

Appendix 2. Brief descriptions of the variables selected in the PSA.

COLOMBIA

Population trends: The increase and decrease of population. These trends are based on the natural growth of the local population, despite the relatively high migration rate of young people, and the influx into the territory of new stakeholders for the exploitation of natural resources. As the population increases there is intensification in the demand for resources and services provided by the ecological subsystem.

Mining: Mining activities, when are carried out improperly, affect biodiversity and water. Extraction procedures and the use of chemicals destroy and pollute the habitat of different species of flora and fauna inhabiting the SESs. It should be clarified that artisanal mining does not affect the ecosystem at the same level as industrial mining does. The artisanal techniques and local knowledge related to this activity are passed from generation to generation. In general, since the 1990s there is an increase of gold mining, which is linked to international gold price trends.

Fishing and hunting: Fishing, conducted by the communities in the studied SESs, is artisanal. The most common artisanal tools are cast nets and fixed traps. In the Calima river, explosives have been used for fishing, although this has been reduced due to institutional and community council control. There are no catch records for fishing in the area. Hunting, in particular related to the illegal wildlife trade for regional markets, is considered as a variable that directly affects the populations of native species. Similarly, the role of various species is highlighted as they transport seeds, so a reduction of these species is reflected in the reduction of forest resilience. Hunting affects biodiversity by causing a decrease in the resources and services provided by the different components of the system. It is clear for the workshop participants that this activity should be allowed just as a subsistence activity linked to livelihoods. The Regional Corporation Valle del Cauca considers it as an activity with a strong impact, but currently strictly controlled. The Council also have regulatory mechanisms.

Deforestation: Timber extraction affects biodiversity because, among other things, ecological niches are destroyed, some species become endangered and erosion processes are generated. This human activity has affected local ecosystems and the members of the Community Council report that deforestation generates significant negative impacts on agriculture and soil. The timber extraction in the eighties and nineties increased with activities carried out by a private enterprise (Cartón de Colombia), which destroyed significant forest areas in Bajo Calima. Timber extraction represents an important income source for these communities. Deforestation was also mentioned as one of the main causes of global warming.

Illicit crops: The coca crops and various environmental and social problems associated with this activity. Coca cultivation is carried out with intensive technology based on the use of agrochemicals. The use of agrochemicals and deforestation are two factors that directly affect biodiversity and water. This is considered a foreign activity. This crop competes with agriculture for food and generates various social tensions. The dynamics of violence linked to the coca trade and control of the activity have affected local people, in some cases displacing them from their homes.

Formal institutions: The set of formal institutions that carry out direct actions on the territory. It is considered that the existence of the Community Council has allowed the

persistence of ethnic groups, which in turn has helped to preserve traditional knowledge. This means that resources are maintained and retained. The analysis of this variable generated a debate during the workshop in relation to the entity of the Community Council and its role in the governance system. There is a concern about its limited regulation and the meaning of self-government in the territories. It is important to note that there is a generational difference between how older and younger people understands the institutions and structure of the governance system of their specific SES. The Community Council interacts with various local and international NGOs and public and private institutions in order to manage and put into practise different development actions. In general, workshop participants recognize the role of some institutions (mainly CVC, SENA, departmental government and ministries) that offer training, support programs and regulate natural resource extraction. However, they criticize the role of institutions such as the Mayor's office and the Colombian State oil company (Ecopetrol) due to their limited support and presence in the territories of Community Councils.

Climate change: Climate change is a relevant variable for agricultural systems that are developed with traditional techniques based on crop rotation, low use of agrochemicals and with high dependence on seasonal rainfall. Crops are planted in the river valley and highlands, which allows the management of various crop species. Due to the limited infrastructure for drinking water supply, inhabitants use rainwater for consumption. Thus, any change in the rainfall and in the rainy and dry seasons directly affects agrobiodiversity and the social subsystem, impacting directly in the local livelihoods. Moreover, there is a gradual consolidation of local knowledge on climate variability, and communities have a clear perception of how this has evolved. In general, three aspects were mentioned in the workshops: increased rainfall, shorter dry periods, and increased extreme events, including floods and landslides. This dynamic of change is starting to cause problems in relation to the planning of crops throughout the year, their advancement in plain areas of the rivers and streams, increased pests and diseases and problems associated with fruit trees flowering. Although not much research in this field exists, the IDEAM projections presented these findings in its third technical report support (IDEAM, 2010).

Agriculture: Agriculture is for subsistence, applying ancestral cultural practises with little technological inputs. This type of agriculture is carried out in small plots (no more than 5 hectares), in which poly-crops are established, looking for associations between different species of plants and animals for a better crop development. A guiding principle to create the crop mix is to ensure diversity and permanence of a balanced diet throughout the year. Similarly, this combination of species responds to other aspects such as pest and disease control, income diversification, and efficient use of the available labour force. Workshop participants recognize that although agriculture is guided by traditional ecological knowledge, agrochemicals are used, in particular for the control of pests and diseases, which affect biodiversity, soil, water and ecosystems. The use of agrochemicals is growing as new generations do not adopt appropriate cultural and traditional customs linked to agriculture.

