Mata Atlântica
Biodiversidade e Mudanças Climáticas

BIODIVERSITY AND CLIMATE CHANGE IN THE ATLANTIC FOREST PROJECT

PART II:CASE STUDIES

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BIODIVERSITY AND CLIMATE CHANGE IN THE ATLANTIC FOREST PROJECT

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Strategy for capacity building in adaptation to climate change based on ecosystems

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3. Context

The approach of Ecosystem-based Adaptation to climate change (EbA) was still little known in Brazil when the Atlantic Forest project was formulated in 2012. Then the project began to be presented in the regions of the mosaics, in 2013, it was evident that, beyond the actual coordination unit team, the project's potential implementing partners required further knowledge about how to operate effectively at the interface between climate change and biodiversity. GIZ developed a training format for the theme, based on the guidelines of the Organization for Economic Cooperation and Development (OECD) and supported by the German Ministry of Cooperation and Economic Development (BMZ). The Atlantic Forest project was, as a result, the first case in which this methodology was applied, first training the project team and then close partners at the federal level. Subsequently, a series of trainings were organized in the focal regions of the project, when it became apparent that the viability of the project would require conceiving and implementing a more comprehensive strategy for capacity building in EbA.

4. Target audience for the pilot project's execution

The first target audience for this capacity building consisted of the joint project team within departments at MMA and GIZ. A second target were institutions that were part of the project's governance structure: state environmental agencies (OEMAs), the Pact for the Restoration of the Atlantic Forest (Pact) and the Atlantic Forest NGO Network (RMA). Finally, a third target audience included partners and key actors in the focal regions (Lagamar, MCF, MAPES and Northeast Region) representing government, civil society organizations, education and research sectors.

As support for the formulation and implementation of the National Plan for Adaptation to Climate Change (PNA), federal institutions representing the plan's strategic sectors were also contemplated. The PNA's sectors are: agriculture, water resources, food and nurtitional security, biodiversity and ecosystems, cities, management of disaster risks, industry and mining, infastructure, vulnerable peoples and populations, health and coastal zones.

5. Process narrative

The strategy for capacity building in EbA was prepared with the objective of strengthening technical and institutional capacities in the project's focal regions and at the federal level, in the context of PNA, to increase the inclusion of EbA in public policies and in territorial planning instruments, and to divulge and promote the approach.

The strategy contained four objectives:

Figure 1. Objectives of capacity building in EbA in the Atlantic Forest project.

*TPIs – Territorial Planning Instruments.

The 1st objective sought to train trainers in EbA in the project's different focal regions, so that they could replicate their training, divulge and promote the approach in their respective areas, generating a multiplying effect. This component originated from the need for Brazilian trainers, since until then only trainers from other countries were available.

The 2nd objective sought, with the help of the trainers and trainees, to assure that institutions understand the importance of EbA and insert it in their working contexts, principally in relation to teaching and research, with a view to continuing to build capacity on EbA in Brazil, even after completion of the strategy and the Atlantic Forest project.

The 3rd objective sought to build awareness among partners, key actors and PNA sectors about the theme, taking advantage of the trainers to beach these broad and diverse target audiences.

The 4th objective sought to apply the new knowledge by integrating EbA in territorial planning instruments and public policies through the recently trained trainers.

From the outset of the Atlantic Forest project up to 2017, courses were planned and delivered, didactic materials were prepared and distributed, and coaching was proferred to the participants in support of their activities.

Courses were developed in two main formats:

- ☑ Methodological course (3 days): Introduction to the concepts, training in adaptation to climate change and EbA, presentation of the methodology for planning EbA measures based on case studies.
- ☑ Course on training of trainers (5 days): Empowerment of participants in planning and implementing EbA measures and to be trainers in the methodological course in EbA. Based on a case study, the participants acquire profound technical knowledge and learn how to reproduce the didactic aspects of the course, using a training manual and other materials.

The training followed the logic of the cycle for integrating EbA in planning (Figure 2), divided into four basic modules:

- ☑ Module 1 - Apply a climatic lens: identify the relevance of climate change in policies, programs, plans or projects.
- ☑ Module 2 - Evaluate vulnerability, potential impacts and risk: identify factors that contribute to the vulnerability and risk of climate change within a given system.
- ☑ Module 3 - Identify adaptation options: identify options for adapting to climate change in a way to minimize climate risk.
- ☑ Module 4 - Select adaptation options: Evaluate and prioritize options based on selection criteria.

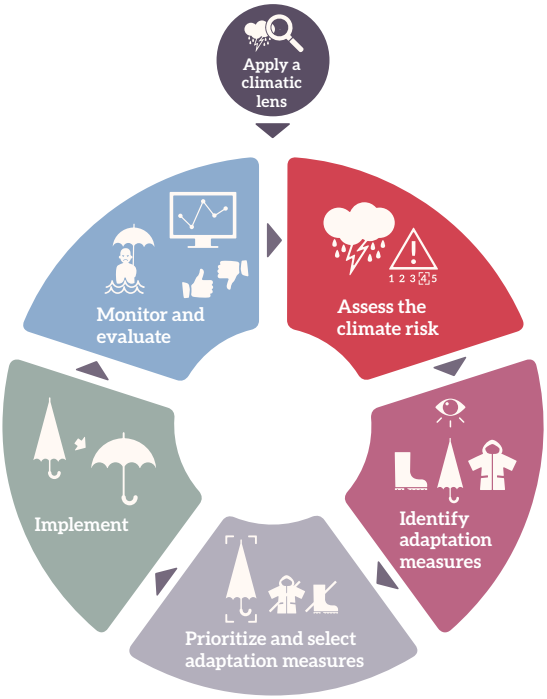

Figure 2. Cycle for integrating EbA in planning.

Several participants in the training of trainers in EbA became trainers in subsequent courses. Others integrated EbA in public policies and territorial planning instruments, with coaching from the project. To encourage exchange of experiences between the newly trained trainers, the project organized two National Meetings for Trainers in EbA, in 2015 and 2017. During the last meeting, planning took place for future actions and continuing interaction of these trainers after the conclusion of the project.

To support the capacity building there were developed different didactic materials:

- ☑ Set of posters: details the application of the cycle of integrating EbA in planning, with examples of the methodology's use, for the purpose of serving as a working instrument in participatory planning workshops;
- ☑ EbA course book: aggregates all of the content applied during the methodological course, for the purpose of supporting learning and serving as a reference for the participants;
- ☑ Training manual: guides the organization and preparation of activities of the methodological course and aims to support trainers and other interested parties in learning methods
- ☑ EbA video: presents, in visual form, the application of the cycle for integrating EbA in planning and related concepts, for the purpose of facilitation the dissemination of EbA.

Awareness-building activities were also organized, such as short courses and workshops, during technical, academic and scientific events: a workshop during the Seminar on Protected Areas and Social Inclusion (Florianópolis, 2015); a short course during the Brazilian Congress for Reducing Disaster Risk (Curitiba, 2016); preparatory workshops during the preparation of Municipal Plans for the Conservation and Recovery of the Atlantic Forest (PMMAs) in Bahia (2015 and 2016) and the Management Plan for the Cananeia -Iguape-Peruíbe Area of Environmental Protection, (APA CIP, 2015), among others.

Finally, the Atlantic Forest project supported the integration of climate change and EbA in the distance learning course for elaborating and implementing PMMAs, with the participation of over 600 people (see Case Study V); and it developed a distance learning course in EbA, translating the content of the methodological course into a visual and digital language and making it available online even after the conclusion of the project, serving as one of its legacies.

6. Results

The main result of the strategy for training in EbA was increased consideration of EbA in planning processes: the course trainees and the people they trained have greater awareness of the vulnerabilities to climate change impacts already observed and projected for the Atlantic Forest, as well as the importance of maintaining ecosystem services for the effectivity of EbA measures. Furthermore, they are capable of divulging their knowledge and inserting the approach in their own areas of activity.

Eleven methodological courses were offered in seven cities located in all the core regions of the project, with the participation of 267 people. In addition, four couses for training of trainers were organized, with 69 trainers trained (Table 1). Of these, 25 have already trained new groups.

Table 1. List of courses in EbA implemented by the Atlantic Forest project.

	Date	Locale	Type of Course	No. Participants
1	28-30 Aug 2013	Brasília-DF	Methodological	25
2	3-5 Sept 2013	Brasília-DF	Methodological	28
3	28-30 May 2014	Brasília-DF	Methodological	27
4	3-5 June 2014	Teresópolis-RJ	Methodological	26
5	24-26 June 2014	Curitiba-PR	Methodological	21
6	1-2 July 2014	Cananéia-SP	Methodological	27
7	22-26 Sept 2014	Brasília-DF	Training of trainers	16
8	29 Sept – 1 Oct 2014	Porto Seguro-BA	Methodological	24
9	7-9 Apr 2015	Paranaguá-PR	Methodological	22
10	18-22 May 2015	Paranaguá-PR	Training of trainers	13
11	15-17 June 2015	Brasília-DF	Methodological	21
12	20-24 July 2015	Porto Seguro-BA	Training of trainers	18
13	13-15 Apr 2016	Brasília-DF	Methodological	26
14	21-25 Nov 2016	Olinda-PE	Training of trainers	22
15	8-10 Feb 2017	Olinda-PE	Methodological	20
11 Methodological courses 4 Training of trainers courses			**267 participants trained 69 trainers trained**	

Of the 69 trainers trained as part of the capacity building strategy of the Atlantic Forest project, 58% were female and 42% were male; 12 were from universities, 12 from climate and environmental research institutions, 15 from foundations or associations involved in management or conservation of a given region, 22 from governmental institutions and 4 from other types of organizations.

In a complementary way, the strategy influenced the preparation of the Brazilian federal government's National Plan for Adaptation to Climate Change (PNA), published in 2016. Key institutions involved in the process of formulating this plan participated in a training on EbA, which enable the incorporation of this approach into the plan's strategy. One of the PNA's principles is to promote and integrate the approach of Ecosystem-based Adaptation in all sectors, and to us ecosystem services as an alternative or complementary adaptation strategy. In this sense, among the 11 sectoral or thematic strategies of the PNA, nine use EbA in guiding the revision and strengthening of their policies: agriculture; biodiversity and ecosystems; cities and urban development; management of disaster risk; industry and mining; vulnerable peoples and populations; water resources; health; food and nutritional security; and coastal zones.

The strategy of capacity building also resulted in the consideration of climate change and EbA in territorial planning instruments by recently trained trainers, such as in the Management Plan for the Cananeia-Iguape-Peruíbe APA (see Case Study III).

7. Lessons learned

- ☑ The implementation of a capacity building strategy requires a considerable amount of technical and financial resources. In this case, the amount of human resources to supervise the replication of courses and the application of knowledge acquired by the trainees in planning instruments was underestimated during the project formulation. Also, the organization of face-to-face training in five different regions that frequently counted on international trainers required high financial investment.
- ☑ Selection of trainees should consider, from the start, potential areas for applying the newly acquired knowledge over the short- and medium-term. This enables rapid application of the newly acquired knowledge, leading to greater impacts following the courses.
- ☑ The processes of capacity building required more time than was initially envisioned. In particular, this was the case for the face-to-face courses, the development of the distance-learning course and and preparation on support materials. There was also a need to provide coaching support for the actions of the trained trainers, to prepare local case studies in support of the courses in different regions and to generate additional content on climate change and EbA, which also extended the time required to conclude the stategy.

8. Recommendations

The conception of a capacity building strategy should – in addition to targets – contain an action plan for its implementation. Armed with a plan from the outset permits planning and monitoring of activities in a more systematic way, and achieving targets more quickly.

It is advisable to plan a capacity building strategy in a flexible way, permitting the inclusion or exclusion of targets in response to windows of opportunity or unexpected needs that arise.

9. Follow-up

The implementation of a capacity building strategy provided the basis for a series of actions that contributed to the integration of an EbA approach in a growing number of processes in the Atlantic Forest and Brazil.

The trainers were trained to reproduce courses or support the insertion of EbA in plans and projects, not only in their own institutions but through consultancies or partnerships with other institutions. The materials prepared by the project will help raise awareness of these processes among various target audiences. The distance course on considering EbA in planning, as well as the course on preparing PMMAs, including EbA, continue to be offered regularly with the expectation of reaching a larger public.

From our point of view, EbA will be a core theme within the PNA and generate applications in the nine sectors that have committed to consider it in their respective adaptation strategies.

Figure 3. Training course in EbA as a response to Climate Change, June 15-17, 2015, Brasilia, Federal District.

CASE STUDY II

Possible methodologies for carrying out an analysis of vulnerability to the impacts of climate change

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3. Context

The Atlantic Forest project has among its objectives the insertion of information about climate change (CC) in Atlantic Forest territorial planning instruments and in environmental public policies, encouraging the development of measures for ecosystem-based adaptation (EbA) to climate change. Among the most critical information gaps identified by the project partners are regionalized data and information about the effects of climate change on the Atlantic Forest. Greater knowledge about its effects permits the consideration of climate change in planning processes and the definition of necessary measures for adaptation. To fill this gap, the project supported the production of information about the impacts of climate change in an accessible format, developing in a pioneering way the first studies on this theme for the Atlantic Forest.

4. Target audience for the pilot project's execution

Participants in processes of preparing or revising territorial planning instruments and public policies within governments, civil society organizations and educational and research institutions.

5. Narrative of the process

Due to the complexity of conducting an analysis of vulnerability to climate change at a large scale such as that of the Atlantic Forest, the initial discussions about concepts associated with adaptation were carried out internally between DECO/SBio, DPMC/SMCF and GIZ. These discussions generated a shared understanding of this theme and enabled participants to scale the work needed for the Atlantic Forest project to meet the demand for information identified by its partners and to achieve the objective of designing and incorporating EbA measures within territorial planning instruments and public policies. To determine the vulnerability of the Atlantic Forest to climate change, it would be necessary to consider regionalized projections of future climate, biophysical and socioeconomic parameters for revealing local and regional sensibilities and indicators of the capacities of Atlantic Forest populations to adapt to the impacts of climate change. A series of workshops and debates led

to the conclusion that a complete analysis of vulnerability would require: (i) the development of a highly complex methodology demanding human, financial and temporal resources beyond those available within the project, and (ii) local and spatialized socioeconomic data that are inadequately registered in Brazil. As a result, the project opted for a study exclusively focused on modelling biophysical impacts, which by itself would fill knowledge gaps and provide a basis for considering EbA in plans, programs and policies, but which could also be complemented subsequently with both socioeconomic data and data on adaptive capacity on a case by case basis.

As a result, the Atlantic Forest project contracted a consultancy to prepare a study on seven biophysical impacts of climate change on the Atlantic Forest:

(i) inundation,

(ii) water erosion and (iii) landslides;

(iv) soil water availability;

(v) distribution of disease vectors;

(vi) impacts on agroclimatic zoning; and

(vii) impacts on distribution of phytophysiognomies.

To do this, the study considered:

- ☑ 5 climatic variables – mean temperature, minimum temperature, maximum temperature, precipitation and relative humidity;
- ☑ 4 climatic extremes – heat waves (WSDI), warm nights (TN90p), sequence of dry days (CDD), sequence of humid days (R10);
- ☑ 7 biophysical parameters – hydrography, topography, soils, phytophysiognomies, remnants of native vegetation, land cover and use, distribution of disease vectors;
- ☑ 4 temporal parameters – 1961-2005 (historic), 2010-2040, 2041-2070, 2071-2100;
- ☑ 2 visualizations of data – absolute and relative (in comparison with the historic period);
- ☑ 2 temporal approaches – quarter or 3-months (summer or December-January-February, and winter or June-July-August) and annual;
- ☑ 2 scenarios of representative pathways for concentration of greenhouse gases – RCP 4.5 and RCP 8.5; and
- ☑ 2 regionalized climatic models for Brazil – Eta HadGEM2-ES and Eta MIROC5.

