Revista AMBIENTE & SOCIEDADE

SciELO

Ecosystem-based Adaptation in Ecuador: Good Practices for Adaptive Co-Management

Pere Ariza-Montobbio [I]
Nicolás Cuvi [II]

[I] *Environment and Health Research Group (BIOMAS), University of the Americas (UDLA) Quito/Pichincha - Ecuador*

[II] *Latin American Faculty of Social Sciences (FLACSO) Quito/Pichincha - Ecuador*

Abstract: Ecosystem-based Adaptation (EbA) requires social learning and linkages between actors and levels under Adaptive Co-Management (ACM), especially in landscapes with high biodiversity and vulnerability, such as the Tropical Andes. Methodology: A multicriteria methodology was designed and applied to identify, characterize, select and evaluate the ACM and the constraining and enabling conditions for its effectiveness in EbA actions implemented between 2011 and 2015. Results: 1. The integration of conservation, restoration and sustainable production, and linkage among institutions and sectors through local leadership, enable knowledge coproduction, social learning and innovation. 2. Governance and planning based on a landscape approach, and acknowledgment of the diversity of contexts, promote dialogue, cooperation and institutional innovation. 3. Economic alternatives in production, marketing and local markets, as well as complete and adequate technology transfers, stable and planned funding and monitoring, promote sustainability.

Keywords: Multicriteria analysis, climate change, Adaptive Co-Managementment.

São Paulo. Vol. 23, 2020

Original Article

DOI: http://dx.doi.org/10.1590/1809-4422asoc20180315r2vu2020L4AO

Introduction

The Tropical Andes are a biodiversity hotspot extending from western Venezuela to northern Chile and Argentina, following the Andean range from approximately 600 meters above sea level, with regional variations. The hotspot has high population density and a wide variety of ecosystems, landscapes and cultures. In these mountains, climate change has had effects that include temperature increase and hydrological changes tending toward greater seasonality, that lead to droughts and flooding, glacier melt and displacement of biomes, species and crops toward higher altitudes (YOUNG; LIPTON, 2006; STADEL, 2008; PÉREZ et al., 2010; BÁEZ et al., 2016; CUESTA et al., 2019). These impacts, combined with changes in land cover and use, an increase in urbanization, migration, mobility and agribusiness in the form of monocultures, as well as the diversification of activities characteristic of new ruralities, are affecting the vulnerability and resilience of communities, ecosystems and landscapes (GRAMMONT, 2004; GRAY, 2009; LLAMBI, 2012; PERALVO et al., 2012).

Various impacts have also been observed in other ecosystems in tropical areas, such as coasts and the Amazon rainforest (MAGRIN et al., 2014). In light of these changes, a number of institutions and actors have proposed that biodiversity and ecosystems may help adaptation (CBD, 2009) through Ecosystem-based Adaptation (EbA), which includes "sustainable management, conservation and ecosystem restoration […], taking into account the multiple social, economic and cultural benefits for local communities" (CBD, 2010). This approach has been adopted in climate change projects and programs in Latin America, especially since the 2010s.

EbA tends to be flexible and complements other adaptation and mitigation proposals, livelihoods and sustainable development alternatives, and it will probably provide benefits in all climate change scenarios as a "no regret" measure (HALLEGATTE, 2009; MUNANG et al., 2013; VIDES-ALMONACID, 2014). It can be managed locally and, by promoting the diversification of livelihoods, simultaneously acts on immediate needs and adaptive capacity to deal with uncertainty (HEATH et al., 2009; UY; SHAW, 2012; CHONG, 2014).

In spite of its potential, the adoption of EbA practices involves institutional and research challenges. Some experiences have faced limitations, mainly in institutional coordination across scales and in follow-up effectiveness and monitoring results (UNFCCC, 2011; MUNANG et al., 2013; DOSWALD et al., 2014). Thus, a fundamental challenge involves building methodologies and indicators to monitor and evaluate EbA actions (UNFCCC, 2011; RAJIB; UY, 2012; CHONG, 2014).

In light of these limitations, the approach of Adaptive Co-Management (ACM) has emerged as a complementary proposal for managing common goods, territories and services (OLSSEN et al., 2004; CARLSSON; BERKES, 2005; ARMITAGE et al., 2009, 2011; PLUMMER, 2009; FABRICIUS; CURRIE, 2015). ACM combines linkage of levels, scales, actors and knowledge types, characteristic of collaborative and cooperative management (BERKES, 2009), with iterative social learning, knowledge production and reflexive feedback of adaptive management (HOLLING, 1978, WILLIAMS, 2011).

This combination offers opportunities for overcoming EbA's limitations and improving its practices.

This research contributes to improving the EbA approach through the development of an evaluation methodology and the search for enabling and constraining factors that guarantee/preclude effective ACM in EbA actions. Research focused on the conditions and processes required for effective ACM in EbA actions, given their importance in encouraging long-term resilience. When secondary data was available, actions results and their impacts on ecosystems were evaluated. There were three research objectives: (i) identify and characterize EbA actions implemented in continental Ecuador between 2011 and 2015; (ii) analyze the degree to which an ACM had or not, been effectively implemented; and (iii) identify conditions that enabled or constrained ACM in EbA actions.

Conceptual framework

Constructing ACM implies encouraging cooperation among levels, and modifying practices and decisions, on the basis of monitoring and social learning. Processes should comply with certain conditions that include, according to Armitage et al. (2009, 2011) and Olsson et al. (2004):

• The existence of a defined, relatively small scale resource system with clear property rights and a group of actors with a shared interest in management, with an agreed management plan.

• Individual and collective leadership composed of persons or groups able to generate trust, a common vision and long-scale commitments to institutional building.

• Legal and political frameworks that facilitate decentralization and local management, and that provide resources, training and the means for actors to function at different scales.

• Actors open to intercultural dialogue, to sharing or resorting to a plurality of knowledges and values, willing to combine these to learn and co-produce new knowledge.

• Information flows through horizontally and vertically integrated networks at different levels.

• Funds and operative capacity to monitor socioecological feedback and respond to that feedback, through participation, generating empowerment and collective interpretation.

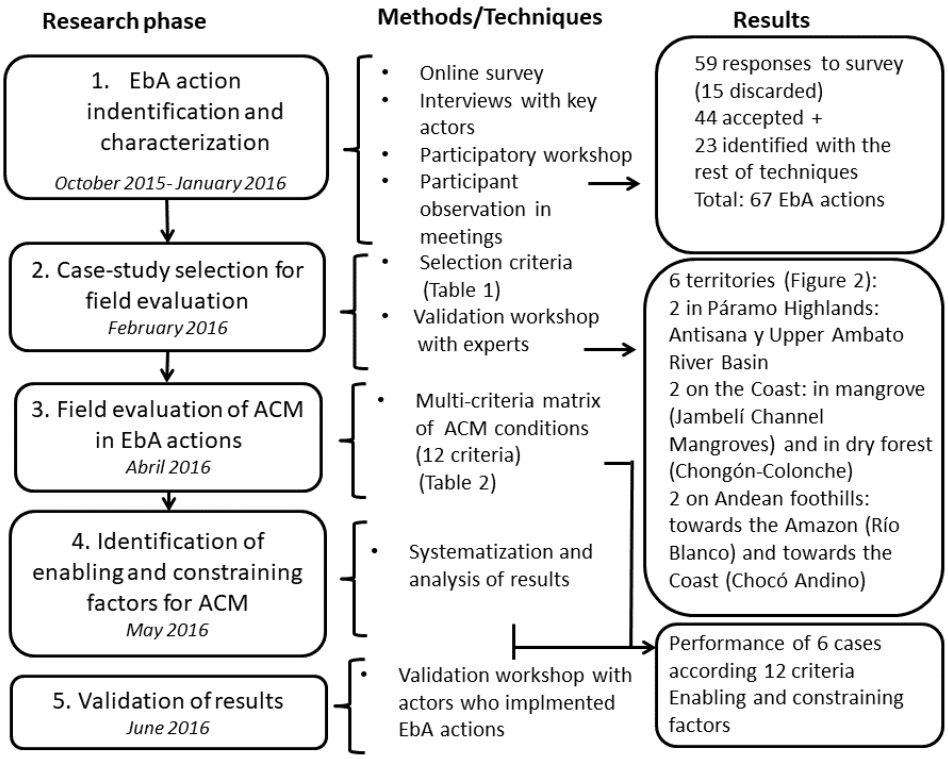
• Actors sensitive to power relations and historical and current inequities, willing to transform them.