Tourism: Tourism has become one of the various sources of income for livelihoods in the studied SES. However, this activity generates a number of direct impacts on biodiversity and water resources. A major cause is the very limited regulation of the activity and the construction and operation of spa infrastructures in the rivers. As a result, various problems are observed such as washing cars, motorcycles and clothes,

solid waste and sewage disposal directly into water sources, and uncontrolled use of river beaches.

Megaprojects: These are large infrastructure projects that are currently under development and have a direct impact on the Councils territories. The Port of Aguadulce and the double-way road that connects Buenaventura to Buga and Cali are two of the most important megaprojects. During the process of implementation of these projects, significant impacts are generated on biodiversity and water resources, like destruction of forests, wildlife, flora and even some places of cultural significance to the community.

Impacts of public policies: This variable refers to the impacts, positive and negative, that generates public policies on biodiversity and water resources. An emphasis is posed in explicit contradictions, for example, between the National Biodiversity Policy and promotion of megaprojects and mining by the National Development Plan, which currently drives various large-scale projects in the municipality of Buenaventura. Another important example in this area is the national policy for the control of illicit crops through aerial spraying of glyphosate.

Water management: Inhabitants build artisanal structures to collect and store rainwater in each of the houses. Currently, the communities are facing a crisis with a political dimension. Water is a common resource that is involved in most of the economic activities and livelihoods of the Community Council (agriculture, mining, river material extraction and tourism). In this sense, the Council currently controls water management, but there is not an entity that regulates the quantity of water for each human use.

Formal education: This variable refers to formal education in primary and secondary schools. The role of SENA is highlighted as an important institution for the promotion of environmental education, preservation of natural resources and promoting sustainable tourism. Also, the education institution José María Córdoba promotes education for children and youth, environmental awareness and sustainability programs. Workshop's participants agree that formal education is a mechanism that stimulates the migration of young people, since rural education is decontextualized and traditional knowledge and cultural dynamics are not included in the curricula.

Locally fostered research: The research is part of the Council initiatives and is reflected in activities such as the environmental impact studies for the construction of a double-way road and other mega-projects in the area. There has been some progress such as the characterization of biotic, abiotic, socio-cultural, political and economic components of the SES. Some of the aspects in the Community Council research agenda are: biodiversity protection, conservation of natural resources, delimitation of protected areas and areas for the protection of water sources, good practices in landscape use, creating recreational areas, ecological corridors (connectivity) and ecotourism trails (research and education). In this sense, some NGOs support the Community Council in this research, which has been linked to development and innovation processes in rural areas, aiming at improving the quality of life of the local inhabitants. People mentioned the need for progress in this field since research is essential for the conservation of biodiversity and water resources. However, they also suggested that the research conducted by external actors could have negative impacts when ancestral knowledge is looted.

Aerial spraying: Aerial spraying with glyphosate is an instrument of the national drug policy. Glyphosate is a systemic herbicide that destroys coca crops. However, the way it is used also affects the forest, food crops and other commercial agriculture, as well as the health of people and animals.

Community as social group: This variable refers to issues directly related to the social group and affects biodiversity and water resources. It describes the inhabitants of the Community Council as a social group. It highlights the responsibility of the community in using and conserving biodiversity and water resources. It does not refer to demographics. For example, when the community is not aware of the importance of resources and the need to take care of them, they may sell those resources, e.g. gold and wood to outside actors, thinking individually and not on the collective interests. Although the bargaining power of the community to deal with large infrastructure project providers has improved, it is not the same with other challenges such as illicit coca crops and gold mining actors. Moreover, the poor management of water and biodiversity by communities affects negatively. People emphasize that there is no culture of waste management and sewage flows directly into rivers and streams without any treatment.

Ancestral knowledge: This variable involves the body of knowledge, practices and beliefs of the community about the relationships among living beings (including humans) and their immediate environment. In other words, it is the ancestral knowledge regarding the SES in what they live, that evolves through a process of historical adaptation and that is transmitted from one generation to the next. In the past, people had very clear hierarchies of authority, but now there is no credibility in them. Ancestral knowledge is usually transmitted by the elderly, which in turn affects the creation, maintenance and administration rules regarding the use of biodiversity and water resources. The migration of the young and the increasing links of the Council with urban centres, among other external factors, impact negatively on this variable, by eroding important cultural aspects such as identity and sense of belonging.