6. Results

A total of 748 maps were prepared, of which 260 are of climatic variables, 104 of climatic extremes and 384 of biophysical impacts of climate change on the Atlantic Forest. These maps were grouped in 114 archives, like in the example of Figure 1. Each archive is composed of eight maps when presenting absolute data or six maps when presenting data relative to historic period.

The study results show that the different regional climatic conditions, together with the biophysical characteristics of the territory, clearly influence the spatial variability and the magnitude of the potential impacts of climate change on the Atlantic Forest.

The South Region shows an increase of inundations under the two RCP[1] scenarios under the two climatic models utilized, due to rainfall extremes that were especially high in this part of the country. Other areas subject to inundations are scattered along the Brazilian coast, consisted of well-developed and flattened floodplains. Extensive inland areas of the Atlantic Forest present reduction of the occurrence of inundations.

Modelling of the occurrence of water erosion revealed differences according to the climatic model utilized. The Eta HadGEM2-ES model shows increase of water erosion in the South and Southeast regions during the winter. The Eta MIROC5 model shows increase in these regions, in addition to the Central-West Region, also during the summer.

Regarding the impact of landslides, increased occurrences are predicted for the South and Southeast regions during both the winter and summer. This is due to increase of mean rainfall and rainfall extremes in a biophysical system already subject to landslides, with sharp slopes and erodible soil.

1 Representative concentration pathways.

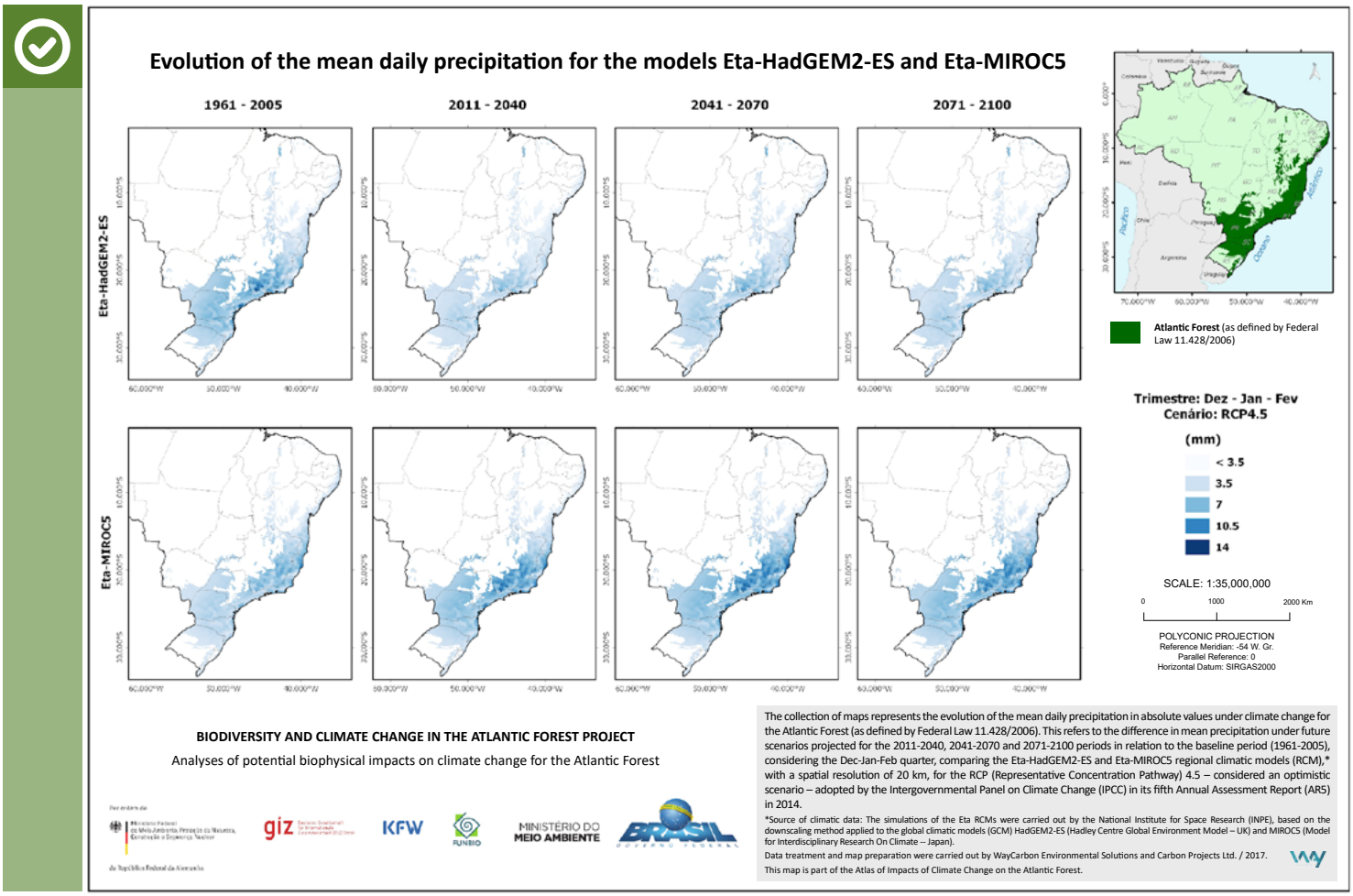

Figure 4. Maps of rainfall projections in the Atlantic Forest.

With decreasing rainfall in the Northeast, there is no projected increase in the occurrence of landslides for the region. However, due to this same reason in addition to increasing temperature, there is a projected decrease in soil water availability for the Northeast, which already is affected by the scarcity of soil water and high indices of drought. Furthermore, decreased soil water availability is also projected for all the other regions because, despite increased mean rainfall projected for the South, Southeast and Center-West, there is also an increase in rainfall extremes, which means greater variation in the rainfall regime.

In relation to the impact on disease distribution, the study focused on the mosquito *Aedes aegypti*, the transmission vector for dengue, zika, chikungunya and yellow fever. An increase in mosquito distribution is expected in all regions of the Atlantic Forest. It is important to stress that the study considered only climatic and biophysical parameters as factors used in projecting impacts. Other variables important in this context, such as cleanliness and maintenance of land or forms of storing water, were not included due to the lack of consideration of socioeconomic data in this analysis.

The impact on agroclimatic zoning was based on the Water Requirement Satisfaction Index (WRSI), commonly utilized in agrometeorological studies on climatic risk zoning for agricultural crops in Brazil. There is a projected loss in areas with agricultural potential in all of the regions, with negative effects on the production of rice, beans and maize, which are critical for the country's food security. The greatest variation in area suitable for crops is predicted in the Northeast, with the greatest impact on small-scale rural properties.

Finally, the effects of climate change on the Atlantic Forest's seven main phytophysiognomies[2] were evaluated. Due to the changes in temperature, rainfall and their extremes, high variation of climatically suitable areas for occurrence of all the phytophysiognomies is expected. The Semi-decidual Seasonal Forest, Decidual Seasonal Forest and Mixed Ombrophilous Forest present the greatest losses in areas suitable for their occurrence, attaining up to 71% loss for Decidual Seasonal Forest in the Eta HadGEM2- ES model, under the RCP 8.5 scenario, for the 2071-2100 period. The Dense Ombrophilous Forest and Open Ombrophilous Forest present certain stability due to increased rainfall. As expected, the ecotones had the greatest gains in climatically suitable areas for occurrence, since they are characteristically locales of environmental transition.

The lack of clear and spatialized information on the impacts of climate change currently represents one of the greatest obstacles for defining adaptation strategies and actions. This study analysing the biophysical impacts of climate change on the Atlantic Forest thus represented an advance in filling this gap and provided a foundation for devising EbA measures for territorial planning instruments and public policies. To encourage this process, the Atlantic Forest project has made available the complete study and all of its maps.

2 Dense Wet Forest, Open Wet Forest, Mixed Wet Forest, Humid Forest, Dry Forest, pionner formations (mangroves, sandy coastal plains, salt flats and flooded areas) and ecotones.

7. Lessons learned

- ☑ When defining a project's objectives, indicators and targets, it is important to consider the data and studies needed, and above all the existence or possibility of developing these data and studies, to assure that the project's objectives, indicators and targets can be achieved.
- ☑ When developing a complex and innovative study, one should plan, from the beginning, a strategy for disseminating the data and results obtained, including the definition of its formats, platforms to be used and actors to involve. In this way, it will be possible to visualize the time and effort required for the study's dissemination and not only its production.
- ☑ Due to the complexity and time required for developing a study such as this, it is necessary to register all the decisions made about it, which avoids conflicts and clarifies the role of everyone involved.

9. Recommendations

- ☑ Being clear about the what type of audience and final use is required of the data enables one to customize them from the start.
- ☑ The communication of final products is critical and should be thought through at the outset of the study.
- ☑ Involving final data users in the planning of the study permits the preparation of products to address the specific needs of these users.

9. Follow-up

The data produced by this study are of great interest to different sectors of the country. Beginning with this assumption, dissemination of the data is the main challenge to assure that they are widely used. Consequently, all 114 files with corresponding maps and associated metadata will be made available on the website of the Ministry of Environment, in pdf, gis and xml formats. In addition, the files are part of the complete study, also available on-line. The study and its results will also be presented in scientific and technical articles, as well as in national and international congresses.

As a result, it is expected that the data generated by this study will continue to be used for planning EbA measures in different territorial planning instruments in the Atlantic Forest, including those supported by the project's component of financial cooperation. It is also hope that the data will be used by those involved in the PNA's strategic sectors, and also to serve as a basis for other public policies related to the theme.

CASE STUDY III

Insertion of EbA in the Management Plan of the Cananéia-Iguape-Peruíbe Area of Environmental Protection in Sao Paulo

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Ricardo Brochado Silva – Acadebio and DIMAN/ICMBio

3. Context

The Cananéia-Iguape-Peruíbe Area of Environmental Protection (APA-CIP) is a federal conservation unit (UC) established in 1984, encompassing the municipalities of Cananéia, Iguape, Ilha Comprida, Itariri, Miracatu and Peruíbe in Sao Paulo state (ICMBio 2015a) and expanded in 1985 (ICMBio 2015b), totalling approximately 234,000 ha. Located in the Lagamar region, which covers the southern coast of Sao Paulo and the coast of Parana state, it is entirely inserted in the Atlantic Forest dominion, with a predominance of mangroves, sand dune scrub and dense wet forest.

In December 2014, ICMBio began developing a management plan for the UC[3], based on a revision of an earlier management document published in 1996. Seeing that the APA-CIP represents an important protected area in the region of the Lagamar mosaic, one of the project's focal regions, a partnership was established to insert Climate Change and Ecosystem-based Adaptation (EbA) in the management plan.

Since EbA is a relatively new concept, few implementation experiences exist, either in Brazil or worldwide. As a result, this case represents a pioneer experience internationally, with inclusion of these globally important themes (EbA and climate change) in a regional scale planning initiative.

The inclusion took place at five levels: (i) training and awareness development of the APA technical team and the consultant team; (ii) information about climate change in the diagnosis; (iii) inclusion of dynamics and dialogues in thematic meetings with communities; (iv) organization of a workshop on climate change and EbA; and (v) development of a crosscutting program on climate change and EbA that will operate in collaboration with

3 With financing from the Mangroves of Brazil project (GEF Mangue) BRA/07/G32, coordinated by DISAT/ICMBio, and with technical support of the United Nations Development Program (UNDP)..

other programs foreseen in the management plan and consideration of EbA in the rules of especially protected zones such as the Mangrove Zone. In this way, the insertion of these themes strengthens the APA-CIP as a regional interlocutor of these themes.

4. Target audience for the pilot project's execution

This experience had several target audiences. First, the APA technical team, which requested support for inserting the themes climate change and ecosystem-based management in the management plan to qualify it. Next, the APA users and residents who could benefit from the knowledge acquired with the management plan's guidelines and actions related to ecosystem-based adaptation to climate change. Finally, APA partners such as research institutes and staff of public agencies for environment, agriculture, water resources and fisheries, among others, as well as NGOs focused on these themes in the APA region. Other target audiences include departments or sectors of federal agencies with headquarters in Brasilia, such as DIMAN/ICMBio or DAP/SBio/MMA.

5. Narrative of the process

The Atlantic Forest project started operation in the Lagamar region in mid-2014, and during this same year it organized two courses on climate change and ecosystem-based adaptation, one in the municipality of Curitiba (PR) and the other in Cananéia (SP). Some participants intended to use EbA in their professional work and thus also participated in the Training of Trainers course on Climate Change and Ecosystem-based Adaptation during September, 2014, in Brasilia – DF (see Case Study I). Thus, in the first Training of Trainers course, a group[4] of participants linked to the APA-CIP, to ICMBio's National Academy of Biodiversity (ACADEBio) and the Registro Campus of the São Paulo State University (UNESP), produced an initial proposal to insert climate change and EbA methodology in developing the APA-CIP Management Plan.

This initiative gained the support of the APA-CIP head of management, as well as the coordination of the Mangroves of Brazil project in Brasilia, which financed the development of the management plan. As a result, at the outset of the plan's development, the intention arose to insert climate change and EbA, yet these themes were not included in the Terms of Reference for contracting a specialized consultancy charged with developing the plan.[5]

At the beginning of the plan's development, it was decided that climate change and EbA would be addressed: (i) in the thematic meetings carried out during the diagnosis, (ii) in specific workshop on climate change and EbA, (iii) in a specific chapter of the plan dedicated to climate change and EbA, and in an Action Program focused on confronting climate change and its adverse impacts.

During the diagnosis, regionalized thematic meetings were carried out in all sectors involved with the APA, with different categories of participants such as, for example, fishermen, farmers and merchants. These contributed with their perceptions and knowledge on climate change and its interference in their livelihoods and productive activities. At the conclusion of the meetings, the participants were invited to participate in the specific workshop on climate change and EbA, which took place in May 2015 at the headquarters of the APA-CIP.

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4 An environmental analysis of the Cananéia-Iguape-Peruíbe Area of Environmental Protection (APA-CIP), the coordinator of the National Academy of Biodiversity (ACADEBio/ICMBio), and a professor of the Registro Campus of the Sao Paulo State University (UNESP).

5 Further information in the section on lessons learned.

The workshop on climate change and EbA lasted one day and had 20 participants, including representatives of local communities, mayor's offices, teachers and researchers, environmental analysts from ICMBio and the Ministry of Environment, technicians of the Atlantic Forest project and consultants, in charge of developing the APA-CIP Management Plan.

The following methodological steps were taken:

- ☑ Identification of the participants' awareness of climate change signals in a map of the APA-CIP (e.g., more intensive rainfall, heat waves, decreased rainfall, longer droughts, etc.);
- ☑ Introductory lecture on climate change and adaptation in general and in the APA-CIP region;
- ☑ Identification of the impacts of climate change in the APA-CIP region, related to biophysical and socioeconomic aspects;
- ☑ Reflection on ecosystem services and their relation with the wellbeing of the population and with adaptation to climate change;
- ☑ Identification and spatialization of possible EbA solutions, covering conservation, recovery, sustainable use, etc.; and
- ☑ Presentation and reflection about the workshop's results and their insertion in the management plan.

During this process, proposals were generated that could be considered EbA measures, even if, sometimes, the proponent did not have knowledge about this approach.

The management plan team evaluated as positive the workshop's contributions and opted to develop a program that focused special attention on ecosystem-based adaptation and that had crosscutting actions with the other programs. Another decision was to insert zoning guidelines and rules that also referred to EbA.

6. Results

The inclusion of the themes of climate change and ecosystem-based adaptation in the steps planned for developing the management plan was assertive, providing significant results.

The information obtained in the meetings with the local residents were considered relevant due to their local knowledge and their involvement in fishing, farming, harvesting of forest products, and other activities related to environment and, consequently, enabled them to provide an empirical interpretation of regional climatic signals. Many proposals raised during the thematic meetings, when considered in relation to the workshop on climate change and EbA, and specifically the activity "EbA Options and Spatialization within the APA-CIP," reveal themselves to be EbA measures that could be potentially carried out in the APA.