Based on these principles, a multicriteria methodology was designed to evaluate ACM in EbA actions in Ecuador.

Methodology

In order to contribute to the Third National Communication on Climate Change in Ecuador, the purpose of the research was analyzing climate change actions undertaken in the country between 2011 and 2015 (MAE, 2017). A methodology was developed in order to identify, characterize, select and evaluate EbA actions under a multi-criteria framework (MUNDA, 2008), as shown in Figure 1.

Figure 1 - Methodology scheme



Source: Pere Ariza-Montobbio.

In this article, an "EbA action" is a project or concrete measure of ecosystem management oriented towards conservation, restoration or its sustainable use, for the purpose of increasing resilience and reducing vulnerability of both ecosystems and human populations (CAMPBELL et al., 2009). Those projects or measures may be consciously planned with adaptation objectives, or they may have been adopted along the way. Indeed, they may have been planned for purposes of conservation or development, but end up contributing to climate change adaptation.

Table 1 – Criteria for selecting case studies

Criteria to guarantee representativeness at the country scale		
Criteria	**Description**	**Score/Threshold**
Geographic and ecosystemic diversity	Representation as diverse as possible of ecosystems and regions of the country, both in terms of individual cases and the set of cases	Does the individual case act on various ecosystems? 0. No. 1. Yes Does the set of cases take into account a representative diversity of ecosystems or regions? 0. No. 1. Yes
Scale diversity	Inclusion of cases that together (and, if possible, individually), address multiple scales, from local ecosystems to provinces or watersheds	Does the individual case cover multiple scales? 0. No. 1. Yes Does the set of cases cover multiple scales? 0. No. 1. Yes
Budgetary and time limitations	Number and diversity of cases adjusted to available time and budget	Is it possible to evaluate the individual case given the available time and budget? 0. No. 1. Yes Is it possible to evaluate the set of cases given the available time and budget? 0. No. 1. Yes
Criteria for selection among cases		
Criteria	**Description**	**Score/Threshold**
Diversity of actors and institutions coordinating among themselves in networks, including local participation	Institutional coordination among diversity of actors, including local participation	0. Actions are carried out by a single main actor 1. Actions are carried out by a local actor and an external actor 2. Actions are carried out by more than one external actor and one main local actor 3. Actions are carried out by various local and external actors in coordination.

Tangible, material on-field actions	Tangible results in the form of field practices. Discarding actions dedicated solely to research, education, communication, training and awareness campaigns.	Is the action focused on obtaining tangible, material on-field results? 0. No. 1. Yes
Outstanding management model	Cases which, during characterization, were considered outstanding by various actors due to their exemplary institutional models.	0. Unknown action or not characterized as exemplary 1. Known action and highlighted by at least one actor interviewed 2. Known action and highlighted by one or two actors interviewed and highlighted in at least one reference in the bibliography 3. Known action and highlighted by more than two actors interviewed and highlighted in more than one reference in the bibliography
Outstanding EbA practices	EbA practices identified as exemplary by various actors	0. Practices are unknown or not highlighted as exemplary during interviews 1. Practices are known and highlighted by at least one actor interviewed. 2. Practices are known and highlighted by one or two actors interviewed and highlighted in at least one reference in the bibliography 3. Practices are known and highlighted by at least two actors interviewed and highlighted in more than one reference in the bibliography
Centered on EbA	Actions and practices centered on EbA (discounting those centered on Water, AFOLU or Risk management)	Is the action focused on the EbA approach? 0. No. 1. Yes
Availability for receiving field visits	Willingness of the implementers to collaborate with field research	Are the implementers willing to receive field visits and to provide additional, detailed information? 0. No. 1. Yes

Grouping into regions	Consideration of the tendency of various identified actions to concentrate in regions	Is the action part of a group of actions in a geographic region? 0. No. 1. Yes

Source: Pere Ariza-Montobbio and Nicolás Cuvi, based on workshops and interviews.

Application of these criteria led to selecting three actions in the "Sierra" (High Andean Hills). Two cases located in *páramo* highlands, the ecosystem most often reported in the survey and one of the most vulnerable to climate change (TOVAR et al., 2013): one in the upper watershed of the Ambato River and other in Antisana. The third case in the High Andean Hills Region was the Andean Chocó, on the Andes foothills descending towards the Coast. Two more actions selected were on the Coast, in the dry Chongón-Colonche forest and in the mangroves of the Jambelí Channel (Canal de Jambelí). Finally, an action was selected in the Amazon, on the Blanco River (Río Blanco) (Figure 2).

While the action in the Antisana *páramo* highlands did not comply with the local community participation attribute, as the site is managed by government institutions with support from universities, that territory was included because it is a key EbA initiative for providing water to the city of Quito.

To analyze to what extent the case studies implemented ACM effectively, the methodology was composed of 12 indicators grouped in three dimensions (Table 2). Following the ACM conceptual framework, the three dimensions covered:

• Ecosystem management practices (good practices and degradation pressures) and the intervention context (state of the population and the ecosystems) (Dimension "Ecosystem services and human wellbeing");

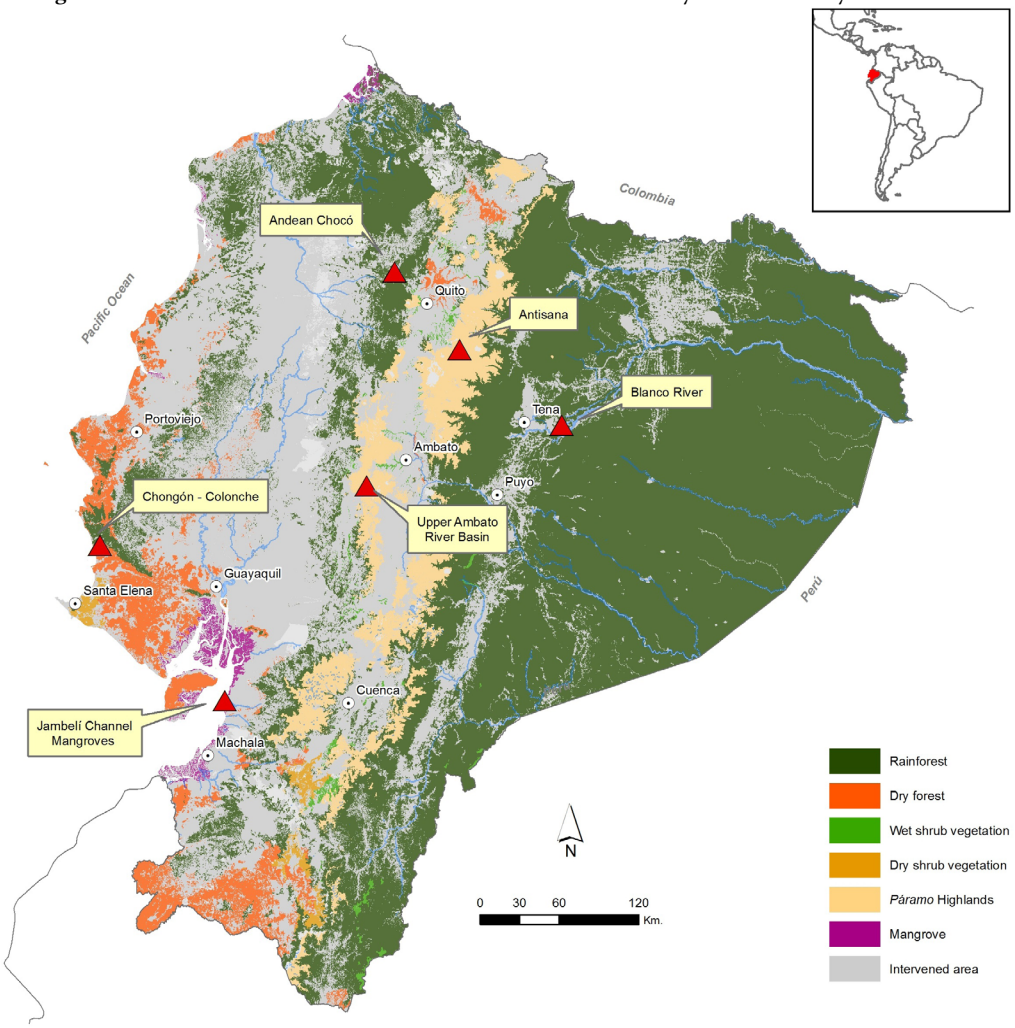
• The capacity of actors to plan, finance, interact and manage those practices and ecosystems (Dimension: "Organizations and institutions: governance");

• Their capacity to generate information and knowledge collaboratively, and to monitor, learn, innovate and act adaptively, in response to knowledge (dimension: "Knowledge").