Regional institution for the environment (Corporación Autónoma Regional del Valle del Cauca CVC): This is the public institution responsible for decisions regarding environmental issues in the department of Valle del Cauca. The territory of Calima is under the jurisdiction of this institution, and the established rules and regulations must be followed. This institution issues permissions and licenses for certain timber extraction activities, and for hunting and fishing. It also regulates the activities related with the use of biodiversity by communities and supports sustainable agricultural activities taking place in the territory.

Markets for natural resources: Natural resources extracted from the ecosystems, such as agricultural products, are usually not processed and are sold in local and regional markets. Some of these products (gold, timber and *chontaduro* -*Bactris gasipaes*-, a local fruit) go to other markets such as Cali and Bogota. Some resources such as gold, timber, tagua or Pecari (*Catagonus wagneri*) and tatabro (*Tayassu albirostris*) have a high demand, which encourages their continued extraction and increasingly affects their availability. The workshop participants recognize an important and growing influence of regional markets on natural resource extraction, which directly affects biodiversity and water resources.

Solid waste: There is no solid waste treatment system. Burning garbage in the community is a common practice, which generates direct impacts on biodiversity and

water resources. It is considered that this affects directly tourism through water and beach pollution. Workshop participants agree that improper handling of solid waste currently represents a major problem for public health.

Armed conflict: This variable refers to the interference of illegal armed groups in the control of territory. The actions of these groups have been associated with the control of coca crops, illegal mining and control of strategic corridors for drug trafficking. These activities have a direct impact on biodiversity and water resources. Sometimes, these groups cause the displacement of people, which directly impacts the social structure of the SES.

Fluvial transport: This variable refers to transport on the Calima River. The boats with big engines generate waves that impact the river valleys, which contributes to their erosion and ecosystem damage. Similar to ground transportation, boat maintenance represents a major source of pollution (waste and oil), affecting biodiversity.

Water management: None of the communities has sewage infrastructure, although some families have septic tanks. In some cases, especially in the houses scattered along the railway and road, sewage drains into nearby water sources, especially in the river or open fields. These practices directly affect biodiversity and water resources by polluting rivers and streams that are in turn used in agriculture, for human consumption and for recreation. Sewage is a problem identified as a priority for the health of the communities, as it is a source of infection, disease and epidemics and a public health issue.

MEXICO

Economic activities (forestry and agriculture for income): These economic activities represent a source of income for the community members. By and large, people produce their own food (maize, beans, and several vegetables). Forest resources are extracted and the community owns a sawmill to add value to timber. The benefits obtained from the sawmill go to the community to finance public goods and services.

Livelihoods (for subsistence): The day-to-day activities performed by all inhabitants for the subsistence of the families and the community regardless of whether or not they generate monetary income. The economy of the community is mostly of self-sufficiency, though this is increasingly not fully achieved and families currently need to buy maize from shops.

Non-paid activities of inhabitants: Activities that are performed by the commoners without payment and on a mandatory basis. These activities strengthen the community ties. Some of the most important activities in this category are: service to the community (*cargos* and commissions), unpaid labour for the community (*tequios*), domestic labour, and monitoring activities.

Migration: Migration refers to changes in the migration patterns and to the nature of such changes over the years, as well as to the reasons for the changes. This variable also includes identifying who migrates, why and where to. In the SES, migration started in the eighties and nineties and there has been a stable trend since then, showing some declining tendency in the last few years, due to the stronger USA regulations.

Political stability: Political stability is related to the political conditions at the regional, national and local levels, whether stability or conflict prevails. It also refers to the degree of compliance with the rules due to the knowledge that community members have of them and to the community's enforcing power. The trust and predictability of behaviour and reciprocity among commoners is important for migration and political stability. The same can be said about the trust in the authorities' performance.

Environmental legislation: This variable includes environmental laws affecting the interrelations among the resource units on the regional, national and local levels. For instance, whether the community performs or stops performing certain activities related to the natural resource management due to regional environmental laws.

Monitoring and sanctioning processes: These processes allow the strengthening of operational rules within the system. The commoners monitor the correct use of the system resources and verify compliance with the established rules. When compliance with the rules is not effective or the resources are used inappropriately, the authority imposes sanctions (penalties, community labour, imprisonment).

Governance institutions: The multilevel organisations affecting the system, their performance and their structure. The Commoners' Assembly, the Citizens Assembly, the municipal authorities, the Communal Property Commissioner, and the Surveillance Council are some of these institutions.

Property rights system: It describes the existence or absence of formal property rights regarding the resource system and the common pool resources.

Collective-choice rules: Rules for collective action and community-based management of resources. For example, there are protocols to act collectively if a fire breaks out or for forest harvesting.

Extraction and exclusion rights: This variable refers to the rights of people to access the resources and to their management. The Assembly of Commoners defines who can use the resources and how, and intervenes in the decision making process related to exclusion and extraction rights. It makes a difference whether these rules are clear or not.

