

Abstract Code: FO6

HumaNature² = Mutual Protection – Risk perception and adaptation to climate change based on ecosystems in the Mata Atlântica, Brazil

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Keywords

Community Based Adaptation, Disaster Risk, Ecosystem Service, Sensitization

Extended Abstract

This study analyzes the perception of the local population in four areas in the municipality of Teresópolis (Rio de Janeiro state/Brazil) regarding the risks associated with extreme climate events and draws up a concept and a strategy of sensitization in order to improve the participation of local residents in the adaptation to climate change based on ecosystem services.

Background

Adapting to climate change is one of the main challenges of the 21st century. In the past decades, natural disasters increased in various regions of the world and the forecast is that they will continue to rise. In Brazil, the greatest probability of risks associated with extreme phenomena such as torrential rain, whose intensity and strength tend to rise due to climate change, is in the country's Southeast and South regions, where disasters caused by landslides and floods have been recurrent. In the Região Serrana (Mountain Region) of the state of Rio de Janeiro, in January 2011, yet another natural disaster occurred, with severe consequences: torrential rain caused landslides and floods that killed more than 900 people and over 35,000 lost their homes. This event put Brazil in third place among countries most affected by natural catastrophes in 2011.

This study was requested by the Environment Ministry in cooperation with GIZ (German Cooperation for Sustainable Development) and the City Hall of Teresópolis. The study is part of the project "Biodiversity and Climate Change in the Mata Atlântica", which aims to promote and maintain biodiversity and recover forest landscape, contributing to the mitigation of and adaptation to climate change. The main objective of this study is a deeper understanding of how local residents' participation in environment risk management in the mountain region can be enhanced. The study shows the potential of linking two groundbreaking approaches to reduce the risks of natural disasters: the potential of ecosystem services and the potential of local residents' participation in disaster risk reduction.

Given the issue's importance and the success observed in the approach's application in the region of Teresópolis, the methods used have a high potential to be applied to other regions, especially in Brazil, but also in other areas across the world.

Regional Context: Mata Atlântica degradation

The mountain region in the state of Rio de Janeiro is part of the Mata Atlântica biome, the third largest Brazilian vegetational complex and one of the global biodiversity hotspots. The Mata Atlântica region undoubtedly suffered the highest concentration of exploration, which led to the conversion of land use of large areas. So, most of the natural ecosystems have been destroyed or degraded through various development cycles, leading to the destruction of habitats that are extremely rich in biological resources. The accelerated processes of industrial and agricultural expansion, as well as urbanization, have worsened this scenario in recent years.

One of the consequences of these processes is the irregular and disorganized occupation of slopes and areas close to rivers and streams. These areas, once their vegetal cover is removed, become more susceptible to the processes of landslides and flooding, leading to high risks for the families residing there. Natural degradation also prevents such cover from efficiently carrying out its functions for risk reduction, such as maintaining slope stability, contributing to the maintenance and regulation of water bodies and climate balance in the region.

The potential of ecosystem services and people's participation in adapting to climate change

One approach for the adaptation to climate change and disaster risk reduction that emerged since 2000 is based on ecosystem services ("green infrastructure"). This approach's difference lies in the use of the benefits that nature can bring to reducing risks and the adaptation to climate change regarding conventional engineering measures ("gray infrastructure"), such as the use of retaining walls and dams. The ecosystem service concept was adopted by the professional and scientific communities that work on adaptation to climate change, as well as by those who work on disaster risk reduction, thus generating the approaches of ecosystem-based adaptation to climate change (EbA) and ecosystem-based disaster risk reduction (Eco-DRR). Although the approaches of adaptation to climate change and disaster risk reduction based on ecosystems are fairly recent, it has an increasingly important role, which is stressed by several international institutions such as IUCN, UNU, PNUMA e GIZ (Colls, 2009; Renaud, 2013; PNUMA, 2009; GIZ, 2013d), for its favorable cost-benefit relation – as well as bringing other advantages for a general sustainable development.

So far, the challenge of reducing risks in Brazil has been taken on mainly through measures based on gray infrastructure or by removing people and homes from the areas supposedly at risk. The risk-reduction measures based on ecosystems have been barely considered, as the potential of ecosystem services is underestimated by those responsible for public policies regarding disaster risk reduction and adaptation to climate change.

This potential can be approached through a monetary viewpoint, setting prices for ecosystem services and establishing payment for them (payment for ecosystem services – PES). However, from a non-financial viewpoint, ecosystem functions can generate value by emphasizing the local population's participation. For that to happen, the people in risk regions must be aware of the benefits that nature can yield to the reduction of risks and its own vulnerability.