The 12 indicators were validated in a workshop with experts, together with the selection of cases, and the evaluation methodology was fine-tuned based on what had been identified at the time.

Each indicator had a range between 0 and 3, with 0 being the most restrictive situation and 3 the most enabling (Table 2). When the actions fulfilled intermediate aspects between the ranges, one of three decimals were used (0.25, 0.5, 0.75), depending on how close they were to the proposed thresholds. Scores were represented on a radar graphic, based on the methods of Multi Objective Integrated Representation (MOIR) (GOMIERO, 2005). These scores were inferred based on qualitative and quantitative information obtained through observation, interviews, focus groups and secondary sources.

Figure 2 – Location of the six case-studies within the ecosystem diversity of Ecuador



Source: Paola Maldonado and Nicolás Cuvi, based on MAE (2014).

Tabla 2 - Indicators for multi-criteria evaluation of ACM in EbA cases in Ecuador

Indicador	**Point range** (from 0 as the most limiting score, to 3 as the most enabling)
Dimension 1: Ecosystem services and human wellbeing Practices and ecological and social conditions that have an influence on ecosystem services and human wellbeing	
State of the ecosystem and its services	0. Ecosystem degradation exceeds the capacity for natural regeneration and intervention is required to recover ecosystem services.
	1. The ecosystem provides some of its potential services but one is degraded and is not provided in sufficient quality or quantity.
	2. The ecosystem provides expected and habitual services, but there is no active management to assure sustainability.
	3. Active conservation and restoration strategies exist to allow restoring, sustaining and extending the quality and quantity of ecosystem services provision.
Socioeconomic status of the population: Measured according to the Unsatisfied Basic Needs index (NBI in Spanish)	0. More than 95% of the population is poor. The Unsatisfied Basic Needs index (NBI, in Spanish) determines poverty on the basis of five components: i) quality of housing, ii) overcrowding, iii) access to basic services, iv) access to education and v) economic capacity. If the household is poor in at least one of the components, its members are considered poor.
	1. Between 75 and 95% of the population is poor.
	2.Between 55 and 75% of the population is poor.
	3. Less than 55% of the population is poor.
Pressures and social and ecological process of environmental degradation	0.There are degradation processes and pressures that interact with climate threats, generating impacts on natural resources and livelihoods, and reducing adaptation options.
	1. There are degradation processes and pressures that are significant and widely extended in the landscape.
	2. There are degradation processes and pressures that are less significant, punctual and localized.
	3. Pressures and processes of degradation are not significant or are very limited.

Dimension 2: Organizations and institutions (governance) Organizational and institutional mechanisms regulating knowledge and practices	
Institutions and institutional linkages	0. There are no institutional structures, or they are weak and do not allow for linkages among actors at different scales.
	1. There is a set of active actors in communication, but without stable ties.
	2. There is an institutional structure that links actors, creating cooperative linkages.
	3. There is a stable dialogue through linkages and institutional structures that generate documents and legal or planning frameworks and agreements. This situation establishes flexible frameworks that allow for a balance between common and individual actions.
Local, social, community and collaborative management	0. Actions are planned vertically and decided upon by external actors without local participation.
	1. Local actors participate in socialization and implementation of actions decided by external actors or superior levels.
	2. Local actors actively participate and have decision-making capacity and responsibility for actions.
	3. Active local participation is supported by institutional structures at upper levels that guarantee local decision-making capacity and responsibility.
Planning	0. There is no structured and organized planning.
	1. There is vertical planning in which only external and upper level actors have a vision about the future.
	2. There is long-term planning in which local and upper level or external actors have a vision of the future. However, those visions are not able to translate into concrete actions, policies or legal frameworks.
	3. Long-term planning by the community is supported by legal frameworks and concrete policies are shared and respected by actors at multiple levels. That planning is based on a long-term vision regarding desirable ecosystem states, with trust and cooperation, respect and linkage of the local vision with other levels.
Funds	0. Funds are scarce, irregular and only available for specific activities.
	1. Funds allow for implementation of actions.
	2. Funds allow for implementation and monitoring actions.
	3. Funding is sustained over the long term and permits implementation, linkages and monitoring actions.

Dimension 3: Knowledge
Knowledge, technologies, and processes for building knowledge and innovation that sustains practices

Availability of information	0. There is a lack of information, or it is poor and badly articulated.
	1. There are base-line studies on various subjects and dimensions.
	2. There is a diagnosis created by the project that is implementing the actions and is linked with strengthening capacities and awareness.
	3. There is constant monitoring and review of available information.
Dialogue among knowledge types and knowledge co-production	0. Knowledge is produced mainly by technicians and experts from outside the local community and ecosystem.
	1. Knowledge is generated with community participation.
	2. The participatory process adapts knowledge and technologies to the context.
	3. The co-production of knowledge integrates current and traditional local knowledge with technical and scientific knowledge.
Action in response to information	0. There is no action in response to the knowledge generated, nor a connection between actions and knowledge.
	1. Current practices are modified according to existing knowledge (simple learning loop).
	2. New knowledge is used to incorporate and create management practices (double and triple learning loop).
	3. Adaptation actions consciously systematize knowledge to modify management, through evaluation and monitoring.
Technological innovation	0. Technologies are not modified, but adopted just as they were conceived by their external creators.
	1. New technologies are incorporated in a process of technology transfer of "black boxes" that do not generate local capacities and understanding about principles underlying their functioning.
	2. There is adaptation and re-signifying of existing knowledge and technology, acquired or traditional, that is applied and adapted to local, current needs.
	3. There is innovation through the integration and combination of sources and types of knowledge to create new applications and technologies.

Source: Pere Ariza-Montobbio and Nicolás Cuvi, based on: Olsson et al. (2004), Tompkins y Adger (2004), Armitage et al. (2009, 2011), Pahl-Wostl (2009), Plummer (2009).

When the degree of effective ACM implementation had been evaluated for each case, common and varying aspects were analyzed and sytematized, as were enabling and constraining factors that explained the ACM's performance. As a product of this process, three analytical categories emerged which structured the discussion: (i) integrality, (ii) landscape approach, and (iii) sustainability. Those three categories aggregated key aspects that turned out to be cross-cutting to the three dimensions (ecosystem services, governance and knowledge). The presence or absence of an integral approach affected ecosytem management practices, social organization and knowledge production by implementing actors. The landscape approach affected the way decisions were made and how to study management practices. Finally, modifyng practices and governance structures in response to new knowledge both facilitated and required sustainability.

The results and the methodological approach were validated in a workshop with active stakeholders involved in EbA actions in evaluated sites. The workshop consisted of three discussion groups in which a variety of participants from different cases (8 to 10 per group) debated major findings and conclusions. Each table adressed three analytical categories: integrality, landscape approach, and sustainability to deepen, in an interrelated manner, the validation of results.

Results

The multi-criteria evaluation of EbA actions performance in different phases was undertaken at two different scales: at the country scale, in the "identification and characterization phase", and at the local-regional scale of the case studies, during the "field evaluation phase". Below, the results for both phases are presented.

