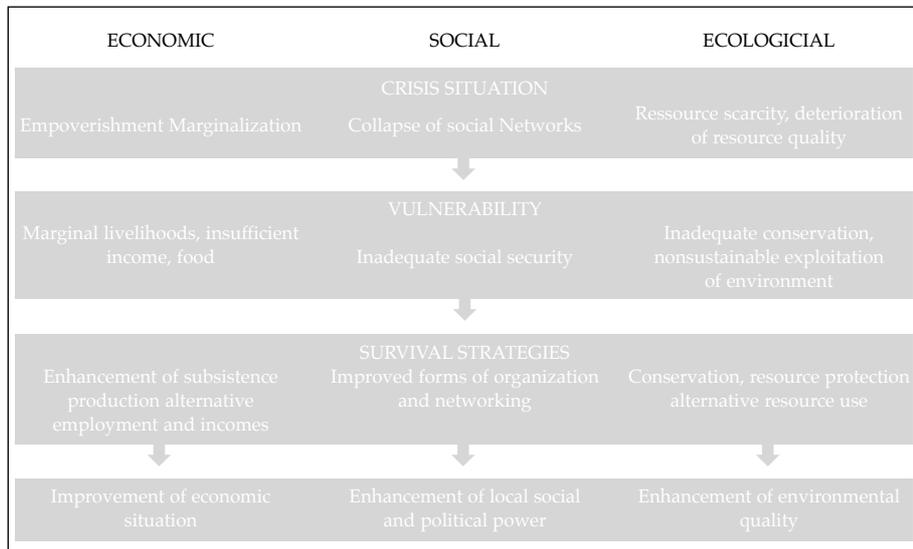


Figure 3. Vulnerability and survival strategies in Andean rural areas.

*Figura 3. Vulnerabilidad y estrategias de supervivencia de las áreas rurales de los Andes.*

traditional tools and cultivation technologies (VOGL, 1990) such as terrace and irrigation systems (Photo1); different forms of irrigated and non-irrigated agriculture; the complementarity of field cultivation, animal husbandry and pastoralism (COPPOCK & VALDIVIA, 2001); agroforestry systems; seasonal and spatial shifts of agricultural activities; and a combination of agricultural and non-agricultural economic activities (e.g. most recently 'agrotourism'). Reciprocity, in turn, refers to a complex system of mutual obligations, forms of assistance and rights within the *Comunidad* (Photo 2). Figure 4 lists in a summarizing fashion the different components of traditional and potentially new forms and strategies of agricultural land use and of farming communities to strengthen and promote the resilience of Andean agriculture and rural livelihoods (REGALSKI & CALVO, 1989). Most experts agree today that this concept of Andean resilience should form the basis and core of rural and regional development initiatives. Andean resilience is not only based on a preservation of biodiversity and promotion of the cultural heritage and traditional approaches and strategies (POHLE, 2004), but always has to cope with and adapt to changes and new developments (Photo 3). These changes may occur within a specific region, may be initiated by local actors and local and regional processes, and may require local responses and adaptations.



Photo 1. Terraced and irrigated field cultivation, Colca Canyon, Peru. (Photo: C. Stadel).

*Fotografía 1. Terrazas y campos de regadío (Cañón Colca, Perú).*

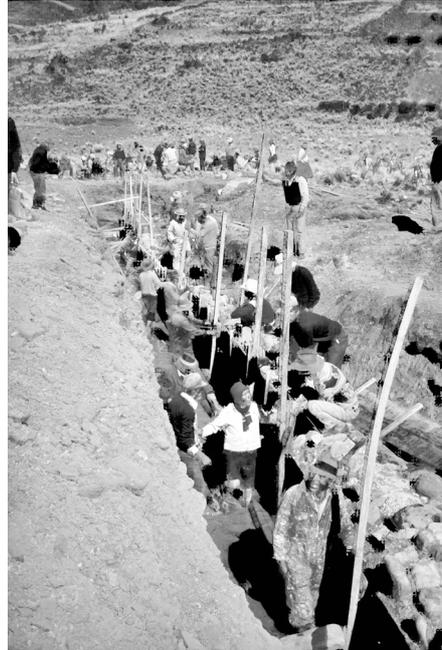


Photo 2. Communal mobilization for the construction of a water supply system, Titicaca region, Bolivia. (Photo: C. Stadel).