The dynamic and participatory format of the workshop on climate change and EbA, with awareness-raising lectures and (in)formation on the core themes and the APA-CIP region, valued the participants' knowledge and perception. This approach favored the public's rapid integration with the themes and the production of new information for the APA-CIP diagnosis. Furthermore, it enabled the participants to validate the insertion of these themes in the APA-CIP Management Plan.

In the evaluation of the plan by the managing agency, ICMBio, several subsidies on climate change and EbA were removed from the plan, and the Program for Confronting Climate was incorporated in the Environmental Management Program, losing some weight in the plan as a whole. Nevertheless, the APA-CIP Management Plan was the first in Brazil to insert these themes and define a working methodology for their formulation, serving as a thematic/practical reference with potential for replication in other management plans.

7. Lessons learned and recommendations

In the process of reflecting about this experience, the lessons learned from the APA-CIP case and associated recommendations were defined in accordance with the phases in developing the management plan.

PHASE I – Planning and organizing the process of developing the management plan

One should plan to build awareness of the themes among the key actors. The forms and duration should be defined for each case. It is essential that the insertion of climate change and EbA is agreed to by all levels of the environmental agency, especially by those responsible for monitoring and approving Management Plans, but also by those that provide financial and human resources and by the technical body. The ideal is that this agreement can be reached as soon as possible, in other words together with or right after the decision to prepare or revise the Management Plan, and that it has some degree of formality. It is also essential that the agreement be extended to the consultancy responsible for preparing the Management Plan. The terms of reference should be absolutely clear that the insertion should be carried out in a serious and efficient manner.

PHASE II - Diagnosis, prognosis, zoning and development of management programs

The insertion of climate change and EbA should be considered starting from the formation of the team, from the evaluation of both information that exists and that needs to be generated, and that it must cover all parts of the management plan, from diagnosis, vulnerability and threat assessments, zoning, action programs to further detailing. It is important to empathize that the vulnerability or risk assessment should cover not only the protected area itself but its entire area of influence, for example, including the watersheds links to the protected area.

In case the option is made for a participatory diagnosis (surveying the perception of local residents, carrying out participatory events about climate change and EbA), the management plan team needs to plan and monitor every step in terms of its implementation and efficiency. To verify the perception of participants in relation to observed climate change over the past 10 to 20 years and the impact on their livelihoods, it is necessary to develop dynamics that permit participants to provide information without undue exposure, avoiding that their fear or difficulty with reading and writing become evident.

A divergence of opinions about climate change may occur, including participants' position that it is not due to human intervention or that only climatic variations exist. It is important to link environmental problems

raised during the meeting with the themes of climate change and EbA, which should not be separated from diagnosing environmental problems and proposing solutions to those problems. Some solutions proposed can be considered EbA measures without participants necessarily understanding this concept.

Specific events about climate change and EbA can provide valuable inputs for the management plan. In this specific event, it is important to "apply the Climatic Lens" (see Case Study I) to identify, together with the participants, which sectors, areas or populations are especially vulnerable. It is also important to consider how to mobilize the population and relevant institutions to assure diverse participation in the event.

Phase III – Evaluation and approval of the plan

In the final version of the management plan, it should be evident that climate change and EbA were considered and what the consequences are. In other words, what does climate change mean for the conservation unit and its buffer zone, and what adaption actions will be taken to reduce vulnerability and which of these actions are considered EbA measures.

It is necessary to monitor whether institutional or personal resistance exists within the environmental agency, the conservation unit team and consultants, and even among the participants in the workshops on inserting climate change and EbA, which may occur starting with the preparation of the terms of reference all the way to the conclusion of the management plan. Such resistance should be detected and addressed, assessing the challenges and results obtained in each phase.

8. Follow-up

The APA administration has a modern and effective management plan for working with ecosystem-based adaptation to climate change during its implementation. Whether this takes place and leads to significant results and impacts depends on several factors.

The first step is the implementation of the management plan. Initially, an obstacle arose when sectors dissatisfied with the rules for combatting and prohibiting the raising of exotic invading organisms succeeded, even in a preliminary court decision, to suspend the implementation of the management plan.

Once this obstacle is overcome, it will be up to the APA team and partners to detail the planning of and initiate training and awareness raising actions on climate change and the need for adaptation, and to undertake ecosystem-based adaptation measures by the APA or by partners.

There are qualified people both in the APA team and in the partner institutions, three of whom are trained in EbA and another trained in the MARISCO[6] methodology, with capacity to use tools to deal with vulnerability and climatic risks.

The experiences and lessons learned from this pilot case will be considered in the development of 11 more management plans of conservation units, supported by the financial cooperation of the Atlantic Forest project in its three focal regions. Climate change and EbA should also be part of these management plans.

6 See Manual of the MARISCO Method in http://www.mma.gov.br/publicacoes/biomas/category/63-mata-atlantica?download=1342:marisco-manejo-adaptativo-de-risco-e-vulnerabilidade-em-s%C3%ADtios-de-conserva%C3%A7%C3%A3o

CASE STUDY IV

Analysis of climatic vulnerability and mapping of ecosystem services as subsidies for the Law on Soil Use and Occupation and the Master Plan for Duque de Caxias, Rio de Janeiro

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Antonio Carlos Oscar Júnior – Municipal Secretariat of Planning, Housing and Urbanization (SMPHU) of Duque de Caxias

3. Target audience for the pilot project's execution

The direct target audience was the Municipal Secretariat of Planning, Housing and Urbanization (SMPHU) of Duque de Caxias/RJ, technicians and staff of other municipal secretariats involved in formulating and revising plans and laws related to territorial planning as well as organized civil society. The indirect target audience was the population of Duque de Caxias, beneficiary of the pilot project's actions.

4. Context

According to federal law no. 10,257/2001, denominated the City Statute, the master plan is required for municipalities with more than 20 thousand inhabitants and/or inserted in metropolitan regions. The City Statute established that the maximum period for preparing a master plan was five years after the statute went into effect, which took place on October 10, 2006. The statute also determined that the municipal law that establishes the master plan should be revised at least every ten years. As a result, in 2016, there was a great effort by municipalities that had developed their plans in 2006 to revise them. Among these municipalities, Duque de Caxias, part of the metropolitan region of Rio de Janeiro and containing over 880 thousand inhabitants, sought the support Atlantic Forest project to update its Soil Use and Occupation Law and, consequently, its Master Plan. Added to this is the fact that the municipalities was already feeling the need to consider climate change impacts and biodiversity themes in its planning, but lacked methodologies to do so.

5. Narrative of the process

Staff of the Municipal Secretariat of Planning, Housing and Urbanization (SMPHU) of Duque de Caxias sought to consider climate change and ecosystem services in the process of revising the Soil Use and Occupation Law and the Municipal Master Plan.

To attain this objective, they sought support from the Atlantic Forest and Regional-Local TEEB[7] projects. Two staff members of SMPHU participated in the course on training of trainers in EbA, organized by the the Atlantic Forest project. After this training, a coaching process helped the trainers in considering climate change and EbA in territorial planning instruments that would be worked on by the municipality.

To begin the process of inserting climate change, EbA and ecosystem services into the municipality's territorial planning instruments, a workshop was organized with representatives from eight municipal secretariats and other related institutions in July 2015, which enabled participants to become aware of the importance of considering these factors in their working contexts and to act in an articulated way. In October 2015, another workshop was organized, entitled *The relevance of ecosystem services and climate change in the context of environmental planning of the municipality of Duque de Caxias*. This workshop aimed to (i) socialize the results of the ongoing analyses on environmental services and (ii) climate change, and (iii) reflect about the opportunities for using this information in the municipality's territorial and urban planning. In November 2015, two one-day workshops took place to begin an analysis of vulnerability in a participatory way. The goals were (a) to understand the terminology of vulnerability, (b) to develop an analysis of vulnerability, focused on systems of interest and key impacts of climate change for the municipality, and (c) identify adaptation measures to be considered in the Master Plan.

The analysis of vulnerability carried out the following steps: (i) capacity building, seeking to raise awareness among participants about the relevance of considering climate change in planning, leveling general knowledge; (ii) focus on systems of interest under elevated climatic risk, previously identified in working groups of key actors; (iii) preparation of impact chains, focusing on exposuse, sensibility and adaptive capacity to climate change, seeking to identify inter-relations between different factors and underlying motives that lead to vulnerability; (iv) mapping of areas sensitive to climate change, establishing cartographic bases for integrating climate change into territorial planning; and (v) identification of adaptation options, with the purpose of making territorial planning an instrument that contributes to reducing climatic risks. While the first workshop analyzed the entire municipality, the second workshop focused entirely on the Xerem district, which is especially vulnerable to climatic impacts.

To assure that municipal planning instruments also consider ecosystem services, a partnership was made with the Regional-Local TEEB project (MMA/GIZ) for capacity building, for generating information for mapping of environmental services and climate, and for incorporating this information into instruments.

The TEEB project carried out a participatory mapping of the most relevant ecosystem services in the municipal territory, producing maps and scientific inputs that supported decision making involving territorial planning and management and natural resources.

This mapping was carried out in four steps, as follows: 1 – The selection of key ecosystem services for the municipality, surveyed through a workshop, questionnaires and e-mail; 2 – The development of a database on land use in the municipality as a basis for carrying out interviews; 3 – The definition of key actors, arranging interviews with them to raise data (specialists, municipal and federal managers, representatives of the local community); 4 – Systematization and spatialization of the information, with data analysis and confection of maps.

7 The Economics of Ecosystems and Biodiversity.

6. Results

The partnership between the Atlantic Forest project and the Regional-Local TEEB project and the Municipal Secretariat of Planning, Housing and Urbanization (SMPHU) of Duque de Caxias resulted in significant contributions to the territorial diagnosis of the municipality.

On the one hand, building capacity to consider climate change and its potential impacts in planning generated increased awareness about the importance of this theme, and of the need to address it in an integrated wasy through cooperation between the municipal secretariats. As a result, this process was reported to be the first opportunity, in years, for joint meetings between technical staff from different municipal secretariats and institutions to debate themes of common interest.

On the other hand, the diagnosis generated concrete technical knowledge about the potential impacts of climate change in relation to different systems of interest at a municipal scale. The workshops on analysis of vulnerability generated impact chains for both the municipal territory as a whole and for systems of interest within the Xerem District, which is especially sensitive to climate change. Detailing that current and future exposure to climate will potentially impact aspects sensitive to systems at risk, current adaptation mechanisms were identified as well as possible options (based on ecosystems) to reduce climatic risks.

At the same time, participatory mapping of areas with key sensibilities in relation to climatic exposure permitted the identification of hotspots that should receive special attention during the formulation of territorial plans and policies.

All data generated during the workshops were validated by the participants, who represented different governmental agencies, non-governmental organizations and academic institutions.

Figure 5. Mapping of areas sensitive to climate change in the municipality.

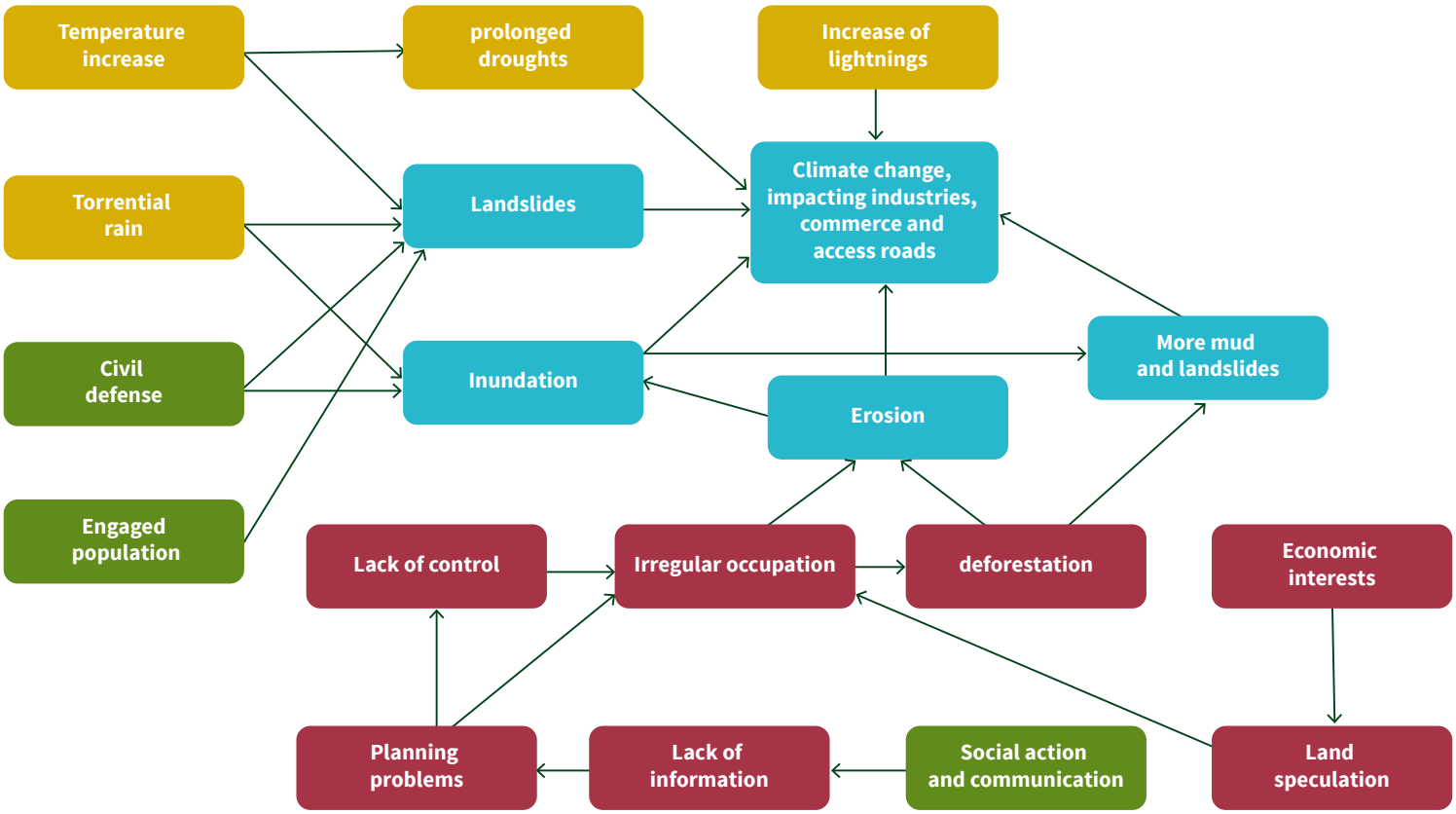

Figure 6. Chain of impact on systems of interest in the municipality.