Identification and characterization of EbA actions

The following general characteristics were found in EbA actions:

1. Scale: Adaptation actions were performed at various scales: national, regional, or local.

2. Objectives: 59% of actions were planned with specific adaptation objectives. Other objectives were the creation of pilot management and capacity building models for natural resource management, reforestation, or ecological restoration. There were also biodiversity conservation programs and community actions oriented to agriculture and natural resource management.

3. Innovative practices: The most common innovative practices dealt with agroecology, forestry or agroforestry. Organizational innovations were detected in local government associations at the same or multiple levels ("*mancomunidades*" and "*consorcios*"), and in local committees and community planning for the management of protected areas. Among public policies generated, there were statutes, ordinances and adaptation and mitigation plans by local governments.

4. Models for actions implementation and execution: 75% of actions formed part of larger programs and were organized through two major models:

a. Actions implemented with strong community participation through agreements among local governments and the central government, with assistance from international organisms, NGOs, universities and businesses.

b. Actions focused on research and intervention, led by conservation and restoration experts based in public and private research institutions and universities.

Of the six cases selected for evaluation, five correponded to the first model, and Antisana to the second.

5. Financing: there was a prevalence of public funds and international cooperation.

6. Ecosystem services addressed: As with the results of Pramova et al. (2012), 47% of those surveyed said that the major services addressed by their actions were, simultaneously: water supply, erosion and landslide prevention, carbon storage and microclimate regulation.

7. Climate change impacts considered: water scarcity, soil erosion, extreme climate phenomena, and effects on security and food sovereignty.

8. Intervention sectors: Considering the four sectors addressed by the Third National Communication (Energy, Ecosystems, Water, and Agriculture, Forestry and Land Use -AFOLU), 75% or those surveyed found synergies between actions in ecosystems sector with the water sector, and 45% with the AFOLU sector.

9. Results, impacts, and sustainability: Regarding the evaluation of the EbA actions impact to reduce vulnerability and improve ecosystem services, 30% of actions already finished reported technical and organizational difficulties with monitoring. In general, the impacts reported referred to number of beneficiaries or vague mentions to changes in vegetation cover, recovery of agrodiversity, and increased water quantity and quality. There were repeated mentions to the need for improving monitoring systems, access to information and financial support to assure the sustainability of actions.

Cases evaluated

Table 3 presents, in detail, the main characteristics of the cases analyzed.

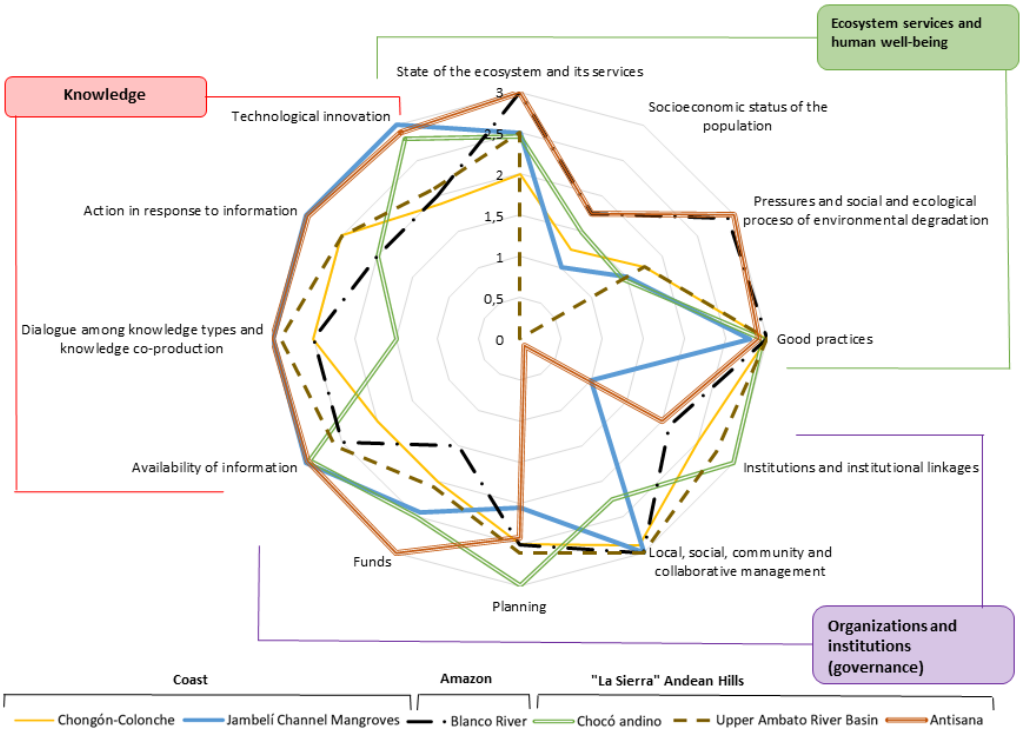
Table 3 presents, in detail, the main characteristics of the cases analyzed Source: Pere Ariza-Montobbio.(2009), Plummer (2009).

Case study	Land ecosystems	Major adaptation actions	Actors involved	Local management participation	History of adaptation processes and actions in the territory
Chongón--Colonche	Dry tropical lowlands forest and shrub, mist forest of the Coast	- Forest conservation (Cerro Blanco, Loma Alta, Dos Mangas, etc.) - Community conservation agreements - Community ecotourism - Implementation of a bamboo fiberboard factory - Strengthening of businesses producing items based on bamboo - Promotion of non-timber forest products - Promotion of sales at agroecological fairs - Consortium to deal with climate change in the coastal cordillera - Recovery of riverbanks with bamboo and banana (conservation-production link) - Renewal of coffee farms (northern area of Santa Elena and Manabí) - Agroecology and agroforestry farms (with emphasis on honeybees) - Analogue forestry farms	- Santa Elena Prefecture, ICDF-Government of Taiwan - Universities (UPSE, UTE, PUCG, USFQ) - UN Small Grants Program PNUD - Communes (Dos Mangas and Loma Alta) - European Union - Italian Cooperation Agency - Brethren y Unida Foundation - Valdivia Regional Board - Olón Regional Potable Water Board - Santa Elena Beekeepers Association (265 members) - Heifer Foundation	Yes	More than 30 years
Andean Chocó	Wet *páramo* highlands, high montane rainforest, cloud forest, lowland tropical rainforest	-Biodiversity conservation initiatives • Conservation and Sustainable Use Areas (ACUS) as municipality protected areas • Private reserves • Protected forests • Protected natural areas within National System of Protected Areas. • Important bird areas (IBA) and endemic bird areas (EBA) - Ecological restoration • Experimental plots of ecological restoration and carbon and biodiversity monitoring • Ecological restoration plots under the National Program for Forest Restoration - Sustainable production: • Agroforestry systems based on analogue forestry • Sustainable livestock raising • Sustainable community tourism • Promotion of organic product sales: EntreBosques Interpretation and Information Center - Investigation and training	- CONDESAN - Imaymana Foundation - Private Forests and Reserves Network of Ecuador, Private Forests and Reserves National Corporation of Ecuador - Decentralized Autonomous Parish Governments - Ministry of the Environment - Environment Secretariat of the Metropolitan District of Quito - ConQuito (Agency for economic production) - Quito Turismo - Provincial Government of Pichincha - Pacto Raw Sugar Association - Tropiculture Association	Yes	20 years