*Fotografía 2. Movilización comunal para la construcción de un sistema de abastecimiento de agua (Región del Titicaca, Bolivia).*

Numerous examples of rural development initiatives, where the resilience of *campesino* communities was supported and strengthened, have been implemented by NGOs in the Andes and have also been documented in the literature. It would exceed the scope of this synthesizing paper to adequately document the large range of locally- or regionally based development programs. In general, these were successful in reinforcing the resilience potential of environments and communities, if local conditions, resources, ‘voices’ and ‘visions’ had been properly appreciated and integrated into larger – scale regional agendas (RHOADES, 2000) and where there has been a genuine participatory research and action approach. In Bolivia, the author had the opportunity to appreciate the work of AGRUCO (‘Agroecología Universidad de Cochabamba’) which also has been presented in the scientific



Figure 4. Resilience of Andean farming communities and agricultural land use.  
 Figura 4. Resiliencia de las comunidades agrícolas en los Andes y uso agrícola.

literature by Stephan RIST (e.g. RIST, 1993; RIST, 2000). The homepage of AGRUCO ([www.agruco.org](http://www.agruco.org)) emphasizes the principal goal of the Institution to contribute to a sustainable endogenous development on the basis of an agroecology and a renewed valorization of the wisdom of indigenous people (translated from Spanish). To AGRUCO and RIST 'adopting an actor-oriented approach development means trying to perceive reality through the eyes of local people' (RIST 2000: 310) While a focus in the development approach is placed on local concepts and traditional values of solidarity, equity, and ecological sustainability, RIST asserts that

*'Campesinos are not opposed to the market economy in principle but are trying to reshape its individualistic and materialistic aspects based on a reevaluation of their traditional world view and the ethical principles that derive from it in changing and dynamic context'.* (RIST 2000: 315)

Table 4 summarizes the most important recent changes of socio-economic conditions which have an impact on Andean agriculture and livelihoods.

BEBBINGTON (2000), in a most succinct analysis, relates to these changes as 'livelihood transitions' and 'place transformations' in the Andes.

Table 4. Changing socio-economic conditions for Andean agriculture.  
 Tabla 4. Condiciones socioeconómicas de cambio en la agricultura andina.