Measures for climate change adaptation to reduce disaster risks are more than a technical issue, especially if they are based on ecosystem preservation. Adaptation has been increasingly analyzed from the perspective of Social Sciences. In that context, the perception of local residents affected by the natural disaster or living in high-risk areas, such as many of those living in Teresópolis, plays a crucial role. Social perception analysis aims to integrate

the population in a participative process for environment risk management, guided by the approach of community based adaptation (CBA). This approach seeks a greater participation of residents in the activities to adapt to climate change, sensitize and qualify them so that they can face future challenges guided by their priorities, needs and knowledge, which can include measures based on the valorization of ecosystem services.

Objectives

The general objective of this study is to increase the active participation of the local population in the region of the *Mosaico Central Fluminense* (network of conservation units in the central region of Rio de Janeiro state) in measures to adapt to climate change and disaster risk reduction by joining the approaches of ecosystem based adaptation to climate change and community based adaptation. To take on this challenge, we used the approach that an increase in local participation in risk reduction occurs through the residents' role in preserving and recovering the ecosystems.

The study's starting point was the analysis and identification of potential factors that prevent people from participating more in risk reduction. To do so, we especially investigated the population's knowledge of the issue, as well as their perception of environment risks and their own role in reducing risks. In order to make people act in a more aware and sustainable way towards the environment, we used an instrument that joins education and environmental communication. Environmental educommunication is used to identify communication strategies of educational content adapted to different social actors to sensitize and prepare people to act. In our context, this means that environmental educommunication offers the chance to draw up a concept and a strategy to influence and train local residents to make them recognize the importance of ecosystem services for risk reduction in the face of natural disasters and recognize their capacity to carry out actions.

To do so, we established the following specific objectives:

- To draw up a methodological set to survey data on social perception. This set must have the potential to be reapplied in other contexts, as the research on social perception generally is quite recent.
- To carry out an analysis of the population's social perception in Teresópolis.
- To draw up a concept and a strategy aiming to increase local participation in risk reduction to decrease their vulnerability in the face of extreme events in times of climate change.

The three objectives are mutually inter-dependent: the methodological set was used to carry out the analysis perception. The results of that analysis were used as a basis to draw up a concept, a strategy and concrete measures to influence local residents and draw up a toolkit to make it easier to reapply the methodological set.

The perception analysis – and, thus, this study's methodological set – is based on an impact chain developed from the theory analyzed during preparation for the study. As mentioned above, several conditions are necessary for the local population to be able to actively reduce risks through the appreciation of ecosystem services. In this way, the impact chain consists of four steps we consider necessary to reach our general objectives:

- the local residents' perception of their own vulnerability,
- their knowledge of ecosystem services' role in the reduction of environmental risks,
- people's perception of their own responsibility, and
- their perception of the possibilities to participate in risk reduction through the appreciation of ecosystem services.

These four steps constitute our main analytic dimensions of the study. To develop a more profound concept and strategy for sensitization, we added two other dimensions: the

experiences with environmental sensitization and the use of socioeconomic media and data on the studied population.

Methods applied

We used both **quantitative and qualitative methods** so that the data could lead to deeper conclusions and for the methodological set to reach a wider range of possibilities. The data obtained through these methods were analyzed and later were cross-referenced, which allowed deeper conclusions. Aside from that, this cross-analysis also allowed for testing and selecting the most suitable methods for the development of the toolkit.

The methods used in this study are:

- Semi-structured questionnaires
- Focal groups
- Qualitative interviews with local key actors

The **semi-structured questionnaires** were the main method used in our study, as we intended to obtain representative and individual data, so that we could observe the variation in people's perceptions. A total of 271 interviews were conducted, 14.8% of the total population in the four sample districts. In addition to the results of the questionnaires, the **focal group method** was used to obtain deeper information on social perception and the local population's attitude towards environmental risks. In all, we established four focal groups. This information was enhanced by the **19 qualitative interviews with local residents**, which endeavored to understand the perception of key protagonists in the communities.

The **concept of sensitization** for the local population was developed based on the results of the perception analysis. In order to disclose and implement this concept we elaborated a **strategy and concrete measures of sensitization and qualification**. We used the three following methods to develop this strategy and the measures:

- Stakeholder-Dialogue
- Qualitative interviews with specialists
- Document analysis

It is essential for the sensitization strategy and measures to include individuals in a participative process so that those measures reach the local populations' needs. To do so, we held a **stakeholder-dialogue** and crossed the results with the **qualitative interviews** held **with specialists** of the environmental education and communication areas from the *Mosaico Central Fluminense* region. We also **analyzed** the **documents** focusing on the most important educommunication concepts and materials in the local, regional and national levels. The combination of these methods led to further results in the identification of a sensitization strategy and measures to reduce risks in the region.