Case study	Land ecosystems	Major adaptation actions	Actors involved	Local management participation	History of adaptation processes and actions in the territory
Upper watershed of Ambato River	Dry and wet *páramo* highlands	- Chimborazo Fauna Production Reserve - Exclusion of livestock from certain areas through agreements and barbwire fences - Relocation of certain dwellings and livestock sites - Reforestation, especially with yagual or paper trees (*Polylepis* spp.) - Introduction of pasture grasses to improve livestock nutrition (pasture improvement) - Introduction of new livestock breeds and genetic improvement - Support for commercial ventures (i.e., essential oils), community infrastructure	- Corporation of Farmers Organizations of Pilahuín - Pilahuín Parish Council - Communities of La Esperanza, Cunucyacu, Yatzaputzan, Tamboloma, Pucará. - Ecology and Development Institute of Andean Communities - Fund for *Páramo* Highlands and the Fight against Poverty in Tungurahua - Honorable Provincial Government of Tungurahua - Municipal Government of Ambato - Water Parliament and Provincial Assembly - Ministry of the Environment (Chimborazo Fauna Reserve; Dry *páramo* Highlands; Socio-Restoration) - Water Boards (Irrigation Boards). This actor is not within the territory but directly depends on water from the *páramo* highlands - Municipal Potable Water and Sewage Corporation of Ambato - GIZ - CONDESAN - The Nature Conservancy - WWF - USAID - DeD	Yes	30 years
Blanco River	Lowland tropical rainforests	- Forestry, medicinal and food plant nursery - Community tourism - Community carpentry shop - Workshop for soap production - Reforestation - Promotion of Amazon gardens (chakra) - Promotion of products for sale: cacao, guayusa	- Blanco River Community - Ministry of the Environment's Forest Partner Program - Autonomous Decentralized Government of Napo Province (GAD) - European volunteers (CAMPS Ecuador) - Tourists - Ministry of Agriculture, Livestock, and Fishing - Autonomous National Institute for Agriculture and Livestock Research - Cacao sales associations: Kallari y Wiñak	Yes	More than 20 years
Antisana	*Páramo* highlands wetlands	- Public acquisition of *páramo* highlands territory (haciendas) - Exclusion of livestock for being the major degradation factor in these areas, and fencing to avoid the reentry of cattle - Establishment of experimental parcels for the restoration of *páramo* highlands - Hydro meteorological monitoring	-Fund for the Protection of Quito's Water - EPMAPS - INAMHI - Hacienda owners - Papallacta Parish Council - National University of Colombia (Bogotá campus) - Ministry of the Environment - World Bank - GEF and General Secretariat of the Andean Community	No	More than 20 years

Scores obtained by the six cases evaluated for each indicator are found in Figure 3, which should be read as a multi-criteria space where values near the center mean less social-ecological resilience.

Figure 3 – Comparison of case- studies EbA performance, according to ACM indicators.



Source: Nicolás Cuvi and Pere Arize-Montobbio.

There was a high prevalence of poverty, both according to Unsatisfied Basic Needs and in terms of low levels of livelihoods diversification (low and very low scores in all cases). There were high and very high scores in the state of ecosystems and their services, and good practices prevailed, tending towards the integration of conservation, restoration, and sustainable production. There were high and very high scores in dialogue among knowledges, information availability and technological innovation, as well as in local, collaborative and commuity management.

Discussion

The integrated, relational anlaysis of scores for the different indicators and dimensions, allowed for exploring common and differential aspects of case studies, in order to systematize lessons learned in ACM performance of EbA actions.

Performance of Adaptive Co-Management

Local, collaborative, community and cross-scale inter-institutional management models (for example, in the form of assemblies or parliaments), have made possible – though not without conflicts – the implementation of good practices, and have restricted or reverted pressures detrimental to ecosystems (high scores, Figure 3). For example, over grazing and degradation of the Upper Ambato River Basin, or deforestation and fragmentation of dry forests in Chongón-Colonche, have been reverted thanks to agreements linked to management plans co-produced by communities and other institutions. In the mangroves of the Jambelí Channel, shrimp producers, together with fishermen and artisanal shellfish gatherers, have reforested mangroves, reverting channel destruction and eutrophication, recycling nutrients and reducing water pollution.

Local leadership has catalyzed local ecosystem management networks and spread commitments within networks at other levels. The main local and regional actors have reinforced governance platforms at the mesoscale, such as the Andean Chocó Commonwealth ("*Mancomunidad*" in Spanish), or have acted as bridging organizations, facilitating ties among scales, as in the case of the Santa Elena Province Government in Chongón-Colonche. When there were poor ties among scales, but high local participation in management, as in Blanco River and the Jambelí Channel, strong local leadership compensated for the absence of mesoscale platforms or bridging organizations.

In the Andean Chocó, social and political leaders and local governments, in collaboration with private reserve owners and local and international NGOs, have promoted the Andean Chocó Commonwealth, which brings together six parishes with common objectives: sustainable livestock raising, agroforestry, forest restoration, conservation and sustainable use areas (ACUS in Spanish), and ecotourism. The Commonwealth has linkages with central, province and municipal governments, and with international organizations.

In the province of Tungurahua (location of the Ambato River), a model of participatory management has been developed based on temathic boards, such as the Water Parliament, which is part of the Province Assembly. There, indigenous and farmers' organizations, agriculturists, the industrial sector and local governments have debated and implemented good practices for the conservation and use of water. The combination of good local community organization, gathered in regional second-level organizations, together with the presence of the Fund for *Páramo* Highlands and the Fight against Poverty in Tungurahua ("Fondo de Manejo de Páramos y Lucha contra la Pobreza de Tungurahua"), has led to the approval and implementation of *páramo* highlands management plans. These plans have included measures such as restoration, relocation of dwellings, fences to keep livestock out from water sources, pasture and livestock improvement, efficient irrigation of lowlands and coproduction of knowledge, among others measures. These have partially reverted environmental degradation, though work is still needed around livelihoods diversification, promotion of alternative markets and spreading initiatives to erradicate poverty.

In Chongón-Colonche, the Santa Elena Provincial Government has developed an environmental and economic agenda that brings together local actors in participatory forums. Synergies have been generated between production and environmental projects that previously worked in isolation. There are community agreements for conservation, forest management, agroforestry systems, riverbank restoration and markets for bamboo, non-timber forest products, honey and other agroecological products. In spite of a historical process of deforestation and degradation, high vulnerability due to water scarcity, and poor livelihood diversification, good practices have made possible a coordinated response, mainly because of previous experience of various decades of cooperative projects in the area.

The innovative efforts to integrate restoration and sustainable use of mangroves have turned the Jambelí Channel into a reference for other shrimp farmers, fishermen associations and governments. The self-financing of shrimp producers, together with long-term local planning, have made it possible to deal with instability in government resources and a lack of ties between scales in long-term planning.

In Blanco River, a community vision has allowed greater livelihoods diversification through community ecotourism, sustainable forestry by adding value to timber and non-timber products, community carpentry, forestry nursery, artisanal soap, essence and medicinal plant production, contributing to the (re)valuing of ancestral knowledge together with modern knowledge. Excellent advantage was taken of funds from the Socio Bosque program, which consists of voluntary conservation of ecosystems by individual and community owners in exchange for monetary incentives. Advantage has also been taken of province government support to promote the Amazon chakra, an ancient agroforestry system. A community agenda has been built, in spite of the absence of fluid and stable institutional coordination between the national and province government.

Blanco River and the Jambelí Channel mangroves, as well as Chongón-Colonche and the Upper Ambato River Basin, exemplify how community empowerment leads to the coproduction of innovative knowledge. In the mangroves and in the Ambato River, innovations have occurred in the management of tree nurseries and reforestation, with participants learning and making changes through trial and error. To a lesser degree, in Blanco River, residents have incorporated knowledges to produce soaps, essences and furniture. However, it must be pointed out that incomplete technology transfers, both in Blanco River and on the Upper Ambato River Basin, have led to limited learning. For example, in soap production, knowledge was not transferred about standards that would have improved access to a variety of markets. In the Andean Chocó, the Ambato River and Antisana, innovative restoration practices were found.

In Antisana, the trans-disciplinary dialogue among ecologists, hydrologists, geographers and public administrators, among others, have made possible modifications in certain practices. However, the absence or partial participation of the community has reduced the dialogue for the production, maintenance, promotion and recovery of biocultural memory. The availability of funds and information, and the acquisition of estates ("haciendas") by the public administration, have made possible a decrease in grazing pressures, facilitating

an innovative process of conservation and restoration.