<p><b>INCREASED MARKET AND PROFIT ORIENTATION</b></p> <ul style="list-style-type: none"> <li>- CONVERSION OF LAND USE FROM SUBSISTENCE ORIENTATION TO MARKET ORIENTATION WITH THE CULTIVATION OF EXPORT-ORIENTED PRODUCTS</li> <li>- INTENSIFICATION OF AGRICULTURAL LAND USE, OFTEN WITH INCREASED APPLICATION OF IRRIGATION, IMPLEMENTS AND MECHANIZATION</li> <li>- OFTEN AGRICULTURAL LAND AMALGAMATIONS BY PRIVATE LAND OWNERS, COOPERATIVES, CORPORATIONS AND GOVERNMENTS</li> <li>- POTENTIALLY DETERIORATING LAND USE AT THE OUTSKIRTS OF THE COMMERCIAL FARMS</li> </ul> <p><b>STRENGTHENING OF COMMUNITY SUBSISTENCE AGRICULTURE WITH REGIONAL MARKET ORIENTATION</b></p> <ul style="list-style-type: none"> <li>- SUSTAINABLE, TO THE LOCAL CONDITIONS ADAPTED LAND USE</li> <li>- AGRICULTURAL SYSTEMS AND TECHNIQUES BASED ON PROVEN TRADITIONAL PRACTICES AND ON ECOLOGICALLY AND CULTURALLY ADAPTED METHODS</li> <li>- AGRICULTURAL LAND USE PROTECTING ENVIRONMENTAL INTEGRITY AND CAUTIOUS RESOURCE USE (LAND, SOIL, WATER, VEGETATION)</li> <li>- EMPHASIS ON NATIVE CROPS AND CONSERVATION OF BIODIVERSITY</li> <li>- PRODUCTION AND PROCESSING OF NICHE PRODUCTS FOR UP-SCALE MARKETS</li> </ul> <p><b>CHALLENGING NEW INTERFACES BETWEEN CONSERVATION AND AGRICULTURE/FORESTRY</b></p> <ul style="list-style-type: none"> <li>- CONFLICTING OR COMPLEMENTARY INTERESTS AND RESULTING LAND USE</li> <li>- TRANSITION/BUFFER ZONE BETWEEN AGRICULTURAL LAND USE AND BIOSPHERE, BLENDING AGRICULTURAL PRODUCTION/FOREST USE AND CONSERVATION, OR SHARPLY DELINEATED EXCLUSIVE ECONOMIC AND CONSERVATION ZONES</li> </ul> <p><b>URBAN GROWTH AND RURAL INVASION</b></p> <ul style="list-style-type: none"> <li>- INVADING URBAN LAND USE WITH TENTACLES OF LAND SPECULATION</li> <li>- INTENSIFICATION OF URBAN MARKET ORIENTED HORTICULTURE, OR 'BLIGHTED' AGRICULTURAL LAND</li> <li>- CONVERSION OF AGRICULTURAL LAND TO TRANSPORTATION INFRASTRUCTURES (HIGHWAYS; AIRPORTS), SHOPPING CENTERS; INDUSTRIAL PARKS, RECREATION COMPLEXES</li> <li>- LAND USE CHANGES RESULTING FROM FOREIGN REMITTANCES</li> </ul> <p><b>ALTERNATIVE RURAL ECONOMIC ACTIVITIES</b></p> <ul style="list-style-type: none"> <li>- ECOTOURISM WITH A CONSERVATION OF ECOLOGICALLY IMPORTANT OR VULNERABLE AREAS COMBINED WITH ENVIRONMENTALLY COMPATIBLE TOURISTIC INFRASTRUCTURE</li> <li>- AGRO TOURISM WITH A MAINTENANCE OF AGRICULTURAL LAND USE COMBINED WITH 'SOFT' TOURISTIC INFRASTRUCTURES</li> </ul>
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Today, the rural Andean regions are more closely integrated into national economies and societies and the livelihoods, landscapes and, development of the Andes is increasingly also affected by global processes (Photo 4). (BEBBINGTON, 2001) speaks of 'Globalized Andes'. Yet, in view of this impact of globalization on Andean landscapes, communities and activities, local voices and visions should be integrated into the development agenda. (RHOADES, 2000). Based on his experience of a multi-year research and development partnership with indigenous communities in the Cotacachi region of northern Ecuador, RHOADES (2006) pleads for a 'Development with Identity', e. g. for a genuine participatory development process based on the wisdom of ancestral knowledge, of traditional livelihoods, agricultural systems, on self-determination, and proven forms of social organization. Ideally, this locally – based research and development agenda could be complemented by a genuine partnership with an external scientific, technical and financial input. This could help to enhance the awareness of the local population for the complex local-global issues and better prepare it for adaptive measures which hopefully could also create new opportunities for farmers and rural communities (NEUBERT &MACAMO, 2002).

Based on previous research (STADEL, 1995; STADEL, 2000; STADEL, 2003 a & b; STADEL, 2006) the author has attempted to formulate the following guidelines for a *campesino* oriented development:

- \* based on an understanding and a valorization of the *saber campesino*.
- \* based on a harmony between the environment and society (*cosmovisión andina*).
- \* based on the potential and limitations of the local physical and human environments.
- \* based on the principles of long-term economic viability for the local communities, on a respect for cultural values and traditions, on social well-being, equity and justice for all segments of the society, and on the maintenance or restoration of environmental quality.
- \* based on the traditions of community organization and the principles of economic and social *reciprocidad* (communal solidarity and cooperation).
- \* based on the priorities for an environmentally compatible agriculture (*agroecología*), biodiversity, and for cultural diversity.
- \* based on a complementarity between local traditions and strategies and compatible external innovations.
- \* based on the requirements for a long-term economic, social, and political security, stability, and harmony for families and communities.
- \* based on locally perceived needs, priorities, methods, strategies, and techniques.