Research units and areas

Following the method applied in the research, we selected individuals and communities as our research unit in the four areas in the municipality of Teresópolis. We based the selection of these areas on a study by the Federal Rural University Rio de Janeiro (UFRRJ) conducted in July 2013, which had pre-selected ten districts in Teresópolis having produced a socio-environmental diagnosis for each. Based on that study, we selected four districts as our research areas: Caleme, Granja Guarani, Santa Rita and Vieira. A multi-level and non-probabilistic sample was applied to that selection, on which the following criteria were used.

- Potential to appreciate the ecosystem services and risk reduction
- Rural/urban
- Affected/Non Affected
- Socioeconomic criteria

As the central criterion, the selected areas showed a high potential for preservation and/or recovery of the ecosystems, as the goal of our study is to contribute to a greater participation

of the population in reducing risks based on ecosystem services. To obtain accurate representation of the research areas relevant to the context of Teresópolis, we selected both urban and rural areas as well as those affected and unaffected by the tragedy of 2011. We also chose districts with similar socioeconomic characteristics to those of Teresópolis.

Analysis of local population's perception – main results

To reach the study's goal mentioned above, the analysis was based on an **impact chain** that includes four necessary main steps: vulnerability, ecosystem services, responsibility and possibilities. The results show that there are **three main gaps** in the impact chain, which have important implications to the sensitization concept.

First, the analysis of the **perception of vulnerability in the face of environmental risks** shows that people have a **relatively high perception** of their vulnerability and believe these **risks will increase in the future**.

- That means that, for our impact chain, conditions exist for the population to actively participate in risk reduction in the areas we researched.

→ That is why we recommend that the sensitization concept **not focus on increasing awareness of the vulnerability** of the local population. However, this high perception of vulnerability doesn't necessarily mean that people can draw adequate conclusions from their behavior regarding risk reduction and valorisation of ecosystem services. Environmental sensitization must be proportional to an **adequate understanding of vulnerability** so that people can choose the risk reduction measures most adequate to their context.

Second, the results of the analysis of the **knowledge of the functions of the ecosystem services** for the reduction of environmental risks suggest that, even if the population has some knowledge of the importance of environment protection, **few people have a wider understanding of the role of ecosystem services in the reduction of environmental risks**.

- This awareness isn't enough for people to actively and efficiently participate in risk reduction through ecosystem services. This result leads to our first gap in the impact chain:

The lack of knowledge of the functions of ecosystem services for reduction of environmental risks

→ As a consequence, we recommend the concept of sensitization to focus on the **increase of knowledge** on the role of local ecosystem services for risk reduction.

Third, we analyzed the **local population's perception of its responsibility regarding the preservation and recovery of ecosystem services**. Although there is some perception of such responsibility in the area of nature conservation, the main result is that most **people don't perceive the importance of their role and responsibility in the reduction of environmental risks**. That refers especially to the lack of perception of their responsibility regarding more adequate measures, especially in the area of recovery of ecosystem services.

- Considering these results, we can identify the second gap in the impact chain:

The lack of awareness regarding the own responsibility to preserve and recover ecosystem services for the reduction of environmental risks

At least 50% of the people perceive themselves as responsible for the preservation of nature, and so we can also identify a **great potential** of people who feel responsible, but, in most cases, don't know how to value ecosystem services.

→ That is why we recommend the sensitization concept to target an **increase in the awareness of individual responsibility** and knowledge about the **adequate measures to value ecosystem services**, taking this great potential into account.

Fourth, we analyzed the **local population's perception of its own options to contribute to the reduction of environmental risks** through the valorization of ecosystem services. The results show that a great part of the people sees the **lack of resources and options** as well as the **lack of possibilities to obtain such resources** as the greatest obstacle to value ecosystem services to reduce risks.

- These results lead to the third gap in the impact chain:

The lack of knowledge of how to obtain resources and how to better organize in order to have more options to preserve and recover ecosystems

→ That is the reason why we recommend that the sensitization concept also encompass the **increase in knowledge of how and where to obtain financial resources and options** to value existing ecosystems.

In this way, we can conclude that if the content of the three gaps identified by this study is added to the concept of sensitization and people are oriented in these areas, it is likely that people will be more organized and involved in the reduction of environmental risks through ecosystem appreciation.