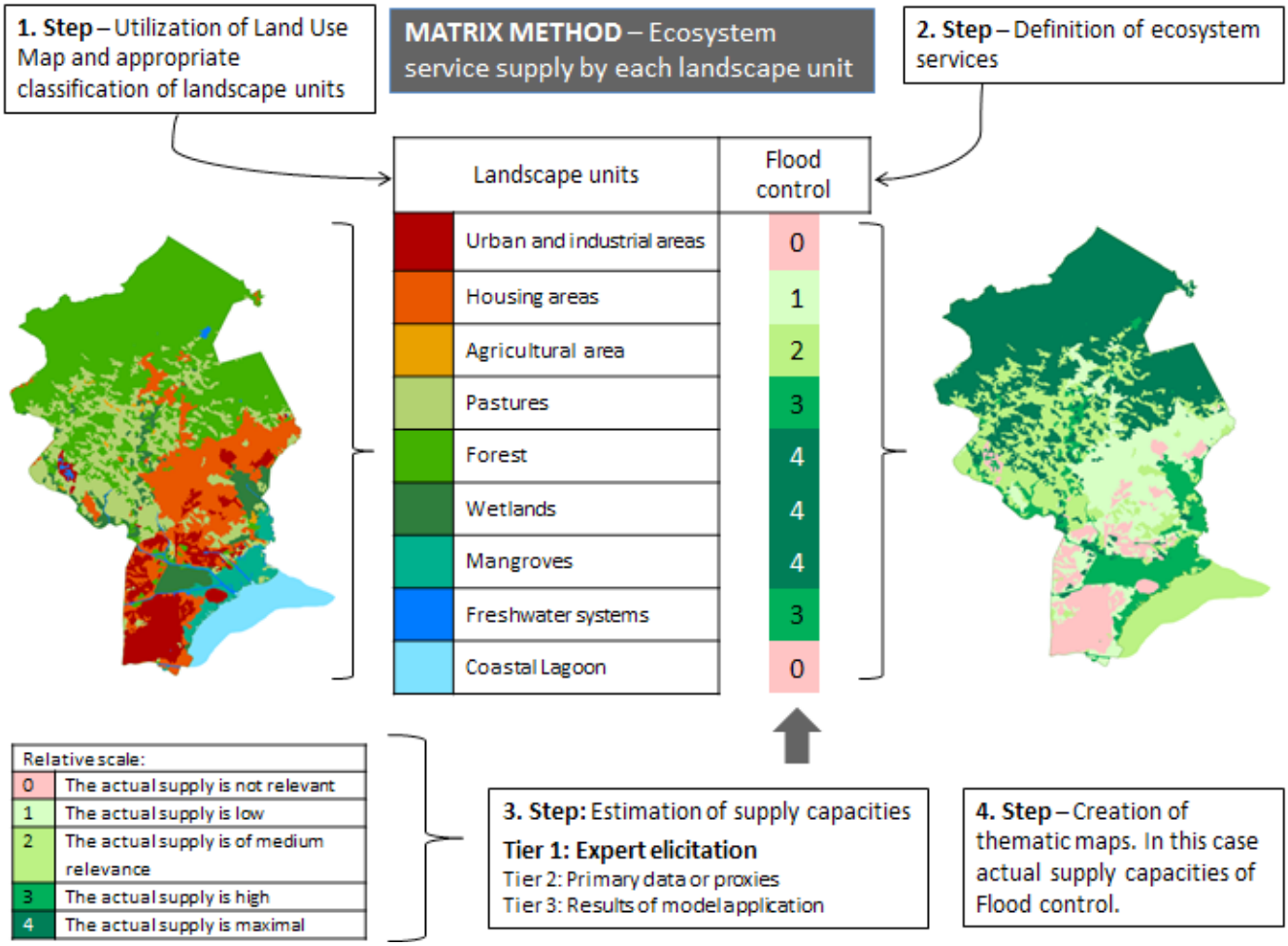

Figure 7. TEEB: 9 thematic maps of ecosystem services.

7. Lessons learned

- ☑ The consideration of climate vulnerability was critical for the diagnosis of the municipality, permitting identification of measures focused on reducing vulnerability.
- ☑ Climate change was also an excellent theme to bring together experts and viewpoints of different municipal sectors and secretariats, encouraging joint collaboration to reduce common risks.
- ☑ The option was right to work systematically in capacity building to assure that everyone would reach a common level of understanding.
- ☑ The prior political articulation at higher levels may have played a key role in assuring greater participation by the different secretariats.
- ☑ Further follow up after gathering data and information is an important strategy to assure the integration of this data and information in territorial planning instruments.

8. Recommendations

Innovative processes within municipal agencies generally require significant institutional articulation at the outset to assure that the results of these processes are widely adopted. The SMPHU – as the main articulator in municipal planning processes – was aware of the importance of seeking support of decision makers in other municipal secretariats, primarily because environmental issues are not necessarily considered to be an attribute of this secretariat, but rather, of the Environment Secretariat, which was not giving priority to climate change issues. Nevertheless, articulation proved to be more difficult than expected, ways were not found to obtain explicit support from key agencies, such as the City Council or even from the Mayor. This was due to the lack of SMPHU's political power in the mayor's office, as well as the impending municipal elections beginning in mid-2016, which practically brought political decisions to a halt within the mayor's office. Based on this analysis, a more intensive prior articulation is advised with key municipal secretaries, such as that of Environment, so that achieved results are more likely to be widely diffused among important municipal agencies.

9. Follow-up

The project offered technical and methodological support to SMPHU under the premise that both the formulation of the Municipal Law on Soil Use and Occupation and the revision of the Municipal Master Plan were about to occur. The studies supported by MMA and GIZ should have furnished important inputs for these processes. However, the processes were delayed due to the budget situation of the municipal government and political conditions. Despite the consideration of the diagnoses generated and of Ecosystem-based Adaptation as key approach in the Terms of Reference to revise the Municipal Master Plan generated the expectation that the technical and methodological contributions really would provide a basis for municipal plans and policies regarding territorial use in Duque de Caxias, the definitive impact – such as changes in territorial zoning in favour of conservation and restoration of key ecosystems to reduce risks in the municipality – would only become a reality after the development and implementation of these policies and plans in the coming years.

CASE STUDY V

Integration of climate and EbA in the methodology for the elaboration of Municipal Plans for Conservation and Recovery of the Atlantic Forest (process of participatory preparation of Guidelines for Preparing and Implementing PMMAs)

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3. Context

The Municipal Plan for the Conservation and Recovery of the Atlantic Forest (PMMA) was established by Federal Law no. 11,428/2006, known as the Atlantic Forest Law, together with the Fund for Recovery of the Atlantic Forest Biome and definition of the Law's Article 38, which states that "*the resources from the Fund for Recovery of the Atlantic Forest Biome will support projects that involve conversation of native vegetation remnants or areas to be restored, implemented in Municipalities that possess a municipal plan for conservation and recovery of the Atlantic Forest, duly approved by its Municipal Council of Environment*." The Federal Government defined in Decree no. 6,660/2008 the minimal scope and content of these plans and, beginning in 2010, several municipalities in the Atlantic Forest started developing their PMMAs.

Under the Project "Protection of the Atlantic Forest II",[8] in 2013 a broad process of consultation and methodological development was launched for the elaboration of these plans, which resulted in the publication of Guidelines for the Elaboration of Municipal Plans for Conservation and Recovery of the Atlantic Forest by the MMA during that same year.

In 2015, over 100 plans were in different stages of preparation and implementation. To analyze these experiences, MMA supported a diagnosis of the process of the elaboration of the plans and a critical assessment of their contents in terms of their efficacy as instruments for conserving and recovering the Atlantic Forest. This substantial collective effort led to the development of a new version of the guidelines. The Atlantic Forest project assumed coordination of this process, which defined some special themes to be considered in the assessment and reformulation of the guidelines, including the integration of vulnerability to climate change and ecosystem-based adaptation in the PMMAs, regional integration between the plans and the contribution of the PMMAs to the municipal master plans.

4. Target audience of the execution of the pilot project

Municipal managers and council members, civil society, decision makers at municipal, state and federal levels.

8 The Projet Protection of the Atlantic Forest II took place between 2010 and 2013 and was part of the Brazil-Germany Cooperation, coordinated by the MMA with technical support provided by GIS and financial support by KfW.

5. Narrative of the process

The Atlantic Forest project promoted, from the end of 2014 to mid-2017, a broad participatory process of assessing existing PMMAs and revising the guidelines for the elaboration of PMMAs, which had been published by the Ministry of Environment in 2013. One of the objectives of revising the guidelines was to consider climate change and ecosystem-based adaption in municipal planning.

The process had three stages: (i) diagnosis of the processes of developing PMMAs; (ii) assessment of the plans' content and suggestions for revising the guidelines based on public consultation; and (iii) preparation and publication of new guidelines.

Stage I – Diagnosis of the processes of developing the PMMAs:

From the end of 2014 until the end of 2015, the project carried out four regional diagnoses of PMMA preparation processes – one in the Northeast region, covering 12 PMMAs supported by the NGOs S.O.S. Mata Atlântica, Gamba and Conservation International; another in the South and Center-West regions, with 5 PMMAs supported by the NGO Miraserra; a third with 26 PMMAs in Rio de Janeiro state supported by the State Secretariat of Environment (SEA) and the Municipal Association of Rio de Janeiro State (AEMERJ); and with a group of 50 PMMAs in the South and Southeast regions, supported by S.O.S. Mata Atlântica and Ambiental Consulting. The diagnoses followed a format agreed upon by the MMA, GIZ and the consulting teams, were undertaken by the same institutions that supported the plans, were based on consultations with actors involved in each PMMA or regional set of PMMAs, and, to a lesser degree, included field visit to interview key actors.

The diagnoses examined the methodologies used in preparing the PMMAs and to what degree they followed the Ministry of Environment's guidelines. The diagnoses also narrated difficulties faced by the municipalities such as the lack of available information and technical capacity within municipal agencies to integrate climate change in the PMMAs.

Stage 2: Assessment of PMMAs and proposals to improve their guidelines

The consulting firm MS Consultoria was contracted, in early 2016, to carry out a critical assessment of contents and the progress of the diagnosed PMMAs in achieving the prior stage. The Atlantic Forest project organized, in March 2016, a workshop to present and validate the results of the critical assessment of the PMMAs and of the proposals to revise the guidelines. A total of 27 specialists participated, including representatives of the environmental agencies (OEMAs) of the four states in which Atlantic Forest project operates, of municipalities, NGOs, MMA and GIZ.

Important recommendations for revising the guidelines emerged during this stage, with proposals for how to increase the scale of the PMMAs through support and technical assistance for the municipalities. As for inserting climate change and EbA in the plans, difficulties experienced by the municipalities in addressing these themes were pointed out, and simplified strategies were suggested to demystify their complexity.

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Stage 3: Revising the guidelines

This third stage took place between September 2016 and July 2017 and was conducted by the project team with support from the firm Ambiental Consulting. The consultancy involved three phases: (i) preparation of a proposal for new guidelines, seeking to facilitate understanding of the technical and methodological content; (ii) virtual consultations with the main actors involved in preparing and implementing PMMAs in the country; and (iii) preparation and realization of two sequential events. The first event was a technical meeting of 20 trainers in EbA who were linked to the theme of PMMAs, representatives of state governments, of municipalities and academic institutions. The participants formulated recommendations on how to integrate climate change and EbA in the different stages of preparing and implementing PMMAs. The second event was a workshop with broad participation of institutions that work with PMMAs, during which the proposed content of the new guidelines for PMMAs was discussed in detail, including recommendations made during the prior day's technical meeting. This permitted the integration of EbA in the new guidelines for PMMAs, which were published by the Ministry of Environment in 2018.

Concurrent with this process supported by consultancies, the Atlantic Forest project supported activities to produce knowledge about the integration of climate change and EbA with PMMAs. Two coaching activities were carried out during the Training of Trainers course in Porto Seguro (2015), during which 12 trainers discussed, with support of an international consultant in EbA, how to insert environment and EbA into PMMAs, and 4 trainers discussed how to integrate climate change and EbA in the on-line course on PMMAs, offered by Ambiental Consulting on the platform www.pmma.etc.br. Afterwards, continuity in coaching was provided on promoting the insertion of climate and EbA in the on-line course, through a combined effort by Ambiental Consulting, CI, AEMERJ and the Atlantic Forest project, and on publishing a test version of the course. In addition, the project supported the NGOs Gamba and Conservation International in integrating climate change and EbA in nine PMMAs in the MAPES region. The results of these efforts also enriched the content of the new guidelines.

The three stages in the analysis and revision process, which ran from the end of 2014 until August 2017, led to updated PMMA guidelines that are simple and easily communicated, built on lessons learned from existing experiences and validated by the main institutions that work on developing PMMAs.

The new guidelines contain robust and detailed recommendations for integrating climate change and EbA with PMMAs through the stages of preparation, development, implementation and monitoring. Furthermore, a chapter was incorporated with climate change and EbA concepts, as well as annexes containing references on where to find additional information.

6. Lessons learned

Throughout this process of participatory development and collective learning, the following lessons were learned:

- ☑ Experiences such as that of the PMMA of Porto Seguro (BA) demonstrate the viability of inserting climate change impacts and EbA in PMMAs, but greater detailing requires external technical support for data analysis (as was provided by CI in this case).
- ☑ Considering the reality of most municipalities and the difficulty of assuring technical support for analysing climatic data, other ways of working on climate change and EbA were illustrated by two cases: Ilhabela, where the PMMA includes in it´s planning chapter the need for further technical studies on climatic risks and preparation of an adaptation plan containing EbA measures; and Conceição da Barra, where the PMMA onde advocated working on conservation and sustainable use measures, identified as EbA measures in the action plan.
- ☑ In order for municipalities can carry out planning while considering climate change and EbA, it is necessary to provide current climate change data at a municipal scale.
- ☑ The insertion of climate change and EbA in the on-line course revealed substantial interest of the participants in these themes. In other words, actors are aware of these themes, which enables them to be considered during planning.
- ☑ People generally feel that climate change is happening, but still do not perceive how they can adapt to it.

7. Recommendations

- ☑ The insertion of climate change and EbA in the guidelines, with the involvement of several relevant actors, does not assure, in and of itself, the insertion of these themes in the PMMAs to be elaborated. In addition to the technical recommendations and information provided by the new guidelines, the following inputs are required: training events and technical and didatic materials on the themes, available data on climate change and its impacts on the Atlantic Forest at a municipal or regional scale, and ongoing studies that demonstrate the benefits of EbA measures.
- ☑ It is advisable that municipalities with plans already developed or under implementation consider climate change and identify, among its action plan, those actions that can be classified as EbA. This enables municipalities to perceive the need for adaptation and its potential for implementation, in addition to increasing the relevance of these themes and generating good practices that can be replicated by other municipalities.

8. Follow-up

The project's Financial Cooperation will support the development of several PMMAs in Rio de Janeiro and Parana states, using the new guidelines as a technical basis, which will enable the practical application of its content.

We expect that the distance course on EbA, prepared by the Atlantic Forest project, will train participants to insert EbA in PMMAs.

Considering that just over 100 PMMAs have been prepared or are in preparation, within a universe of approximately 3,400 municipalities in the Atlantic Forest, it is important to achieve greater scale by promoting the development of PMMAs and, consequently, the integration of climate change and EbA in the PMMAs. Concerted action between institutions with potential to strengthen this idea, such as state governments, NGOs and municipal associations, is also important.

The possibility of obtaining resources for carrying out actions related to climate change and EbA is critical for integrating concepts such as integrating EbA with payments for environmental services in the PMMAs.

Figure 8. Lauching of the PMMA, Itagimirim, Bahia.

Figure 9. Regional PMMA Workshop at Porto Seguro/BA: participants prepare proposals in the regional map.

CASE STUDY VI

Regional integration of ten Municipal Plans for Conservation and Recovery of the Atlantic Forest (PMMAs) in the South and Extreme South of Bahia

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Renato Cunha and team of the Environmental Group of Bahia (Gamba)

3. Context

The Municipal Plans for Conservation and Recovery of the Atlantic Forest (PMMAs) seek to present diagnoses and propose actions for conservation, recovery, and sustainable use of the Atlantic Forest in a municipal context (see Case Study V).

One of the innovations introduced by the municipalities and developers of PMMAs is the recommendation to develop, whenever possible in a joint and integrated way, PMMAs of adjacent municipalities inserted in the same regional context.

In a pioneering initiative, in 2013, Rio de Janeiro State Secretariat of Environment (SEA-RJ) proposed the joint development of 15 PMMAs in the northeast region of the state. SEA-RJ supported efforts to map Atlantic Forest remnants, to gather other environmental information, and, subsequently, to prepare the PMMAs, which mobilized resources for studies to establish conservation units and to launch recovery programs in the region. The advantages of developing PMMAs jointly are evident, and related to the optimization of efforts. The environmental features of a territory, such as watersheds, forestlands that should be conserved, and degraded areas to be restored, usually extend beyond a single municipality and cover two or more municipalities.

SEA-RJ continues to support the development of joint PMMAs in the watersheds of the Sao Joao Lakes, and the Paraíba and Guandú rivers. The Atlantic Forest project adopted this approach in the municipalities located in Rio de Janeiro State Central Mosaics and Lagamar regions.