Clear land tenure and property rights, identifiable social actors, and small scale, well defined resource systems have been very important for the successful implementation of ACM. Communal ownership in Blanco River has facilitated control of illegal hunting and logging. In Chongón-Colonche, communities have applied their rules through community monitoring and control, and have managed to reduce deforestation in spite of relatively strong pressures, in comparison with Blanco River or Antisana.

Constraining or enabling conditions for ACM

The analytical process led to the identification of three grouping factors: integrality, landscape approach, and sustainability. These three categories structured the discussion of the factors that promoted or limited ACM in the cases evaluated.

Integrality

Integrality alludes to the systematic, coordinated and synergetic organization of interventions, especially around: integration among conservation, restoration and sustainable production; linkage among actors and institutions at different levels; and integration among sectors (Ecosystems, Water, Energy and AFOLU). In the cases studied, integrality was a constraining or enabling factor for ACM, given that its absence or presence impeded or permitted the coordination of good practices, the linkages of actors and sectors, and dialogue between diverse knowledges generated by the modification and/or incorporation of management practices.

As in Fischer et al. (2014) and Green et al. (2005), social and institutional conflicts were detected between productivist and rationalist visions, on one hand, and conservationist and environmentalist perspectives, on the other. For example, the Ministry of Agriculture, Livestock, Aquaculture and Fisheries has promoted forestry plantations of commercial monocultures, while the Ministry of the Environment, through the National Forest Restoration Program, has focused on nonproductive and noncommercial native species. As a result, in Chongón-Colonche, agroforestry and agroecological strategies promoted by communities, the province government and NGOs had to deal with pollution and competition from the agroindustrial monocultures promoted by the Minsitry of Agriculture, Livestock, Aquaculture and Fisheries.

In the Jambelí Channel, mangroves restoration also has not been sufficient to call into question the economic and spatial dominance of extensive and intensive shrimp farming. Instead, in the Andean Chocó, Chongón-Colonche and Blanco River, local actors have promoted integration through productive restoration, occasionally with support from public institutions.

The integral approach also refers to institutional linkages that allow for communication and information flows between actors at different levels. Collaborative local management, proactive local governments, governance platforms at the mesoscale, or linkage and

bridging organizations (KOWALSKI; JENKINS, 2015), demonstrated relevant potential for success, while fragmentation and lack of dialogue among institutions were limitations.

Finally, the management of Water, Energy, AFOLU and Ecosystems must be integrated (PRAMOVA et al., 2012; CHONG, 2014). There were synergies among sectors, which could be strengthened by tackling adaptation challenges from landscape approaches that avoid divisions between sectors.

Landscape approach

According to Reed et al. (2015, 2016), the landscape approach is an integrated and multifaceted strategy intended to bring together multiple actors from diverse sectors to generate solutions at different scales. Integral adaptation actions with a landscape approach can contribute to overcoming conflicts arising from standardized policies and programs, with nation-wide visions, that do not take into account local specificities. Governance platforms at the mesoscale and bridging organizations facilitated links among scales (upward and downward), making EbA and other adaptation approaches viable. Crucial to this effort were the "*mancomunidades*", parliaments and trusts that plan and act for landscape and functional ecological units, such as watersheds, rather than considering only administrative divisions (RAJIB; UY, 2012; UY; SHAW, 2012).

Local leadership and collaborative management, with strong community planning and a common agenda, are crucial for regional governance from the bottom up, and to guarantee good practices. A common vision for the future at the landscape level can facilitate place identity (ESCOBAR, 2011), valuing local projects and demanding support and respect from higher government levels (TOMPKINS; ADGER, 2004). The local level has been crucial in the construction of the Andean Chocó Commonwealth, where interest in identity and local biodiversity have been recovered. In Blanco River, ancestral practices such as the Amazon chakra, have been valued anew. In the mangroves, small shrimp producers, together with fishermen and artisanal crab fishers, have transformed long-standing conflicts into cooperation. In Chongón-Colonche, local participation in several projects for long periods has permitted, among other things, the recovery of the biocultural memory.

Sustainability

There are many visions, definitions and approaches on sustainability (WU, 2013). In this study, sustainability has been understood as the ability of EbA actions, along with their results and impacts, to be sustained through time. To that end, it is necessary to guarantee funds, through markets that make activities economically viable, or through innovative schemes for fund-raising. Monitoring actions, and modifying and redesigning them in response to learning, requires complete technology transfers and capacity building.

For conservation and restoration, alternative and innovative markets are needed for new and traditional products (CAMPBELL; LÓPEZ, 2011; PLOEG, 2015; VIGNOLA et al., 2015). There were limitations, such as unfair, unstable and vulnerable milk markets,

and the lack of markets for honey, crab meat and non-timber products. But there were also opportunities, such as a bamboo manufacturing industry, a beekeeping center and an agroecological market in Chongón-Colonche, as well as the carpenter shop in Blanco River. These activities, and the markets that make them viable, promoted landscape connectivity, water cycle regulation, raised local incomes, diversified livelihoods and funds for conservation and restoration.

There is a need for capacity building and recovering, maintaining, innovating and transferring technologies that broaden the social base of potential adopters of sustainable production technologies and practices. In addition, technology transfers must be complete and adapted to the context. Examples of top-down, incomplete technology transfers, appeared in projects such as the artisanal soap workshop in Blanco River, or the improved pastures and the introduction of vicuñas into the Upper Ambato River Basin. Those processes did not address systemic causes of vulnerability, such as unfair integration into markets or dependence on monocultures and technologies, and they can lead to "maladaptations" (BARNETT; O'NEILL, 2010) and to the erosion of the biocultural memory that has been adaptive for millennia (TOLEDO; BARRERA-BASSOLS, 2008; CUVI, 2018).

There were opportunities in financing mechanisms, different from traditional donor schemes, that usually generate dependence or debt. For example, the Tungurahua Fund supports *páramo* highlands conservation and restoration, as well as sustainable production initiatives. Other opportunities are the benefits of products from agroforestry systems, or funds, though unstable, from government programs such as Socio Bosque, Socio *Páramo* and Socio Manglar programs.

Permanent evaluation and monitoring is important. The recovery of the biocultural memory and participatory monitoring guarantee the coproduction of knowledge, dialogue among science, local and policy knowledge, action research, and the overall provision of background information for robust monitoring. Though information was available in all cases, as Rajib and Uy (2012) and UNFCCC (2010) found, monitoring systems were still under construction and development. Some reasons were the lack of reliable data and technologies for field measurement (for example, of streamflow rates), as well as weak capacities and insufficient funding. The strengthening of robust and integrated monitoring systems, like that of the Socio Bosque program, is critical for completing cycles of adaptation and reflecting on implemented practices.

Conclusions

EbA actions implemented in Ecuador from 2011 to 2015 were characterized by broad diversity in terms of geography, scale, themes addressed, institutional development and EbA previous experience. Conservation and regulation of water and soil, prevention of landslides and food provision were most often addressed issues, through conservation, restoration and agroecological measures.

There were institutional and planning innovations, but most actions lacked monitoring, information and sustained financing systems, which could lead to social learning and iterative adaptation and modification of ecosystem management practices.

In the cases studied, local leadership catalyzed adoption of good practices and reduction of environmental degradation, even under prevalent poverty and lack of livelihood diversification. Entrepreneurship, planning and a common vision of the future at the local level, also empowered coproduction of knowledge, social learning and innovation. Local initiatives and dynamics originated in and benefitted from governance at the mesoscale and from bridging organizations, though there were also business-community alliances. Local participation made possible, in several cases, transforming long-standing conflicts, recovering the biocultural memory and linking actions with previous processes.

There were conflicts at different institutional levels. For example, approaches that separate production, restoration and conservation, restrict dialogue among different institutional levels, or separate actions into Water, Energy, AFOLU and Ecosystems sectors. However, local initiatives demonstrated the potential that results from integrating those approaches at the landscape or watershed level, with a vision of territory and place.

The inexistence of alternative markets, the lack of monitoring, incomplete technology transfers and/or technologies not adapted to the context, and the lack of incentives for adopting good practices, limit the sustainability of EbA and ACM actions. However, there are innovative diagnostic, supervision and financing systems, as well as sustainable markets, appropriate technologies and social initiatives that enable them.