- \* based on the principles that development efforts have a priority focus on the most fragile environments and on the most marginal segments of the population.
- \* based on the philosophy that *campesinos* are not subjects who have to adapt themselves to external concepts and demands, but are participants and genuine partners in the development process.



Photo 3. Modernization of small-scale agricultural operation, Chibuleo region; Prov. Tungurahua, Ecuador. (Photo: C. Stadel).

*Fotografía 3. Modernización de una pequeña finca agrícola.*

#### **4. General observations on global impacts on Andean agriculture and rural livelihoods and tentative guidelines for Andean research**

What can certainly be affirmed is the fact that almost all Andean regions and communities have been affected by supra-regional, in many instances even national or global trends, forces and actors; and that the local landscape –agricultural and institutional– is thus at the same time a transnational landscape (BEBBINGTON, 2001:430).

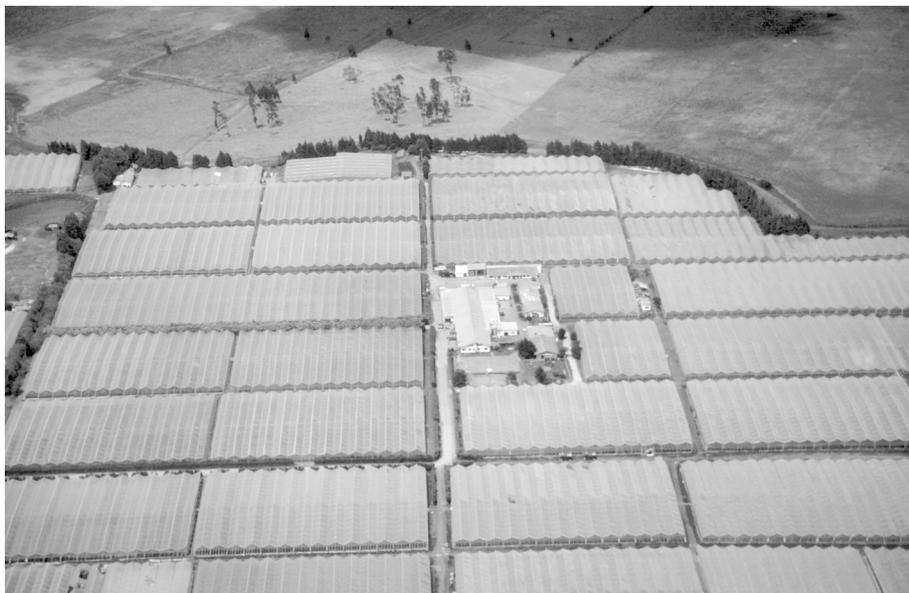


Photo 4. Export-oriented flower cultivation, Sabana of Bogotá, Colombia (Photo: C. Stadel).  
*Fotografía 4. Cultivo de flores destinado a la exportación, Colombia.*

In 2005, the international GLOCHAMORE (Global Change Impacts and Sustainable Land Use and Natural Resources Management in Mountain Biospheres) consortium organized a Workshop in Granada, Spain. During this meeting, the Latin America Working Group proposed the following recommendations relating to mountain Biosphere Reserves (BR) and their adjacent areas in the light of globalization trends (STADEL 2006b: 270-271):

- \* High priority should be given to local stakeholder involvement, particularly in buffer zones and transition areas.
- \* The 'distinctiveness' of individual BRs should be maintained.
- \* Regional/global networks or subnetworks for scientific and management cooperation should be initiated or strengthened.
- \* Sets or indicators for global and regional comparison should be designed.
- \* A multi-scale approach within and between BRs to deal with scale differences should be taken.
- \* Economic/poverty drivers and land use change are particularly relevant for Latin America.

- \* BR planning and management tools should be developed to assist individual countries in regional or local planning.
- \* Training and involvement of local researchers should be fostered (capacity building).
- \* Incentives for community-based research on global issues should be encouraged.
- \* Cooperation/complementarity and possible conflicts between stakeholders should be investigated with the objective of developing integrated solutions.