4. Target audience for execution of the pilot project

Mayor offices and environmental councils of the ten municipalities covered by this initiative, institutions that operate in the involved territories, and partners that have worked on developing PMMAs.

5. Narrative of the process

In the South and Extreme South of Bahia, PMMAs of ten municipalities were developed, with the support of Conservation International (CI), S.O.S. Mata Atlântica, and the Environmentalist Group of Bahia (Gamba). Yet, those plans were not constructed in a joint and integrated way from the outset, but, by the end, they became integrated based on a regionalized geospatial perspective.

A pilot experience of developing a PMMA for Porto Seguro was published in 2013 and addressed ecosystem-based adaptation measures for climate change, with support from CI and the International Climate Initiative (IKI). Based on this pilot experience, an additional nine PMMAs were developed in the South and Extreme South of Bahia in municipalities (Santa Cruz Cabralia, Belmonte, Canavieiras, Eunapolis, Itabela, Guaratinga, Itagimirim, Itapebi and Mascote) where the cellulose company Veracel operated. This was an initative spearheaded by S.O.S. Mata Atlântica, under the technical coordination of the Environmentalist Group of Bahia (Gamba), in partnership with ANAMMA, RMA, CNRBMA, WWF, CI, Veracel, and the Atlantic Forest project.

Through the partnership with CI and support from the Atlantic Forest project, those PMMAs counted on information about vulnerability to climate change, such as projected changes in rainfall, temperature, and the dynamics of coastal erosion. In prioritizing their actions, the plans identified EbA measures. In addition, WWF carried out a landscape analysis covering the ten municipalities (including Porto Seguro), producing maps of priority areas for conservation and recovery of Atlantic Forest for each municipality, and a map of the region covering the ten contiguous municipalities.

Preparation of the 9 PMMAs began in 2014, each one following its on pace, reflecting the dynamics and political moment of each municipality, not permitting an integrated preparation from the start. As a result, the first PMMAs, such as that of Eunápolis, were finished in 2015 while the last ones, such as those of Itapebi and Belmonte, were ready only in 2017.

Starting in 2015, in a joint action involving S.O.S. Mata Atlântica, CI, Gamba, WWF, and the Atlantic Forest project, a methodology for regional integration of those ten PMMAs started to be prepared. To construct this integration collectively, the Atlantic Forest project organized face-to-face and virtual meetings with the partners and consultants, during which the concepts and methodology for integration were defined, and information gaps and inputs necessary for discussing regional integration were identified. Also, there was the identification of key local and regional actors who should be involved in the process and in the required partnerships to assure the effective integration of the ten PMMAs.

In July 2017, the Atlantic Forest project hired a specialized consultancy in landscape management and GIS, with broad knowledge of the region, to provide technical inputs and concrete proposals involving opportunities for inter-municipal integration of the PMMAs involving: (i) conservation, (ii) recovery, and (iii) sustainable use of natural resources. The hired company, Econamfi of Ilhéus - BA, used the action plans of each municipality, prepared in a participatory way, during local workshops in which priority actions were identified considering the reality of each municipality, and based on existing data on the region, for example “Independent Monitoring of the Vegetational Cover in the Extreme South of Bahia,” tendered by the Forest Forum with resources from the private company Veracel, public data

on rural properties in the State Registry of Forests in Rural Properties (CEFIR/CAR) and the landscape analysis carried out by WWF Brazil for the ten municipalities. In addition, the project commissioned the Brazilian Foundation for Sustainable Development (FBDS) to generate spatial data on the environmental debt of all the Areas of Permanent Protection (APPs) covering the region's water bodies. CI made available data generated on the region's vulnerability to climate change.

Based on this data set and a detailed analysis of all the 605 actions planned in the ten PMMAs, Econamfi provided technical inputs during a Regional Integration Workshop for discussion of opportunities and needs for the integration of the ten PMMAs, formulating 14 proposals of areas where actions planned in the individual PMMA could be implemented involving conservation, recovery, and sustainable use, as part of an integrated approach that extrapolates municipal boundaries.

At the same time, the Atlantic Forest project supported Gamba in completing the last PMMAs (Itapebi, Mascote, and Belmonte), and in carrying out two campaigns aimed at mobilizing local and regional actors to participate in a regional workshop on integrating the ten PMMAs.

The Workshop for Regional Integration of the ten PMMAs took place during September 4th to 6th, 2017, in Porto Seguro, in the state of Bahia, also with support from the Atlantic Forest project. Approximately 70 people participated representing governmental agencies and civil society of the ten municipalities, as well as ICMBio and INEMA-BA, Costa do Descobrimento Intermunicipal Consortium and Intermunicipal Consortium of the Atlantic Coast, and PMMAs supporters, such as CI, S.O.S. Mata Atlântica, ANAMMA, MMA, GIZ, among others.

During the workshop, the participants recalled the challenges and strengths of the ten PMMAs participatory development , while CI presented the importance of considering the region's vulnerability to climate change and the EbA measures in the action plans. Afterwards, Econamfi presented the technical inputs generated by the analysis of regional integration of the ten PMMAs, pinpointing 14 proposed areas where actions should be implemented by two or more neighbouring municipalities in an integrated way.

On the workshop's second day, the participants were divided in three groups, representing three sub-regions based on the region's main rivers. They debated and mapped the proposals for integration prepared by Econamfi involving the major themes of conservation, recovery, and sustainable use of natural resources. On the occasion, the participants changed the polygons proposed in function of the local reality and also added new actions and polygons not indicated by the consultancy. The adjusted proposals were presented and validated during a plenary session. In many cases, relatively large polygons were delimited, often along rivers that cut through the region, and EbA actions or measures were indicated for each local that should provide a basis for the regional integration of the PMMAs. The coordinators and co-responsible persons were defined for each integration action proposed by the working groups.

On the third day, a general panorama of the planned actions was presented, and questions involving the organization and governance of the integration actions of the PMMAs proposed during the workshop were discussed. Regarding organization, the participants opted to define a coordination group that would represent government and civil society. The group

would be formed by two members from each municipality, to maintain and monitor the integration of the PMMAs and to articulate the integration agenda with the relevant Inter-municipal Consortia (CONDESC and CIMA). The group also discussed the communication between the participants and the fund-raising for implementing EbA measures, prioritizing regional integration to build a network among the regional actors.

The next steps following the workshop are to distribute the workshop report, to deliver the proposals to top decision makers in municipal governments and to the environmental councils, and to organize a face-to-face meeting with those actors.

6. Results

The Workshop for Regional Integration of the 10 PMMAs resulted in concrete proposals of joint actions among the municipalities in the themes of conservation, recovery, and sustainable use of natural resources, including greater awareness raising among the participants about the importance of ecosystems for required adaptation to climate change.

It was established a focal group to catalyse the issue of regional integration among the ten municipalities, demonstrating greater commitment by municipal actors with conservation and recovery at the regional level.

7. Lessons learned

The processes of regional development of a set of PMMAs are not always carried out simultaneously. The municipalities follow their own agendas at their own pace, and progress is often impeded by a precariously structured Secretariat of Environment, a low degree of mobilization by civil society and high turnover of staff responsible for the environmental agenda. In the case of those ten municipalities, there was high turnover of the technical staff involved, and the work wound up demanding more time than initially envisioned.

8. Recommendations

The process of integration between PMMAs in the same regional context should be pursued from the initial planning of the plans' development, which should enable synergy without great additional effort.

This joint development should lead to increased interaction and exchange of relevant information between the municipalities.

Considering the lessons learned, the regional integration processes of the PMMAs should be flexible to permit reaction to unforeseen events, delays, and withdrawals by municipalities.

9. Follow-up

It is important to verify in which manners mobilization might be carried out to promote regional integration of the PMMAs and its contribution to assure the implementation of the integration agenda of the ten PMMAs in the South and Extreme South of Bahia.

For this, it will be important to seek a mechanism for monitoring the implementation of the PMMAs and their specific actions of integration among the municipalities to evaluate their impacts.

In partnership with the state environmental agencies (OEMAs) and local partners, the Atlantic Forest project will support the development of two sets of PMMAs, financed by the Financial Cooperation, in which regional integration should be a premise for hiring consultants to assist in preparing those PMMAs and from which additional lessons can be derived for future initiatives involving regional integration of those plans.

The main recommendations for regional integration of PMMAs were presented in the new version of the Methodological Guidelines for Developing and Implementing PMMAs, prepared with support from the Atlantic Forest project, as well as in the online course on EbA, available on the platform pmma.etc.br. Consequently, people and institutions interested in the regional integration of PMMAs might consult the guidelines and receive online training.

Figure 10. Participants at the workshop carried out in Porto Seguro, Bahia, during September 4-6, 2017. Source: GAMBA Archives.

Figure 11. Didactic techniques used during the workshop carred out in Porto Seguro, Bahia. Source: GAMBA Archives.

CASE STUDY VII

Capacity building in ecological restoration in collaboration with the Pact for the Restoration of the Atlantic Forest (Pacto)

1. Coordination Unit Team of the Biodiversity and Climate Change in the Atlantic Forest project involved in the case

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2. Project partners involved in the case

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Ludmila Pugliese – Pact for the Restoration of the Atlantic Forest (Pacto)

3. Context

Pact for the Restoration of the Atlantic Forest (Pacto) is an initiative launched in 2009 for the purpose of linking and integrating different actors (governments, NGOs, scientific community, companies, and landowners) involved in the restoration of Atlantic Forest, inducing environmental, social, and economic benefits in large-scale actions. Pacto has as target to catalyse the restoration of 15 million hectares of Atlantic Forest by 2050.

Technical advice to this initiative provided by the project Biodiversity and Climate Change in the Atlantic Forest involved: (i) execution of measures related to methodological development; (ii) implementation of forest restoration; and (iii) recovery of degraded areas. Furthermore, Pacto functions as a platform for disseminating and expanding the scale of experiences and initiatives developed within the scope of this project.

Pacto has developed and provided a theoretical framework that describes in detail how to plan and implement a restoration project, as well as a protocol for monitoring that project, a critical component for the success of restoration projects. It also maintains a databank on restoration projects, which is used by the Atlantic Forest project to verify the progress of restoration monitored through Pasto's monitoring protocol.

In October 2015, Pacto initiated a new governance model, based on a campaign among over 220 signatories to identify the ones interested in becoming Regional Pacto Units (UR), encouraging the engagement of new members at state level. A total of 18 URs were selected representing 12 of the 17 states with Atlantic Forest. Among their functions, these regional units exercise the role of Pacto's Executive Secretary, replicating the national governance model at a regional scale, linking, training, and integrating the different actors involved in the productive chain of ecological restoration in the Atlantic Forest.

4. Target audience of the pilot project's execution

Pacto's Regional Units, technical staff, and managers at state and municipal governmental agencies, non-governmental organizations, and companies.

5. Narrative of the process

To disseminate knowledge about Pacto's tools among the URs and other relevant actors, the Atlantic Forest project supported six training courses between 2015 and 2017, delivered by the Northeast Center for Environmental Research (CEPAN), which hosted Pacto's national coordination. Those courses covered Pacto's monitoring protocol, the new version of the databank, Pacto's new governance structure, and the issues of gender equity and restoration (Table 1).

In 2015, CEPAN organized two 32-hour courses on applying "The Monitoring Protocol for Forest Restoration Programs and Projects," directed to a set of actors from different sectors (technical staff and managers from state and municipal government agencies, non-governmental organizations, and companies). The first course took place at the Rural Federal University of Pernambuco (UFRPE) in Recife, aiming to address the Atlantic Forest's Northeast region, and the second course took place at S.O.S. Mata Atlantica's Centre for Forestry Experimentation in the municipality of Itu, state of Sao Paulo, aiming to address the Mosaic of Conservation Units in the Central Atlantic Forest of Rio de Janeiro and the Lagamar Mosaic of Conservation Units.

Those courses consisted of theoretical activities during two days, followed by a day dedicated to practical field activities and a final day for analysing data collected in the field. The field work took place in areas under restoration using different techniques, and with varying ages of seedlings. The participants applied Pacto's monitoring protocol by setting up in situ monitoring plots within the areas under restoration.

In 2016, CEPAN delivered two 24-hour courses seeking to enable Pacto's URs to operate as multipliers in their respective regions of action. The first course took place at S.O.S. Mata Atlântica's Centre for Forestry Experimentation, and the second course at the Guapiacu Ecological Reserve (REGUA) in the state of Rio de Janeiro. The course covered key concepts of restoration ecology, Pacto's models of functionality and governance, and its main tools (theoretical references, monitoring protocol for restoration projects, and database). The participants also learned about Pacto's geospatial mapping strategy,[9] as well as basic notions of remote sensing, how to use geoprocessing software to analyse field data, and how to introduce those data into Pacto's database.

Pacto delivered a course on governance at the landscape level in Porto Seguro, in the state of Bahia, using as case studies restoration initiatives in different contexts (agroforestry systems, agroecological settlement projects, restoration using different techniques) to illustrate governance principles that will be useful for Pacto's URs.

A 3 days course on the theme of gender equity in Pacto's projects and strategies took place in Antonina, in the state of Parana, during 2017, with support from the Atlantic Forest project, CEPAN, MMA, and IUCN. The objective was to train leaders and strategic actors about the chain of restoration with gender scope, so that those concepts could be disseminated among Pacto's members and partners, in all spheres of action.

9 Which designates each entity or phenomenon with a location on Earth.

6. Results

The two course on Pacto's Monitoring Protocol (2015) had a total of 47 participants from the states of Pernambuco, Paraiba, Sergipe, Bahia, Sao Paulo, Rio de Janeiro, and Santa Catarina, including technical staff from Environmental secretariats, water management agencies and other governmental agencies, in addition to NGO and company representatives.

Among diverse applications of the course mentioned, the participants pointed out the monitoring of areas under restoration in various projects under implementation or proposed, including agroforestry systems with income generation for traditional communities, projects to recover riparian forests and the margins of reservoirs used to supply cities, applications involving environmental licensing and analysis, approval and monitoring of PRADAs.

In the two courses to strengthen Pacto's 18 URs (2016), the UR representatives achieved uniform comprehension and proficiency of concepts involving restoration, Pacto's structure and functioning, and the available tools (theoretical references, monitoring protocol for restoration projects, and database). The courses also enabled both, facilitators and participants, to express their expectations regarding the role of the URs in Pacto's future actions. As a result of those courses, the URs are acting effectively in developing local agendas, and disseminating knowledge about Pacto, the use of its tools and its theoretical approach to different regions of the Atlantic Forest. Based on the governance model developed during Porto Seguro Workshop, a new pattern of action has emerged within the URs that allows a shared vision of the movement, with regional peculiarities.

Among the results of the course on gender equity in restoration (2017), a highlight has been the exchange of experiences related to initiatives involving gender and restoration led by some URs, GIZ, and other institutions involved with gender, including the activities of Pacto's Working Group on Diversity, which edits the blog Women of ImPACT (Mulheres de ImPACTO). The participants discussed the Reforestation project in Espirito Santo State (Reflorestar), which counts with female workers, who are direct beneficiaries, and activities of collecting and benefiting seeds for use in restoration using the "muvuca"[10] model, led and carried out by women supported by the Instituto Socioambiental (ISA).

Participants also selected and validated a list of necessities and opportunities to be addressed by the Diversity Working Group for integrating gender equity in Pacto's governance structure and tools. Other themes and actions were identified for development by the Diversity Working Group, including the preparation of a letter stating the Group's position regarding restoration, diversity, and gender,

10 Restoration technique based on direct seeding using a mixture of seeds from different species, applied manually or mechanically.

guaranteeing great participation of women in Pacto's other working groups and its Board, and increasing the participation of men in the Diversity Working Group.

Over a two-year period, those courses trained a total of 112 people, including technical staff from municipal and state governmental agencies, and institutions that serve as Pacto's URs, with 160 hours of courses in five Atlantic Forest states. With those numbers, the objectives of capacity building were achieved, providing a foundation that will endure after the project concludes.