Concept, strategy and measures for sensitization – main results

The key results of the social perception analysis allowed the elaboration of a concept of sensitization to reduce risks. This analysis led to the identification of the three main gaps in the local population's social perception, specifically regarding knowledge, consciousness and possibilities. These gaps indicate the lines of intervention for sensitization and are the basis for the elaboration of educational material.

The sensitization strategy and measures were drawn up from an analysis of the data of the workshop and of the interviews with specialists, as well as certain relevant documents. We also found two more gaps which must be taken into account during the implementation of sensitization strategy:

- there is a **lack of networking and communication** between the community and institutional levels, i.e., between the community and the government in the issue of environmental educommunication;
- although various educational and environmental communication activities are held, **the concept of appreciation of ecosystem service for risk reduction isn't part of the existing strategies** yet.

The main results of this study regarding the concept the strategy and measures towards sensitization are:

- Knowledge transfer isn't enough to overcome the identified gaps, but it is also necessary to train and qualify people to organize and support existing structures such as NGOs,
- The existing structures of civil society organisations constitute the main entry points, but the need of training for better participation has been identified. A deeper analysis of all relevant organisations in the field of environmental education and communication in the region still has to be done,
- A greater focus on mainstreaming of the potentials of ecosystem services is also recommended at different levels of the different sectors that play an important role in risk reduction.
- Due to the lack of networks and communication it is recommended to develop an integrated knowledge management from the local to the national level. Furthermore, there is a need for training in the field of valorization of ecosystems for reducing risks.
- At the local level, it is necessary to involve residents in the process by working with social agents, i.e., change agents in communities. These people, committed to community issues, are the main entrance points to reach people and mobilize them towards environmental issues. We identified different change-agents that offer the potential to reach local people by different measures.
- The most-used media of communication in the communities are television, radio and the internet. These media offer a high potential to communicate relevant information regarding environmental issues.
- We can also say that residents are interested in putting actions into practice when there is a greater possibility to carry out such actions.

We can conclude that main entry points for the implementation of the designed strategy exist in the municipality of Teresópolis. Likewise, the local population is highly motivated to put into practice actions to reduce risks. In addition the existing examples of transformation in the field of environmental education and communication in the region need to be considered. Thus, it is certain that both the strategies and the measures meet the residents' needs.

Recommendations and perspectives

The results of this study led to various recommendations for a more active and effective participation of local residents at disaster risk reduction procedures through the valorization of ecosystem services in the region of Teresópolis. Furthermore, the elaborated methods and the collected data as well as the sensitization concept, strategy and measures can be used by different public policies and other stakeholders in the region. This includes:

- To generate information on the general perception of the state of the environment such as degradation of nature, garbage disposal and the region's biodiversity.
- To obtain a better concept of the perception of climate change to develop sensitization concepts and environmental education campaigns regarding the adaptation and mitigation of climate change.
- To use the data on the local population's perception and knowledge for greater inclusion in territorial planning
- To use the data to strengthen participation and mobilization of civil society.

This study shows the potential of joining two groundbreaking approaches to reduce risks of natural disasters: the potential of ecosystem services and the potential of people's perception to increase their participation in disaster risk reduction. Given the subject's importance and the success of the approach's application in the region of Teresópolis, the methods used have great potential to be applied in other regional contexts.

Developing a toolkit for data survey

Based on the experiences resulting from the development of the methods and the analysis of surveyed data, a toolkit was created. This set of methodological instruments can be transferred and applied to other contexts with similar topics. The toolkit is adequate for the analysis of different natural disasters, regions, target-groups, scales and types of projects, as well as for different thematic priorities in social perception. In the context of their studies, the users of the toolkit can choose to apply all the methods or select only those they believe are necessary to reach their goals, also taking into account the available human resources and time.

An approach on risk reduction based on ecosystems along with the inclusion of the local population can be part of an integrated solution and financially feasible for many areas of the world. However, the kinds of natural disasters and their effects on humans and the environment, and, consequently, the measures of disaster risk reduction vary in the different contexts. As a result, this approach needs to be adapted in relation to the risks and local ecosystems as well as the local population's needs.

An analysis of the social perception like that presented in this study allows the identification of the people's capacity to participate in risk reduction and problems associated with it, especially those regarding the lack of knowledge, perception of self-responsibility and possibilities to act. From these results, it is possible to draw up concepts, strategies and measures for sensitization and training according to local needs. Instead of implementing blueprints from top to bottom, these concepts, strategies and measures are adapted to the different local needs, which increases their efficiency.

This increase in local participation and the inclusion of an appreciation of ecosystem services is a valuable contribution to an integrated strategy of risk management. This study supports those issues, contributing with methods, analyses and strategies that are valid not only in a Brazilian context, but also for the global scenario as well.