Linking design, implementation, monitoring, evaluation and sustained financing to encourage complete adaptive cycles and foster social learning was necessary in all cases. Promoting research, planning and implementation of ecosystem management on the ground demands constant feedback and complementarity. While social learning did take place, there has yet to be a questioning of social structures and power relations required for a transformative vision of adaptation (PELLING et al., 2015). More profound processes of organization at the local and broad society levels are necessary to assure that incremental adaptation, within the status quo, transcends to the level of transformative approaches that seek to change social and institutional relations.

Acknowledgment

We are grateful for project financing from EcoAndes and the Programa de Bosques Andinos, coordinated by the Consorcio de Desarrollo Sostenible de la Ecoregión Andina (CONDESAN), with support from the Swiss Development Agency (COSUDE), the United Nations Environment Programme (UNEP), and the Global Environment Facility (GEF). Special thanks to Gabriela Maldonado, Manuel Peralvo and Francisco Cuesta for their contributions to the methodological design and during field work. Thanks, also, to the Ecuadorian Ministry of the Environment and the staff of the Tercera Comunicación Nacional del Ecuador: Jorge Núñez, Diego Guzmán, Eva Costa and Laura Cadillach. We are deeply grateful to all who responded to the online survey and those who shared

their knowledge with us during field work. Especially outstanding was support from Julio Cabezas, our research assistant, and Jorge Zalles, for his collaboration in systematizing workshop information. We also thank Edwin Ortiz and Paola Maldonado for their support with GIS and mapping. To Victoria Reyes-García and Álvaro Fernández-Llamazares, and to the anonymous reviewers for *Ambiente & Sociedade*, for their comments on previous versions of the article, many thanks. We assume full responsibility for the content of this final version.

References

ARMITAGE, D. et al., Adaptive co-management for social-ecological complexity. Frontiers in Ecology and the Environment, v. 7, n. 2, p. 95-102, 2009.

ARMITAGE, D. et al., Co-management and the co-production of knowledge: Learning to adapt in Canada's Arctic. Global Environmental Change, v. 21, n. 3, p. 995-1004, 2011.

BÁEZ, S. et al., Effects of Climate Change on Andean Biodiversity: A Synthesis of Studies Published until 2015. Neotropical Biodiversity, v. 2, n. 1, p. 181-194, 2016.

BARNETT, J.; O'NEILL, S. Maladaptation. Global Environmental Change, v. 20, n. 2, p. 211-213, 2010.

BERKES, F. Evolution of co-management: Role of knowledge generation, bridging organizations and social learning. Journal of Environmental Management, v. 90, n. 5, p. 1692-1702, 2009.

CAMPBELL, A. et al., Review of the Literature on the Links between Biodiversity and Climate Change: Impacts, Adaptation, and Mitigation. Montreal, Secretariat of the Convention on Biological Diversity, 2009.

CAMPBELL, B.; LÓPEZ, S. (Eds). Integrating Agriculture, Conservation and Ecotourism: Examples from the Field. Dordrecht, Springer, 2011.

CARLSSON, L.; BERKES, F. Co-management: concepts and methodological implications. Journal of environmental management, v. 75, n. 1, p. 65-76, 2005.

CBD (Convention on Biological Diversity). Decision adopted by the conference of the parties to the convention on biological diversity at its 10th meeting. UNEP/CBD/COP/DEC/X/33; 2010.

CBD. Connecting biodiversity and climate change mitigation and adaptation: Report of the second ad hoc technical expert group on biodiversity and climate change. Montreal, Secretariat of the Convention on Biological Diversity, 2009.

CHONG, J. Ecosystem-based approaches to climate change adaptation: progress and challenges. International Environmental Agreements: Politics, Law and Economics, v. 14, n. 4, p. 391-405, 2014.

CUESTA, F. et al., New Land in the Neotropics: A Review of Biotic Community, Ecosystem, and Landscape Transformations in the Face of Climate and Glacier Change. Regional Environmental Change, in-press, 2019.

CUVI, N. Indigenous imprints and remnants in the Tropical Andes. In: Leal, C.; Padua, J.; Soluri, J. (Eds). A Living Past: Environmental Histories of Modern Latin America. Nueva York, Berghahn; 2018.

DOSWALD, N. et al., Effectiveness of ecosystem-based approaches for adaptation: review of the evidence-base. Climate and Development, v. 6, n. 2, p. 185-201, 2014.

ESCOBAR, A. Ecología política de la globalidad y la diferencia. In: ALIMONDA, H. (Coord). La naturaleza colonizada. Ecología política y minería en América Latina. Buenos Aires: CIC-CUS y CLACSO; 2011. p. 61-92.

FABRICIUS, C.; CURRIE, B. Adaptive Co-Management. In: ALLEN C.; GARMESTANI, A. (Eds). Adaptive Management of Social-Ecological Systems. New York and London, Springer, 2015, p. 147-179.

FISCHER, J. et al., Land Sparing Versus Land Sharing: Moving Forward. Conservation Letters, v. 7, n. 3, p. 149-157, 2014.

GOMIERO, T. Multi-Objective Integrated Representation (MOIR): an innovative tool for farming system analysis. (Doctoral thesis in Environmental Sciences and Technology). Universitat Autònoma de Barcelona, 2005.

GRAMMONT H. C. La nueva ruralidad en América Latina. Revista Mexicana de Sociología, n. 66, special, p. 279-300, 2004.

GRAY, C. L. Environment, Land, and Rural Out-migration in the Southern Ecuadorian Andes. World Development, v. 37, n. 2, p. 457-468, 2009.

GREEN, R. et al., Farming and the Fate of Wild Nature. Science, v. 307, n. 5709, p. 550-555, 2005.

HALLEGATTE, S. Strategies to adapt to an uncertain climate change. Global Environmental Change, v. 19, n. 2, p. 240-247, 2009.

HEATH, M. et al., (Eds). Partners with nature: How healthy ecosystems are helping the world's most vulnerable adapt to climate change. Cambridge (RU), Birdlife International, 2009.

HOLLING, C.S. (Ed). Adaptive Environmental Assessment and Management. New York, John Wiley & Sons, 1978.

KOWALSKI, A.; JENKINS, L. The role of bridging organizations in environmental management: examining social networks in working groups. Ecology and Society, v. 20, n. 2, p. 16, 2015.

LLAMBÍ, L. Procesos de transformación de los territorios rurales latinoamericanos: los retos de la interdisciplinariedad. Eutopía, n. 3, p. 117-134, 2012.

MAE (Ministerio del Ambiente del Ecuador). Mapa de Ecosistemas. Quito, MAE, 2014.

MAE (Ministerio del Ambiente del Ecuador). Tercera Comunicación Nacional del Ecuador sobre Cambio Climático. Quito, MAE, 2017.

MAGRIN, G. et al. Central and South America. In: BARROS, V.R. (Eds). Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge and New York: Cambridge University Press; 2014. p. 1499-1566.

MUNANG, R. et al., Climate change and Ecosystem-based Adaptation: a new pragmatic approach to buffering climate change impacts. Current Opinion in Environmental Sustainability, v. 5, n. 1, p. 67-71, 2013.

MUNDA, G. Social multi-criteria evaluation for a sustainable economy. New York, Springer, 2008.

OLSSON, P.; FOLKE, C.; BERKES, F. Adaptive Comanagement for Building Resilience in Social–Ecological Systems. Environmental Management, v. 34, n. 1, p. 75-90, 2004.

PAHL-WOSTL, C. A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. Global Environmental Change, v. 19, n. 3, p. 354-365, 2009.

PELLING, M.; O'BRIEN, K.; MATYAS, D. Adaptation and transformation. Climatic Change, v. 133, n. 1, p. 113-127, 2015.

PERALVO, M. et al., Adaptación al cambio climático en los Andes Tropicales. Discusión y conclusiones. In: CUESTA, F. et al., (Eds). Panorama andino de cambio climático: Vulnerabilidad y adaptación en los Andes Tropicales. Lima, CONDESAN y SGCAN, 2012.