Table 1. Pacto training courses carried out with support from the Atlantic Forest project

Date	Locale	Theme(s)	Target	Participants
Nov 10-13, 2015	Rural Federal University of Pernambuco (UFRPE), Recife - PE	Pacto's monitoring Protocol	Governments, NGOs, and companies	22
Nov 30 - Dec 3, 2015	Center of Forestry Experimentation (Itu - SP), S.O.S. Mata Atlantica	Brasilia-DF	Methodological	28
May 23-25, 2016	Center of Forestry Experimentation (Itu - SP), S.O.S. Mata Atlantica	Governments, NGOs, and companies	25	27
Jul 27-29, 2016	Guapiaçu Ecological Reserve - RJ	Pacto's concepts of recovery, functionality, and tools	Pacto Regional Units	18
Oct 24-30, 2016	Porto Seguro - BA	Landscape- scale governance	Pacto Regional Units	18
Jun 20-22, 2017	Antonina - PR	Gender equity in recovery	Pacto Regional Units and Diversity Working Group and NGOs	18

7. Lessons learned

The leadership and initiative of the coordination and of Pacto´s Executive Secretariat were essential for developing all of this capacity building, including the mobilization and training of the involved actors. The development of on-line modules for distance learning (EaD) could have increased the number of people instructed.

8. Recommendations

It is necessary that the efforts of the Pacto's Diversity Working Group will be continued, mainly in relation to gender equity, in projects and actions involving ecological restoration and the Pacto's governance structure, due to the pioneering nature of this theme.

Itt is also important for the URs and for Pacto to continue and expand the capacity building efforts that have begun during the Atlantic Forest project, in order to reach a greater number of relevant actors, thereby contributing to increasing the scale of Pacto's restoration activities.

9. Follow-up

It is anticipated that all of training efforts have a multiplier effect in the regions, contributing to achieving Pacto's restoration target. In particular, the URs are now able to replicate the courses delivered in their regions.

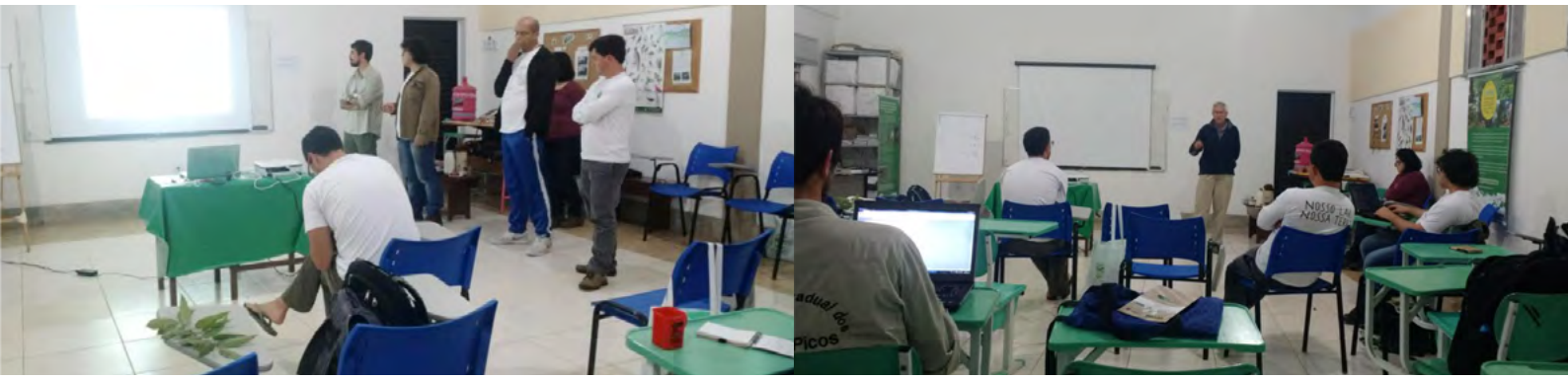

Figure 12. Training course on using tools developed by Pact for Restoration of the Atlantic Forest for regional units, July 2016, Rio de Janeiro. Source: Pacto's Archives.

Figure 13. Presentation of the new interface for Pacto's databank and instructions on how to use it. Source: Pact Archives.

CASE STUDY VIII

Contribution to the National Policy and Plan for Native Vegetation Recovery

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Rubens Benini – TNC
Bernardo Strassburg and Jerônimo Sansevero – IIS
Ricardo Rodrigues e Pedro Brancalion – USP/Esalq

3. Context

After the review of the Forest Code (Law n. 4,771, of September 15, 1965), Brazilian Government approved the Law for Native Vegetation Protection (Law no. 12,651 of May 25, 2012). The new law reaffirmed the requirement for landowners to conserve, recover or compensate for alterations of native vegetation located in areas of permanent protection (APPs) and legal reserves (RLs). Today in Brazil, summing up the areas of APPs and RLs that need to be recovered or compensated, there is an estimated deficit of 21 million hectares, with 6 million hectares in the Atlantic Forest (SAE, 2013[11]; Soares-Filho, Rajão & Macedo, 2014[12]).

In view of the great extent and diversity of ecosystems and landscapes to be recovered, and the effort required to do so, it is essential to establish financing, planning, coordination, and support mechanisms to make these actions viable.

To support this process, in the latter part of 2013, Brazilian Ministry of the Environment signed a memorandum of understanding with the World Resources Institute (WRI) to develop a strategy for large-scale recovery of native vegetation in Brazil, an essential step for assuring commitment to a shared workplan and a minimal level of formalization to begin the process of mobilizing the other partners.

In that context, workshops were organized in Sao Paulo – SP, Rio de Janeiro – RJ and Brasilia – DF during September 24-30 2013, to promote discussions and share information about the best practices for restoring degraded or altered areas in Brazil among representatives of NGOs, the private sector, governments, and institutions for research and extension that are active in

11 SAE – Secretaria de Assuntos Estratégicos (SAE). 2013. Impacto da revisão do código florestal: como viabilizar o grande desafio adiante? Brasília: SAE. Available at: <http://www.sae.gov.br/site/wp-content/uploads/Artigo-codigo-florestal.pdf

12 SOARES-FILHO, B.; RAJÃO, R.; MACEDO, M. Cracking Brazil's Forest Code. Science, v. 344, n. 6182, p. 363-364, 2014.

this field. Those workshops included over 45 organizations and a total of 70 participants, who discussed opportunities for and challenges to developing a national strategy for the recovery of native vegetation.

The objective of these consultations, based on analysis of examples, was to identify existing barriers to recovering native vegetation in the different biomes, and also to point out success factors that enable these actions in Brazil and other places worldwide. The suggestions and recommendations generated during these workshops, as well as useful information gathered from the meetings, discussions and research, provided a foundation for preparing a preliminary version of Planaveg.

4. Target audience of the pilot project's execution

Federal, state, and municipal governments, non-governmental organizations and research institutions.

5. Narrative of the process

The leadership of the former Department of Biodiversity Conservation (DCBio) in preparing the preliminary version of Planaveg, as well as of the coordination of the Atlantic Forest project, provided a promising opportunity for involving the project in this process. The preparation of a national plan for recovery of native vegetation meshed perfectly with the project objectives of mitigation of and adaptation to climate change based on ecosystems.

At the beginning of the project's involvement in this process, an informal working group (GT) was established to develop jointly a preliminary version of Planaveg through an integration between science/research, practice, and policy. The GT included representatives from the following institutions: WRI, International Union for the Conservation of Nature (IUCN), International Institute for Sustainability (IIS), The Nature Conservancy (TNC), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, and Luiz de Queiroz Agriculture College of the University of Sao Paulo (Esalq/USP).

The preliminary version of Planaveg was developed with a view of expanding and strengthening public policies, financial incentives, markets, technologies for recovery, good agricultural practices, and other measures necessary for the recovery of native vegetation, mainly in APPs and RLs, but also in degraded areas with low agricultural productivity. The proposal was structured around eight strategic initiatives that address: i) raising awareness of society about the benefits of recovery; ii) increasing the quality and quantity of native seeds and seedling; iii) developing markets for products and services generated from areas under recovery; iv) aligning and integrating public policies; v) developing financial mechanisms to support recovery initiatives; vi) expanding technical assistance and rural extension; vii) spatial planning and monitoring; and viii) research, development and innovation.

In May 2014, the Atlantic Forest project supported a technical seminar in Sao Paulo to discuss the theme of spatial planning and monitoring of native vegetation recovery, identified as a priority by the GT in developing the strategy. A total of 26 people participated in the seminar, including representatives from institutions such as Embrapa, INPE, SFB, UNESP, and USP. The document produced during this seminar served as basis for the preparation of strategy 7 in the preliminary version of Planaveg.

In September 2014, the Atlantic Forest project supported another technical seminar in Sao Paulo to discuss the supply of and demand for native seeds and seedlings for recovery, also identified as a priority theme. The seminar included 34 participants from institutions such as the Ministry of Agriculture, Livestock and Food Supply (MAPA), Embrapa, Incra, UFSCAR, USP, SMA-SP, IPEF, Pacto, and ISA. The document produced during the seminar provided the basis for the preparation of strategy 2 in the preliminary version of Planaveg.

The preliminary version of Planaveg was presented in over 20 national and international events related to the theme, which generated further suggestions and refinements. The consolidated preliminary version then underwent to a public consultation process, carried out by disseminating the proposal on Brazilian Ministry of the Environment's website, where contributions were made by institutional email between December 2014 and August 2015. This process generated 167 emails containing a diverse array of suggestions and contributions, mostly from ordinary citizens but also from representatives of governmental agencies and civil society organizations.

6. Results

Following the development of Planaveg's proposal and subsequent political discussion, efforts focused on stimulating reflection and political decision about the best form of implementation. In this way, rather than arising from an a priori decision, the plan was formulated to establish a broader foundation to consolidate a large-scale recovery initiative at the national level, to promote a detailed debate, and to support the decision making process. This process of political articulation culminated with the launching of Decree no. 8,972 of January 23rd, 2017, which instituted the National Policy for the Recovery of Native Vegetation – Proveg.

In addition to instituting the objectives and guidelines of Proveg, the policy defined its two main instruments: the National Commission for Native Vegetation Recovery (Conaveg) and the actual National Plan for Native Vegetation Recovery (Planaveg). Conaveg is responsible for the coordination, implementation, monitoring, and evaluation of the policy and the plan. This commission is composed of representatives of six ministries, state and municipal governments, and civil society organizations.

7. Lessons learned

Due to the articulation between research institutions, civil society, and government, provided by the interinstitutional work group, it was possible to develop a preliminary plan solidly based on consolidated scientific methods, such as the assessment of success factors required for recovery (Hanson et al., 2015[13]), and on state-of-art technical and scientific data, including models of the environmental debt of APPs and RLs (SAE, 2013; Soares-Filho, Rajão e Macedo, 2014).

Due to the establishment of the work group to develop the preliminary version of Planaveg, it was possible to capture the beneficiaries' demands in a clear and objective way, and, therefore, to develop more suitable actions in order to achieve the plan's objectives. The decision to establish a small working group facilitated discussions and decision making. A larger working group, in addition to increasing the complexity of the process due to the heterogeneity of actors interested in the theme, would have increased the necessary costs of participation.

The selected method for social participation, an online public consultation, brought good suggestions that were incorporated to the plan. However, due to lack of financial resources, it was not possible to carry out well-organized public hearings and sectoral debates, which could have increased social participation and raised other structural contributions to the proposal.

A constant challenge for this type of process is to maintain a proper balance between representativeness and efficiency in the preparation of technical reasons for decisions and in the political and institutional articulation involving public policies. In terms of representativeness, one of the lessons learned consists in the need of involving, from the beginning of the process, other actors from the public and private sectors to assure greater alignment and participation.

There were times when the informality of the Work Group's structure led to difficulties in the continuity of some actions due to the lack of formally signed commitments and the provision of financial resources to assure more effective participation of the Work Group's members. Participatory experiences may lead to risk of dilution of responsibilities due to the absence of formal and institutional instances.

From a technical perspective, a deeper analysis of the economic aspects of actions defined in the preliminary version of Planaveg, including mobilization of financial resources, would have contributed to convincing and mobilizing stakeholders from private sector and economic areas of governments.

13 HANSON, C. et. al. The restoration diagnostic: a method for developing forest landscape restoration strategies by rapidlya assessing the status of key success factors. WRI, 2015. Disponível em: <https://www.wri.org/sites/default/files/WRI_Restoration_Diagnostic_0.pdf>. Acesso em: 13 jan. 2017.

8. Recommendations

To involve all important groups and sectors in the implementation of Planaveg, the establishment of thematic advisory chambers was proposed for Conaveg. As a result, more specific discussions will take place within the advisory chambers involving diverse institutions from civil society, private sector, academia, and state and municipal governments, thereby providing inputs to Conaveg's activities and improvements in the plan's anticipated actions.

Also, participation of state entities is essential, since they are the main agents in the implementation of recovery actions proposed in Law no. 12,651/2012, through the Environmental Compliance Programs (PRAs). The involvement of state governments will enable greater detailing of the proposed strategic initiatives in more concrete activities. Local stakeholders, whether from government or civil society, have a strategic function in renovating the formulation of local public policies.

9. Follow-up

After the launching of Decree no. 8,972/2017, the next challenge will be to expand the involvement of all stakeholders, including private sector, academia, and civil society organizations, in the implementation and monitoring of Planaveg. This involvement might take place in the thematic chambers foreseen by the decree to support the work of Conaveg.

The purpose is that all the ministries and entities represented in Conaveg identify, establish, and coordinate programs, projects, and actions that are able to contribute to the objectives of the policy and that are committed to their implementation within the defined timeframe. Interministerial Ordinance no. 230 of November 14th, 2017, established the first version of Planaveg, published on the MMA's website.

Planaveg cannot be implemented in isolation of other existing public polices. It is, in fact, a necessary complement to make viable different sectoral and trans-sectoral policies, such as hunger and misery fight, climate change, environmental services, biodiversity, sustainable agriculture, water resources and energy, among others.

CASE STUDY IX

Orbital monitoring of native vegetation in the Atlantic Forest

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Leonardo Queiroz Correia – DECO/SBio/MMA
Christiane Holvorcem – GIZ

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Departments of the Ministry of the Environment: DECO/SBio, DFCD/SMCF

3. Context

According to official data, nowadays the Atlantic Forest presents 29% of its original forest cover (MMA, 2015), a number that reveals this biome to be one of the world's biodiversity hotspots (Mittermeier et al., 1999, Myers et al., 2000), endangering the subsistence and maintenance of its ecosystems and, consequently, its associated ecosystem services.

Initiatives to recover the Atlantic Forest began at the end of the 19th Century (De Almeida, 2016), although, recently, a growing number of large-scale initiatives and programs to recover the Atlantic Forest have been launched, led not only by the federal and state governments, but also by companies, NGOs, and civil society organizations. All of those efforts contribute to the commitments made by Brazil to the United Nations Framework Convention on Climate Change, or UNFCCC).

Given the legal obligation to carry out the actions provided by Federal Law no. 12,651/2012, which deals with the Protection of Native Vegetation, as well as the internationally agreed goals, the Federal Government launched Decree no. 8,972/2017, which instituted the National Policy for Native Vegetation Recovery(PROVEG), which aims to restore 12 million hectares by 2030, and which brings as main guidelines, among others, combatting climate change, establishing incentives for biodiversity conservation and recovery, for ecosystem services, for recovery of areas of permanent preservation, legal forest reserves and areas of restricted use, and for stimulus of the economic and social benefits for native vegetation recovery.

In this context, and as part of the Environmental Monitoring Program for Brazilian Biomes (PMABB) – which was instituted by MMA Ordinance no. 365, of November 27th, 2015, which aims to carry out coordinated actions involving satellite monitoring of land cover and use, to produce and make available official information that is harmonized, systematized, and up-to-date – discussions began in the Technical Coordinating Committee of the CPMABB. The objective was to establish a monitoring system of vegetation recovery in those biomes, which would permit monitoring of areas under recovery, accounting of areas under restoration to attain the established goal for recovering areas in environmental debt, as well as gathering data that enable quantification of greenhouse gas emissions. Another desirable result is that such

data be able to assist in the quantified estimate of how areas under recovery function as carbon sinks, which creates perspectives for international payments for carbon credits through REDD (reducing emissions from deforestation and forest degradation).