At the 'Symposium on Climate Change: Organizing the Science in the American Cordillera' in Mendoza, Argentina (CONCORD, 2006:31), the author addressed potential changes and adaptations of agricultural land use and of rural livelihoods under the impact of climate change and socio-economic globalization. The anticipated warming trend may result in upward shifts of some altitudinal zones of crops and pastures and of the upper limits of settlements, and it may shorten the frost hazards at intermediate levels. Changing precipitation regimes may also affect the rural water supply and irrigation potential, most notable perhaps resulting in the melting of the snow or ice caps of the highest summits. This has been recently documented in the Cotacachi region of Ecuador where the 4937m high Nevado Cotacachi has lost its cap of glaciers and permanent snow over the last few decades; a fact which has severe impacts on the water availability of the region (RHOADES, 2006: 64-73). Oscillating climate conditions with significant repercussions on agriculture and rural livelihoods occur during 'El Niño' or 'La Niña' events with their altered regional precipitation regimes often requiring short-term adaptations of agricultural activities.

In the current focus of the scientific debate on climatic changes, the impacts of changing socio-economic conditions largely resulting from external –at times global-level– forces and actors should not be overlooked. Overall, agricultural activities and rural livelihoods have been greatly affected by an increased market and profit orientation. While the impacts of these changes may be ambivalent, these new developments have often widened the socio-economic gap within specific rural regions. Reacting to these potential threats to the viability and autonomy of regional economies, many communities have attempted to protect their regional environmental base and to safeguard a sustainable small-scale agriculture.

The new awareness of environmental protection, the delicate balance between agriculture and forestry on the one hand and conservation or environmental rehabilitation on the other hand, represents new challenges and opportunities. In some areas, the interface between ecological postulates

and regional economic necessities have stimulated the development of various forms of ecotourism or agrotourism with their emphasis on environmental protection and sustainable small-scale agriculture. Undoubtedly, one of the most fundamental factors of the socio-economic transformations of most rural Andean regions has been the improvement of the transportation infrastructure and the enhanced or new forms of communication. This has resulted in various forms of interactions between regional cities, metropolitan centers and international destinations and the rural Andean communities. For instance, family members may work periodically or permanently in the larger cities of the country or abroad, may send financial remittances to their villages, or may culturally bring city life of foreign tastes and habits to their homeland.

## 5. General conclusions and suggestions for research priorities

Based on the observations and experiences in various parts of the tropical Andes, the following general conclusions relating to Andean agriculture and rural livelihoods and suggestions for research priorities and development strategies may be made – albeit in a tentative fashion. These comments and recommendations do not suggest that they may not have been properly considered in research, policies and strategies.

They are meant to provide a summary of observations and experiences of Andean scholars and practitioners:

1. Given the heterogeneity and diversity of Andean environments and community, any generalizations about the *campesinado* of the tropical Andes, about the nature and extent of its vulnerability and the various forms of resilience and adaptation appear to be problematic.
2. Global changes are affecting all regional levels and all segments of Andean communities. The global changes may however have varied impacts on specific regions and people.
3. While global climatic changes have major repercussions on human livelihoods, other types of global changes (cultural, social, economic and political ones) have also a major impact on environments and livelihoods. Furthermore, changes affecting the rural Andes are not only of a 'global' nature, some or them emanate at a regional or national level.
4. In view of the spiritual value of land, forest and water in the Andean cultural tradition, adaptive strategies of communities to global changes should take into account the 'sacredness' of land and water.