Economic value of natural resources: It refers to the prices of the natural resources, such as timber and forest product prices. These prices are externally set so the community has little or none capacity of negotiation.

Importance of the resources for inhabitants: This variable is related to how important the resources are for the lives and economy of the commoners and how much they depend on such resources.

History of use: It is the history of the community, regarding land use and natural resource management. It also comprises how the interactions among the resource units have changed over the years.

Sanitary infrastructures and services: This is related to the infrastructure and services that improve health conditions in the community.

ARGENTINA

Petrochemical Industry Pole: The cluster of industries and companies located near the Ing. White Port, between the communities of White and Cerri. The Petrochemical Industry Pole is perceived as an external power group, with capacity for lobbying against the direct interests of users on top of being a possible threat as one of the major pollution sources.

Employment sources: Sources for possible jobs for the stakeholders. According to the SES delimitation, they are mainly situated in the fishery and tourism sectors. Commerce and public sector employment are the most important secondary employment sources.

Tourism: Selling tourism services and products. The “beach and sun” tourism is one of the main sources of income for the communities of Pehuén Co and Monte Hermoso. This activity entails the intensive use of coastal resources and is both complementary and conflicting with artisanal fishery.

Local Markets: The set of relations between sellers and buyers in the local context of fishery. Local markets condition consumers and price determination.

External governance of fishery: Groups of organizations belonging to different government levels that have some legal authority over the resource, as well as formal legislation and norms on controlling, monitoring and sanctioning the use and appropriation of the resource. For stakeholders, it is an external variable since they have no influence power on them.

Lack of political interest in environmental sustainability: The attitude of external decision makers towards legislation on resource units and resource system. It depends on external stakeholders. According to the workshop participants, the lack of political interest in environmental sustainability can be seen through different actions or omissions by decision makers.

Fishermen associations: Internal networks (associations and chambers) related to the management, use and marketing of resources. Such unions increase the social capital of users. Through these network structures, fishermen share information and develop collective actions.

Catches: Number of fishery resource units extracted by artisanal fishery.

Seasonality of fishery and tourism: Seasonality is a characteristic of fishery activity since it represents the extraction of a resource with regeneration periods. Seasonality is also a characteristic of tourism activity because of the “beach and sun” tourism which normally takes place in summer.

Wildlife: The relevance of biodiversity and the equilibrium of species’ interactions in a biological sense.

Income: Income as a measurement of quality of life. This is directly linked with the use of resource since the two main income sources of communities are fishery and tourism.

Artisanal fishery history: History of the use of fishery resources. Artisanal fishery is based on traditional extracting methods. Fathers often teach their sons the techniques to fish and the traditional knowledge about the SES. The history in the Argentinean case is relatively new (see Deliverable 4.2, chapter 2 at URL: <http://comet->

la.eu/index.php/en/publications.html) and fishery is mostly related to the Italian immigrants in the region.

History of artisanal fishery: The history, traditions and type of activity carried out by small crafts and boats with traditional techniques as hand line, trammel or gill net, shrimp net fishing, etc.

Dredging and LNG (Liquefied Natural Gas) Project: The expansion of the Petrochemical Industry Pole and the enlargement and deepening of the *Canal Principal* (main channel), promoted by external users and decision makers. This is an important infrastructure project consisting of building a plant to transform LNG into regular gas near Cerri. The project caused a conflict among internal and external stakeholders.

Conservation measures: Group of activities and procedures made by users (mainly internal stakeholders, but also external, although to a lesser extent) in order to achieve sustainability of the resource.

Community networking: Ideas and perceptions about activities realized by a user may affect other users and the common use of resources. This type of thinking has become relevant and has pushed the community to reflect about the importance of networking activities.

Environmental changes in coast and estuary: A series of physical changes in coastal environment and estuary, as observed by users. This variable depends on human and environmental factors, including climate change and variability.

Overfishing: The excessive catches of fish and shellfish. The effects of overfishing are recognized in biological terms (reduction of the resources) and bio-economics terms (less profitable activity). The stakeholders point at offshore fishery as the main responsible.

Resource sustainability: The possibility to maintain equilibrium between the resource extraction and its regeneration, in order to achieve the ecologic and economic sustainability of the SES.

Changes in climate patterns: Changes in climate patterns perceived by users. Some of these changes are a decrease in rainfall, an extension in drought periods, an increase in water temperature and an increase in the rotation and speed of winds.

Pollution: Pollution patterns affecting the SES and users' activities, such as air pollution caused by toxic emissions from factories and water pollution caused by industrial waste and sewage.

References

IDEAM (2010). Segunda comunicación nacional ante la Convención Marco de las Naciones Unidas sobre Cambio Climático. MAVDT, IDEAM, PNUD, GEF. Bogotá: Editorial Scripto.