Under the scope of the component supporting public policies, the "Biodiversity and Climate Change in the Atlantic Forest" project supported a study that carried a survey about the state of art of existing methods (including international iniviatives) for orbital monitoring of native vegetation recovery, by conducting comparative analysis of the different identified methods to point out main obstacles and opportunities, and to formulate general recommendations for building an orbital system for monitoring the native vegetation recovery not only for the Atlantic Forest, but also for Cerrado and for Amazonia, biomes defined by the Ordinance as priorities for monitoring vegetation recovery.

The study surveyed the state of the art of monitoring vegetation cover, examining the methodologies used by the latest vegetation monitoring programs, such as semiautomatic systems that use extensive catalogues of imagery (especially those from the Landsat series), processing of image temporal series, automatic classification and detection of changes, and mapping of large areas. The study indicated a possible methodology to be developed that is able to deliver a monitoring system for monitoring the vegetation recovery at biome level in Brazil.

4. Target audience of the pilot project's execution

Restoration specialists and researchers involved in the theme.

5. Narrative of the process

According to Townshend et al. (2012), until a few years ago, an analysis of forest cover at a global or even continental scale, using Landsat imagery, would be a complicated task due to a series of factors, such as: absence of a set of multi-temporal, well-registered data set, viations in the sensors, need of internal human involvement in post processing, variation in the spectral response of forests, need to develop a data set for analysing precision, and a large demand generated in terms of the computational power required for data processing and storage.

According to those involved in this field, confronting those challenges requires an automatic or semiautomatic methodology for image processing, and a computational infrastructure capable of supporting a large volume of data. The infrastructure issue involves not only technology for selecting and storing the data set, but also processing power. For image processing, surface reflectance products are required to perform atmospheric correction of the images; reduction of topographic effects by orthrectification, as well as corrections of variations in the geometry of solar illumination; need to develop a training data set for global analysis of the imagery (classification), as well as for error analysis and robust procedures for global classification of the imagery.

In general, the automation process occurs in the pre-processing step, data transformation, and post-processing, while classification is the only step that is, in practice, totally automatic. The pre-processing step includes the conversion of original satellite imagery in reflectance values, which involves correcting the effects of atmospheric conditions as well as correcting for elevation and solar angles.

The step of transforming the data varies from method to method and is linked to the classification method, since it is the entry data and can vary between: calculation of spectral indices (e.g., EVI, NDVI or NDFI), extraction of image fractions by spectral mixture analysis (e.g., SMA, MLME or AutoMCU), and calculation of spectral-temporal metrics. The next step, classification, generally requires a degree of interaction with the user. For classification processes, analysts interpret the image and generate training samples. For methods based on decision trees (most used by programs based on analysis of large temporal series of imagery), the user interprets transitions between cover classes observed in fractions of imagery or indices that instead, calibrate the decision rules of the decision tree method.

As in classification, the method for detecting change are based on a set of thresholds that can be applied: (i) reflectance values, (ii) vegetation index values, (iii) fractions of images, or (iv) spectral-temporal metrics. Finally, the post-processing step includes the recoding of output values for compatibility with earlier map products in case of updates, and also the application of filters to eliminate spurious pixels and to stagger final data to a minimally defined mapping unit.

In terms of computational infrastructure, the main possible solutions are geospatial tools such as those currently under development by large multinational IT companies, which uses web-based platform that combines satellite imagery catalogues, including imagery with low, medium, high, and very high spatial resolution together with great capacity for processing and analysis of planet-scale data.

Despite the differences between them, the already existing methodologies were developed specifically to extract information about vegetational cover dynamics, including both losses (through deforestation and degradation) and gains of vegetation (recovery/regeneration), independent of the biome in which they occur.

Despite heading in the direction of the objectives of a future monitoring program of vegetation recovery, it still has limitations that need to be solved. When applied to large homogeneous masses of vegetation, such as the Amazon Forest, the results are coherent and exciting, yet for areas where the vegetation is generally less dense, of lower stature, and highly influenced by soil responses - such as the Cerrado -, or highly fragmented - such as the Atlantic Forest -, the results still present significant errors.

To implement a monitoring program of vegetation recovery, it would be necessary to resolve certain issues that still limit its utilization. Among those issues, the following stands out: a) computational infrastructure suitable for storing, recovering, processing, and presenting data; b) differences among biomes; c) lack of data due to cloud cover; d) development of decision rules for classification algorithms by decision tree; and e) development of methods to verify generated products.

For an official monitoring program of the Brazilian government, it may not be possible to use the infrastructure of foreign private companies due to issues involving confidentiality of strategic data. In this case, there are two alternatives: a) invest in research and in the

infrastructure development within Brazil that supports this type of project, or b) increase discussions about the possible use of a public-private partnership for use and/or acquisition of infrastructure.

Although the developed methods have been designed specifically to detect differences in vegetation cover, regardless of the biome, they functions well for areas with large homogeneous masses of forest vegetation, such as the Amazon Forest, yet still present significant errors when dealing Cerrado and Atlantic Forest due to the strong soil signal and to the presence of extensive agriculture areas in Cerrado, to the extreme fragmentation of Atlantic Forest, and also to the presence of extensive areas dedicated to agriculture and silviculture in this biome.

One of the solutions to those issues is the use of masks. One of the premises for implementing a vegetational recovery monitoring program is to know the exact place where deforestation occurs, because it is only possible to regenerate/restore a site that has been deforested/degraded. This information exists for Amazonia (PRODES) and for the Atlantic Forest (S.O.S. Mata Atlantica) since the 1980s, and for the Cerrado (UFG/Lapig) since the 2000s. These masks would be utilized to isolate the areas that have been deforested, allowing users to observe whether regeneration took place during those years and for how long it has been occurring. Agricultural areas could also be isolated using Embrapa's crop maps as masks. Finally, planted forests and areas under regeneration could be differentiated by isolating the areas with planted forests using the data available primarily by state forestry institutes.

The described methods would not be possible without the development of generic algorithms for imagery classification. Traditional methods for automatic imagery classification, already established and well-known, present excellent results when applied individually image by image, yet they become unfeasible when one intends to process large volumes of images due to the interaction with the user.

On the other hand, those generic algorithms based on decision rules depend on rules well established by professionals who are very familiar with vegetation dynamics in a determined region, so that the rules capture changes. For some regions, such as Amazonia, the rules are well known, both for loss and degradation, and for vegetational recovery. However, for a more heterogeneous environments, such as Cerrado and Atlantic Forest, the rules do not capture all vegetational dynamics yet, and more research would be necessary in this area to obtain better results.

5. Results

The study presented a vision of the methods and algorithms utilized for detecting changes in forest cover utilized by the most advanced monitoring programs that exist today. These programs have in common the high level of process automation, the use of temporal series of Landsat data, and the mapping of large geographic areas.

Because multi-temporal analysis of remote sensing data is one of the most efficient methods for verifying changes in land use and cover, the automation of proceeses as a whole was indispensable.

The limitations of the methods described here are related mainly to the process of classification. As generic classifiers, they still do not possess all of the possible combinations of rules to detect the great variation of use and cover classes, making this certainly an agenda for future research. Issues such as surveying

samples for mixture models, or methods for extracting image samples should also be part of a more specific research agenda that seeks to improve constantly the quality of image fractions.

In addition, there is a need to discuss in greater depth the use of private computational infrastructure that is both national and foreign in strategic government projects. In case the option made is for a new project to monitor vegetational cover recovery utilizing the technologies described above, a solution must be found regarding infrastructure, which needs to be sufficiently robust to hold such a larger amount of data.

6. Lessons learned and recommendations

Despite the magnitude of the challenges, they are in place and will certainly become less difficult to the extent that recovered areas or areas under recovery are counted as targets. To make this a reality, it is necessary to develop instruments capable of monitoring these initiatives, especially those involving areas so large that periodic and systematic monitoring by traditional methods of collecting field data is impossible, as the monitoring at biome scale. Consequently, and in response to the guidelines to be followed under various policies related to this theme, it is necessary to structure a system of spatial planning and monitoring that supports decision making involving native vegetation recovery.

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CASE STUDY X

Potential for natural regeneration of native forest in Brazilian biomes

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Jonathan Vinagre – Hired consultant

3. Target audience of the pilot project's execution

Federal and state governments, civil society organizations, and productive chain actors of native vegetation recovery.

4. Context

Forest restoration and the recovery of native vegetation are essential measures for adaptation to climate change, contributing to reduce risks associated with extreme climate events and assuring the maintenance of critical ecosystem services, such as water supply under scenarios of rising temperatures and/or decreasing rainfall. The Environmental Compliance Programs (PRA) established under the Law for Native Vegetation Protection (Law no. 12,651/2012), in the process of implementation, it will be required the recovery of great extensions of Areas of Permanent Preservation (APPs) and Legal Reserves (RLs) in the country. Furthermore, public policies, such as the National Policy for Native Vegetation Recovery (PROVEG), which instituted the National Plan for Native Vegetation Recovery(PLANAVEG), were developed with the objective of making feasible the large-scale recovery of vegetation in Brazilian biomes.

Considering that resources available for recovery actions are limited, it is essential to optimize their use, prioritizing areas where recovery generates maximum benefit to ecosystem services while using the most suitable technique (natural regeneration, conducting natural regeneration, enrichment planting or total planting) for each area to be restored. Due to the high costs associated with planting of native seedlings, whenever possible natural regeneration should be used, with or without other techniques. To provide information about this theme to PLANAVEG and other relevant stakeholders (governments, civil society, and private sector), in 2015, the Atlantic Forest Project hired a study entitled, "Spatial Analysis of the Potential for Recovery and National Regeneration of Brazilian Biomes," conducted in partnership with the World Resources Institute – WRI Brazil.

5. Narrative of the process

The study's first step was to divide Brazilian territory into Planning Units (UPs). The country was divided into approximately 166,000 level-12 water basins, following an earlier study.[14] Then, the attributes of the UPs (indicators) which could influence the potential for native vegetation recovery were selected. The choice of indicators for geospatial modelling changed several times during the study, in an iterative process modelling refining, carried out collectively based on discussions with specialists in all six Brazilian biomes (Amazonia, Cerrado, Caatinga, Atlantic Forest, Pantanal, and Pampa).

Subsequently, a geospatial database was built from several sources related to the selected indicators. Among the research sources utilized, the following stood out: Satellite Monitoring data of Brazilian Biomes Project (PMDBBS), mapping of forest remnants by S.O.S. Mata Atlantica, Amazonia and Cerrado TerraClass project (INPE and Embrapa), global bases GlobCover and Finer Resolution, and detailed mappings produced by the states of Mato Grosso do Sul and Rio Grande do Sul. The advantages and limitations of each of those data bases were analysed in detail, in terms of scope, resolution, and quality.

An exploratory analysis of the data compiled for each of the UPs (micro basins) was then carried out utilizing the grouping analysis function of the ArcGis software. This function implements a non-deterministic method of grouping UPs based on user-specified indicators. In addition to attributing each UP to one of the defined groups, the software produces reports showing descriptive statistics of each group, such as mean, standard deviation, and minimum and maximum values of each indicator. Those statistics were utilized to characterize the typical conditions of the UPs in each group, seeking to relate them to the conditions found in different sites of the same biome. Separate analyses were carried out for each of the six Brazilian biomes.

Between October and December 2015, the consultant interacted intensively with the members of Planaveg Working Group and with specialists in restoration - one for each biome -, including two face-to-face meetings on October 9 and November 20, 2015, discussing methodology and results of the first analyses of the natural regeneration potential, proposing improvements in the methodology, incorporating new layers to the database and excluding others, producing new analyses, and comparing the obtained results with field data provided by specialists.

As a result of those interactions, a revised set of eight indicators was adopted (percentages of vegetation, croplands, pastures, deforestation during the past 10 years, areas under 60 meters from water bodies, mean distance between fragments of native vegetation, mean slope, and mean of the historic use index), which underwent adaptations to the specificities of each biome. In separate meetings with specialists in each biome, the descriptive statistics of each group generated by the analysis were correlated with different conditions found in the field, and restoration techniques were proposed (among the techniques listed in Law 12,651/2012: conduction of natural regeneration, planting of native seedlings and seeds, and the combination of the two previous techniques) that would have highest probability of success in the UPs of each group.

The methodology and modelling results were presented and discussed in a workshop that took place from May 30 to June 1, 2016, in Brasilia-DF, with the participation of 36 technicians

14 Soares-Filho, B et al., 2014. Cracking Brazil's Forest Code. **Science** 344: 363-364.

and specialists from different biomes. In this workshop, it was emphasized that the study was not sufficiently detailed to guide specific recovery projects at property scale, but the study would be very useful to guide national public policies on native vegetation recovery. The participants proposed and debated various ideas to make the analysis more realistic and precise. It was also argued that the result of the analysis should only show the potential for natural regeneration, without making more specific recommendations about which restoration techniques would be more suitable for each UP group, due to scale limitations of the data utilized in the study.

The consultant then carried out a new series of analyses, incorporating the methodological suggestions derived from the workshop and the revised methodology. The results of the new modelling were presented and discussed with specialists of the six biomes between December 2016 and April 2017, during virtual meetings. In the analyses resulting from this process, the natural regeneration potential of each UP group was estimated by specialists establishing the categories: "high," "medium," "low/medium", "low," and "very low." However, not all biomes contained all the five established categories, and the category "low/medium" only appeared at Pampa.

A second workshop to present and discuss the methodology and revised results took place in Brasilia-DF on May 4-5, 2017, with the participation of 27 technicians and specialists from the six biomes. Among the suggestions proposed during this workshop to refine the analysis and its dissemination to the target audience, the following stood out: (a) standardize the natural regeneration potential among the various biomes to facilitate comprehension, establishing just three categories: high, medium, and low potential; and (b) divide Cerrado´s low potential category into two sub-categories: low potential under intensive cropping (lower potential), and low potential under pasture (greater potential).

6. Results

The final results of the study include maps of the potential for natural regeneration (low, medium, and high) for each of the six Brazilian biomes and tables showing the percentages of each category's area in each biome.

The classification of the different potential was also integrated with environmental debts (relative to Area of Permanent Protection and Legal Reserve) estimated by Soares-Filho et al. (2014). This integration enabled the relation between the contribution of natural vegetation regeneration to the process of environmental compliance and the current legislation regarding native vegetation recovery.

The complete results of the study can be found on MMA´s website. Below, there is a table presenting the percentages of the potential for native vegetation natural regeneration in each biome and a map showing its potential for the Atlantic Forest biome.

Table 2. Potential for Native Vegetation Natural Regeneration in Brazilian Biomes.

Potential (% in relation to anthropized areas[1])				
Biome	**Low Potential (%)**		**Medium Potential (%)**	**High Potential (%)**
Amazônia	46		15	39
Caatinga	51		27	22
Cerrado	30 (agriculture)	60 (pasture)	10	NA[2]
Atlantic Forest	59		32	9
Pampa	31		44	25
Pantanal	54		NA	46

1 Only anthropized areas recoverable for environmental compliance of rural properties were considered for presentation of results. All areas in micro basins that were not covered by native vegetation, water bodies, also excluding urban areas, were considered to be anthropized areas.