5. In view of the impacts of globalization on agriculture, forestry and water resource utilization, a conservation of the Andean agricultural biodiversity is of paramount importance. This agro-biodiversity enhances the ecological stability and the food security of local communities.
6. Farming communities should be enabled and empowered to face the exterior challenges and changes on the basis of an enhanced self-confidence, pride, knowledge and autonomy.
7. Rural development strategies should follow the principles of the so-called 'pro poor approach'; e.g. should focus on the needs and priorities of small farmers.
8. In view of the multi-faceted Andean livelihoods and newly created opportunities, rural development strategies should rely both on proven traditional economic 'safety nets', as well as on new 'windows' of local opportunities.
9. Research on Andean rural environments and communities should be carried out in a genuine partnership between local populations with their wisdom and practical knowledge and external scientists and experts with their sets of expertise and know-how.
10. External influences impacting an Andean natural and human environments require local ecological and social-cultural 'filters'.
11. In view of a pervasive penetration of market orientation, corporate economic interests, modernization and globalization, research on Andean land use systems should focus on alternative and diversified forms of agriculture, e.g. agro-ecology, agro-forestry, agro-biodiversity, agro-tourism, agro-industry.
12. Andean farming communities should be informed about good agricultural and livelihood practices. This 'pooling' of successful experiences and their promotion could enhance further adoption, replicate successes and catalyze the development process in wider regions and larger *campesino* communities.
13. Research on global changes in rural Andean regions should take a genuine cross-disciplinary integrative approach.
14. While there is a persistent need for research on local regional case studies, the research on global changes should also be focused on entire watersheds, ecological belts and niches, cultural realms, and in general on highland-lowland interaction systems.
15. Research on the impact of global changes in the rural Andes should focus both on the most fragile and vulnerable environments, as well as on successful 'islands of sustainability'. Global changes may either

exacerbate the risk of land and livelihoods, or initiate potential paths of development and progress.

16. Research on the impact of global changes in the rural Andes should be well integrated into the experiences and knowledge of local and regional stakeholders and practitioners. In particular, Andean farmers have a wealth of *saber andino* and have, over many centuries, developed successful strategies of resilience and adaptations to changing conditions.

## 6. Concluding remarks

The experiences of scientists and practitioners confirm that the environmental and social compatibility of agricultural activities and rural livelihoods and of development programs form the basis for a sustainable future of the Andes. It has also become obvious that ecological considerations, parameters and policies cannot be isolated from the cultural and social context of the Andes and that there is a close interrelationship between the Andean environment and Andean livelihoods (LLAMBI *et al.*, 2005).

This paper emphasized the diversity of agricultural landscapes and systems of the tropical Andes and attempted to portray the major challenges and constraints for farming and rural living. But it also focused on the wealth and potential of natural and human resources and on the long tradition of the *Saber Andino* which, over the centuries, gave witness to many successful forms of resilience and adaptation to environmental, economic and social challenges and changes (APFFEL-MARGLIN, 1998; LAURIE *et al.*, 2005). While many opportunities and problems are local in nature and may require local responses, increasingly today rural environments and communities are affected by national and global processes and actors, and may therefore require strategies at a wider regional, national, or even global level (GSAENGER, 1998). Yet, it appears paramount, that the stewardship over the Andean environment and resources should be kept in the responsibility and control of indigenous or local communities (HOFFMANN, 2007). Furthermore, any conservation or development initiatives must be based on the cultural heritage, and the needs and priorities of local populations. In the light of neo-liberal market orientation and growing global impacts, the voices of the rural populations should be heard and their own livelihoods secured in a sustainable fashion (FLORA *et al.*, 1997; GIBBS, 2005; GREGORY, 2000). It is therefore with considerable hesitation that this overview of Andean rural environments, their potentials and problems has been formulated in a rather

generalizing fashion. Also, the proposed guidelines for social research in the context of global changes within the Andean realm have to be quite tentative but could hopefully make a contribution to Andean research and development approaches.

In conclusion, the resilience of Andean rural communities has to rely on the dual pillars of a wise adherence to proven traditional values and practices and on the local 'voices' and actions, as well as on locally controlled and sustainable forms of adaptations in a genuine cooperation with external actors. This careful balance –in the past and in the present– has at times not successfully been achieved and has either led to forms of stagnation and marginalization; or to an uncontrolled invasion by poorly adapted economic, technological and cultural influences which may have resulted in deep-rooted crises and disparities. Yet, the growing local *conscientización*, *autogestión*, 'stewardship' for the environment and the resources and empowerment of local stakeholders should in many cases attenuate the ecological and social vulnerabilities and strengthen the potential of resilience and of successful and sustainable adaptations to new developments.

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