PEREZ, C. et al., Climate Change in the High Andes:implications and adaptation strategies for small-scale farmers. The International Journal of Environmental, Cultural, Economic and Social Sustainability, n. 6, p. 71-88, 2010.

PLOEG, J. Newly emerging, nested markets: a theoretical introduction. In: HEBINCK, P.; PLOEG, J.; SCHNEIDER, S. (Eds). Rural Development and the Construction of New Markets. New York, Routledge, 2015, p. 16-40.

PLUMMER, R. The Adaptive Co-Management Process: an Initial Synthesis of Representative Models and Influential Variables. Ecology and Society, v. 14, n. 2, p. 24, 2009.

PRAMOVA, E. et al., Ecosystem services in the National Adaptation Programmes of Action. Climate Policy, v. 12, n. 4, p. 393-409, 2012.

RAJIB, S.; UY, N. Challenges and the Way Ahead in Ecosystem-Based Adaptation. In: Ecosystem-Based Adaptation (Community, Environment and Disaster Risk Management), Vol. 12. Emerald Group Publishing Limited, 2012. p. 257-265.

REED, J.; DEAKIN, L.; SUNDERLAND, T. What are 'Integrated Landscape Approaches' and how effectively have they been implemented in the tropics: a systematic map protocol. Environmental Evidence, v. 4, n. 1, p. 2, 2015.

REED, J. et al., Integrated landscape approaches to managing social and environmental issues in the tropics: learning from the past to guide the future. Global Change Biology, v. 22, n. 7, p. 2540-2554, 2016.

STADEL, C. H. Vulnerability, Resilience and Adaptation: Rural Development in the Tropical Andes. Pirineos, n. 163, p. 15-36, 2008.

TOLEDO, V.; BARRERA-BASSOLS, N. La memoria biocultural. La importancia ecológica de las sabidurías tradicionales. Barcelona, Icaria, 2008.

TOMPKINS, E.; ADGER, N. Does Adaptive Management of Natural Resources Enhance Resilience to Climate Change? Ecology and Society, v. 9, n. 2, p. 10, 2004.

TOVAR, C. et al., Diverging responses of tropical Andean biomes under future climate conditions. PloS One, v. 8, n. 5, e63634, 2013.

UNFCCC (United Nations Framework Convention on Climate Change). Ecosystem-based approaches to adaptation: compilation of information. FCCC/SBSTA/2011/INF.8; 2011.

UY, N.; SHAW, R. Overview of Ecosystem-Based Adaptation. In: UY, N.; SHAW R. (Eds). Ecosystem-Based Adaptation (Community, Environment and Disaster Risk Management), Vol. 12. Emerald Group Publishing Limited, 2012. p. 3-17.VIGNOLA, R. et al., Ecosystem-based adaptation for smallholder farmers: Definitions, opportunities and constraints. Agriculture, Ecosystems & Environment, n. 211, p. 126-132, 2015.

VIDES-ALMONACID, R. Bases conceptuales y enfoques estratégicos para la adaptación al Cambio Climático en América Latina. In: LARA, R.; VIDES-ALMONACID, R. (Eds). Sabiduría y Adaptación: El Valor del Conocimiento Tradicional en la Adaptación al Cambio Climático en América del Sur. Quito, UICN, 2014.

WILLIAMS, B. Adaptive management of natural resources—framework and issues. Journal of Environmental Management, v. 92, n. 5, p. 1346-1353, 2011.

WU, J. Landscape sustainability science: ecosystem services and human well-being in changing landscapes. Landscape Ecology, v. 28, n. 6, p. 999-1023, 2013.

YOUNG, K. R.; LIPTON, J. K. Adaptive Governance and Climate Change in the Tropical Highlands of Western South America. Climatic Change, v. 78, n. 1, p. 63-102, 2006.

Pere Ariza-Montobbio

pariza@flacso.edu.ec

ORCiD: https://orcid.org/0000-0003-0221-7097

Nicolás Cuvi

ncuvi@flacso.edu.ec

ORCiD: https://orcid.org/0000-0002-3206-5672

Submitted on: **20/10/2017**

Accepted on: **28/02/2020**

2020;23:e03152

How to cite: ARIZA-MONTOBBIO, P.; CUVI, N. Ecosystem-based Adaptation in Ecuador: Good Practices for Adaptive Co-Management. **Ambiente & Sociedade.** São Paulo, v. 23, p. 1-27, 2020.

Revista AMBIENTE & SOCIEDADE

SciELO

Adaptação Baseada em Ecossistemas no Equador: boas práticas para Co-Manejo Adaptativo

Pere Ariza-Montobbio
Nicolás Cuvi

São Paulo. Vol. 23, 2020
Artigo Original

Resumo: A Adaptação Baseada em Ecossistemas (EbA) requer da aprendizagem social e da coordenação entre atores em diferentes níveis, sob Co-Manejo Adaptativo (CMA), especialmente em paisagens com grande biodiversidade e vulnerabilidade como os Andes Tropicais. Metodologia: Uma metodologia multicritério em cinco fases foi desenhada e aplicada, para identificar, caracterizar, selecionar e avaliar o CMA e as condições que o limitam ou potenciam nas ações da EBA desenvolvidas entre 2011 e 2015. Resultados: 1. A integração de conservação, restauração e produção sustentável, e a articulação de instituições e setores com base na liderança local, facilitam a co-produção de conhecimento, aprendizagem social e inovação. 2. O planejamento e a governança sob uma abordagem de paisagem, e o reconhecimento da diversidade de contextos, promovem o diálogo, a cooperação e a inovação institucional. 3. Alternativas econômicas de produção e comercialização, transferências adequadas e completas de tecnologia, financiamento estável e monitoramento permanente, fomentam a sustentabilidade.

***Palavras-chave*:** Análise multicritério, Mudanças Climáticas, Co-manejo adaptativo.

***Como citar*:** ARIZA-MONTOBBIO, P.; CUVI, N. Adaptação Baseada em Ecossistemas no Equador: boas práticas para Co-Manejo Adaptativo. **Ambiente & Sociedade**. São Paulo, v. 23, p. 1-28, 2020.

DOI: http://dx.doi.org/10.1590/1809-4422asoc20180315r2vu2020L4AO

Revista AMBIENTE & SOCIEDADE

SciELO

Adaptación Basada en Ecosistemas en Ecuador: buenas prácticas para el Co-Manejo Adaptativo

Pere Ariza-Montobbio
Nicolás Cuvi

São Paulo. Vol. 23, 2020
Artículo original

Resumen: La Adaptación Basada en Ecosistemas (AbE) requiere de aprendizaje social y coordinación entre actores a distintos niveles, bajo Co-Manejo Adaptativo (CMA), especialmente en paisajes con gran biodiversidad y vulnerabilidad como los Andes Tropicales. Metodología: Se diseñó y aplicó una metodología multicriterio en cinco fases, para identificar, caracterizar, seleccionar y evaluar el CMA y las condiciones que lo limitan o potencian en acciones de AbE implementadas entre 2011 y 2015. Resultados: 1. La integración de conservación, restauración y producción sustentable, y la articulación de instituciones y sectores con base en el liderazgo local, facilita la coproducción de conocimiento, el aprendizaje social y la innovación. 2. La planificación y gobernanza bajo enfoque de paisaje y el reconocimiento de la diversidad de contextos, promueven diálogo, cooperación e innovación institucional. 3. Alternativas económicas de producción y comercialización, transferencias adecuadas y completas de tecnología, financiamiento estable y monitoreo planificado y permanente, fomentan la sustentabilidad.

Palabras-clave: Análisis multicriterio, Cambio climático, Co-manejo adaptativo.

Como citar: ARIZA-MONTOBBIO, P.; CUVI, N. Adaptación Basada en Ecosistemas en Ecuador: buenas prácticas para el Co-Manejo Adaptativo. **Ambiente & Sociedade**. São Paulo, v. 23, p. 1-28, 2020.

DOI: http://dx.doi.org/10.1590/1809-4422asoc20180315r2vu2020L4AO