2 NA indicates that the class of potential for natural regeneration was not utilized for the biome in question.

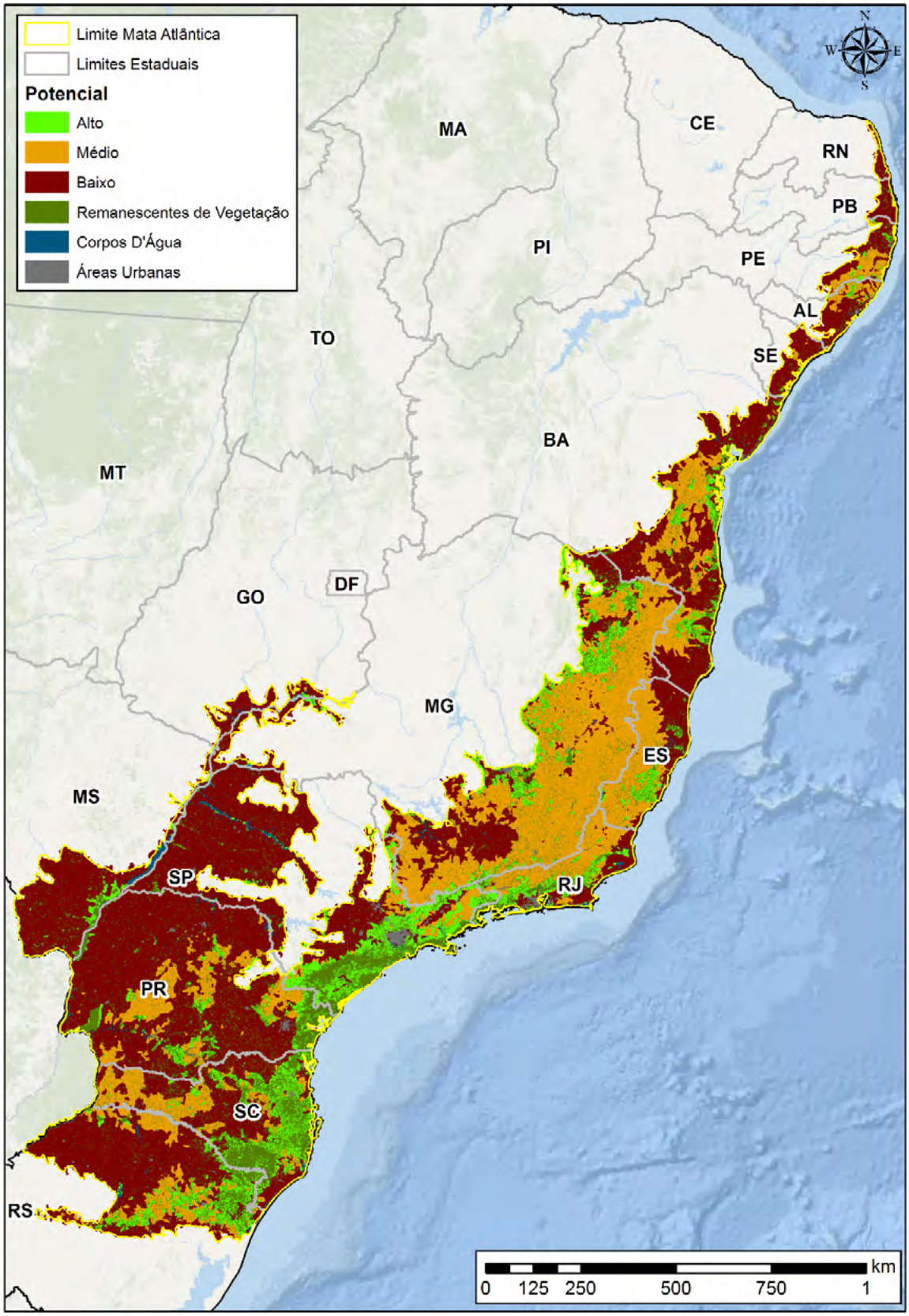

Figure 14. Potential for the Atlantic Forest native vegetation natural regeneration.

7. Lessons learned

During the process of defining the methodology and the data analysis, all those involved in the study confirmed the complexity and difficulties to determine the potential for the vegetation natural regeneration in various Brazilian biomes and the importance of the collaborative approach adopted in the study. The collaboration of specialists in restoration was essential to achieve the results and for the future development of new studies in this area.

Resource and time management in order to obtain the expected results was underestimated by the team involved in the coordination of this process. The expectation of obtaining results in four months of work wound up extending for almost two years, due to a vast required interactions with the specialists and due to the constant adjustments of indicators used in the analysis of groupings. Both face-to-face meetings and both workshops with specialists also demanded substantial financial resources to cover moderation, catering, and travel expenses.

8. Recommendations

Only restoration specialists were invited to the first meetings in 2015 to develop the methodology and data analysis. Involving specialists in spatial modelling from the beginning of the process, to complement the contributions of the restoration specialists, would have avoided the various modifications in methodology and indicators utilized throughout the process.

Whenever data are available, it is necessary to carry out more detailed analyses of the potential for natural regeneration at finer scales in case the study indicates techniques for restoration in the field.

9. Follow-up

The dissemination and presentation of the study´s results for public and private managers, its effective utilization in decision making processes, and the implementation of public policies related to vegetation recovery have great potential for promoting the large-scale vegetation recovery in the country, supporting the implementation of Law no. 12,651/2012 and of PLANAVEG, and also the achievement of the target of recovering 12 million hectares by 2030.

Figure 15. Photographic registry of the Technical Workshopon Scenarios of Potential Natural Regeneration and Restoration of the Native Vegetation of Brazilian Biomes, June 2016, Brasilia.

CASE STUDY XI

Forest Restoration for Water Security Priority Index: an application in metropolitan regions of the Atlantic Forest

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Leonardo Esteves Freitas and João Oswaldo Cruz – Consultants, Mosaico Ambiental

3. Target audience of the pilot project execution

State and municipal governments, watershed committees, civil society organizations, and public and private managers of water resources, among others.

4. Context

Water is a pubic asset, and access to this asset is a right of all citizens. However, water availability has been declining over recent years, due to the gradual increase in demand, the continuing pollution of still available water sources, and the effects of climate change.

Guarantee the availability of water to the population for household, commercial and industrial supply, including its use for generating energy, river transport, and basic sanitation is a duty of governments at all levels: municipal, state, and federal.

In this sense, the presence of native vegetation cover in watersheds supports the improvement of river´s hydrological regime regulation and the quality of water sources such as springs. Consequently, strategies to conserve and recover native vegetation in the main hydrographic basins that supply large Brazilian cities can help increase the quantity and quality of water supplies sufficiently to meet current and future demands.

Forest restoration actions strengthen the ecosystem services of provision and regulation, such as supplying water, and reduce the risks of inundations and landslides. In this way, forest restoration can also be part of a strategy to help people adapt to the adverse effects of climate change, such as an Ecosystem-based Adaptation (EbA) measure.

In 2013, Pact for Restoration of the Atlantic Forest´s (PACTO) Technical Information Group (GT Info) carried out, along with consultants of Instituto Bioatlântica (IBIO) and Nature Conservancy (TNC), an initial study seeking to identify potential areas for Payment for Environmental Services (PES) initiatives in the Atlantic Forest, focusing on the water sources that supply metropolitan regions.

Payments for Environmental Services (PES) program provide incentives, generally financial, to people or groups who promote the maintenance of ecosystems that provide those services, and

also charge a fee of users who gets benefits from those same services. Such arrangements are being discussed in Brazil due to their relevance to forest conservation, to economic activities such as sustainable agricultural production, and to provision of services that are essential for the population, such as water supply.

A second study, which proposed to deepen the initial study developed by PACTO, was carried out between 2015 and 2017 by the firm Mosaico Ambiental, which was contracted by the Atlantic Forest Project. This consultancy gathered new information and performed new data crossings, which enable the identification of micro basins and water sources that supply metropolitan regions (MRs) and urban agglomerations (UAs) in the Atlantic Forest, as well as those micro basins and water sources that most require actions for recovering and conservating ecosystems in order to assure water security of those regions.

5. Narrative of the process

Initiating in 2015, the process consisted of three phases: developing the methodology (May to October 2015), producing the results (May to September 2016), and presenting and validating the results (December 2016 to September 2017). The methodology was developed jointly by Mosaico Ambiental and by members of Pacto's GT Info, during five virtual meeting with the participation of the Ministry of the Environment.

During the development of the study, it was found that the analysis performed could support on the prioritization of forest conservation and recovery actions independently of the used tool, including the possibility of generating PES arrangements. The specific definition of the priorities for PES arrangements would still require an economic analysis related to water use charges and to the concepts of protector-recipient and user-payer that had still not been carried out in this study. Furthermore, at the conclusion of the analysis, as a tie-breaking criterion for the prioritization index developed, priority was given to the water sources with currently less vegetational cover, to incentivize actions to recover native vegetation in those water sources.

Based on the above considerations, it was decided to alter the objective of the prioritization carried out to date, proposing instead a priority index for forest restoration in order to increase water security in the metropolitan regions of the Atlantic Forest.

The first step was to define the water basins that would be included in the study. The criteria established for inclusion of a basin were:

- ☑ Be utilized for urban water supply;
- ☑ Supply one of the 20 Metropolitan Regions (MRs) or Urban Agglomerations (UAs) or more populated cities within the Atlantic Forest, having as a base the limits of the Atlantic Forest Law (S.O.S. Mata Atlântica, 2013/2014); and
- ☑ Be located within the Atlantic Forest biome, based on the limits of the Atlantic Forest Law and the mapping of Atlantic Forest remnants (S.O.S. Mata Atlântica, 2013/2014).

Subsequently, the water sources that supply the 20 most populated MRs or UAs were selected, according to Atlas Brazil: Urban Water Supply (ANA 2011). For each of those water sources, the delimitation of the hydrographic basins was defined, according to the hydrological division in micro basins and river stretches, prepared by the National Water Agency (ANA).

The micro basins selected for analysis were then assessed in terms of their priority for forest restoration with a view to enhancing water security in the Atlantic Forest's metropolitan regions based on the following parameters:

- ☑ Quantitative water balance **(ratio between water demand and supply at each water source)**, derived from the Brazil Atlas: Urban Water Supplies (ANA, 2011) – The worse the situation of the micro basin or water source concerning urban water supply, the higher its priority for this study;
- ☑ Susceptibility to erosion, prepared based on the maps of Soil Erodibility (Sartori et. al., 2005), Slope (Shuttle Radar Topography Mission – SRTM), and Ecosystems Remnants (S.O.S. Mata Atlântica & INPE, 2013-2014) – Greater susceptibility to erosion met higher priority for this study; and
- ☑ Proportion of cover by ecosystem remnants (S.O.S. Mata Atlântica & INPE 2013-2014) – Lower proportion of vegetational cover met higher priority for this study.

Bearing in mind that each of those parameters was developed from different variables, it was necessary to attribute weights to the internal variables of each parameter, using the Analytic Hierarchy Process (AHP) method.

The next step was to cross the data related to those three parameters by also attributing weights, which resulted in an Index of Priority of Forest Restoration for Water Security (IPRH). Greater details about the methodology utilized can be obtained in the technical report available of the website of the Ministry of the Environment (MMA).

The water sources were then ordered based on the value of the calculated index, producing a ranking of water sources for each metropolitan region. To assist the decision making by municipal managers, the water sources entirely or partially in each municipality were also ordered, producing a ranking of water sources for each municipality. It was included municipalities that are located both inside and outside MRs/UAs, providing they supply water to those MRs/UAs.

6. Results

The results of this study are presented in the form of maps and tables, containing the rankings of water sources for each MR/UA and for each municipality. The complete study results, including the geospatial database utilized, can be found on the website of the Ministry of the Environment.

The results can contribute to the optimization of technical and financial resources allocated to public and private programs, projects and actions for conservation and recovery of native vegetation with a view of enhancing water security in the metropolitan regions analysed.

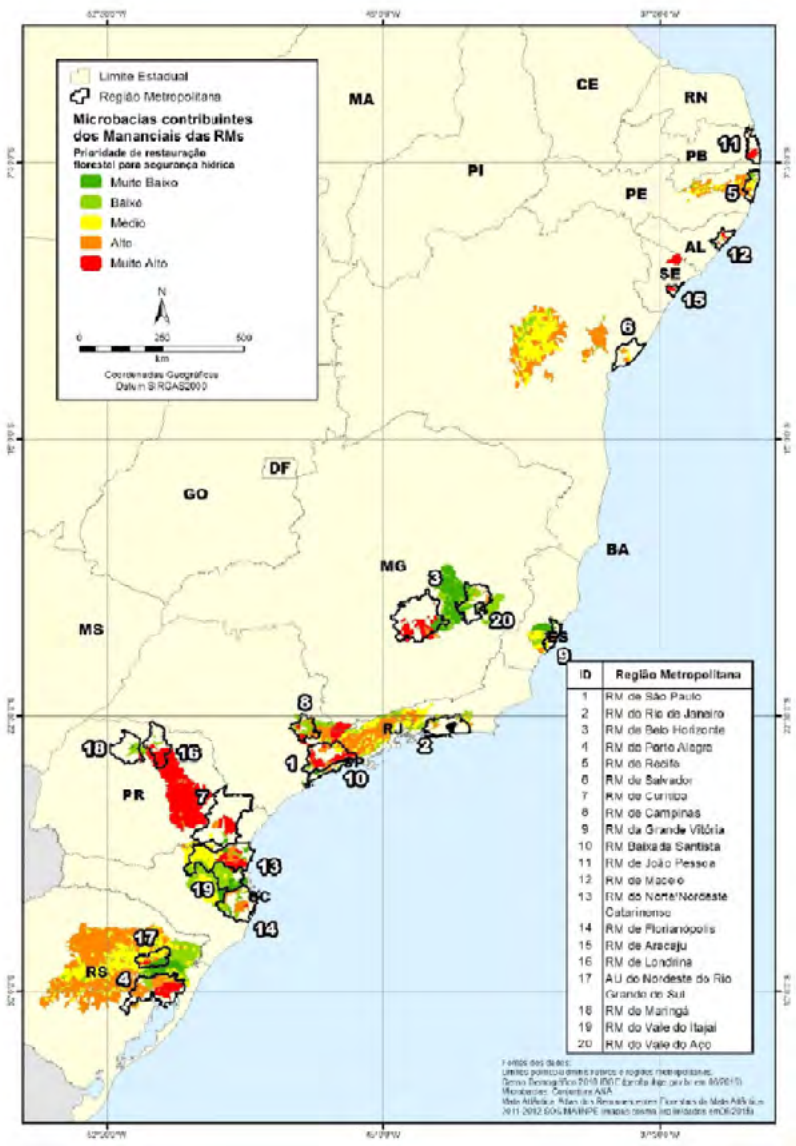

Figure 16. Map of priorities of natural regeneration for water security per micro basins that drain the spring supplying the 20 most populated metropolitan regions in the Atlantic Forest biome.

7. Lessons learned

The definition of the consultancy's objectives, activities and products could have been spelled out in greater detail by the group responsible for monitoring the study (MMA, GIZ, and Pacto's GT Info). Differing interpretations about the objectives of the consultancy after hiring the firm caused some difficulties and delays, resulting in the need to rehire the firm after the end of the contract. The availability of all partners involved, including the firm, to dialogue and accept adjustments in activities enabled the delivery of good results.

In retrospect, it would have been useful to include in the monitoring group from the start technical representatives of ANA and the MMA's Secretariat of Water Resources and Environmental Quality, which coordinate actions directly related to water production. These representatives were only included in the third stage of the process, during the presentation and validation of results, which led to new suggestions and changes in the completed study, even after the end of the consultancy's second contract.

8. Recomendations

To support more effectively decision making by state and municipal decision makers, it is advisable to cross the study's results with more detailed spatial data that may be available for a given region and with data on the institutional arrangements that favour the implementation of conservation and recovery projects.

It is also advisable to optimize the use of financial resources directed to actions involving certain, more critical portions of the micro basin (for example, Areas of Permanent Preservation (APPs) and areas of low agricultural suitability), using additional data.

Forest conservation and restoration actions should be part of a strategy to assure water supplies in sufficient quantity and quality to meet current and future demands. Still, those actions should be carried out in complementarity with other actions aimed at reducing water consumption, promoting adequate soil management, and reducing pollution of rivers, among others, which together will be capable to promoting real recovery of the water sources for the large metropolitan regions of Brazil.

9. Follow-up

The presentation and dissemination of this study's results to public and private managers of water resources, and their effective utilization in decision making and implementation of vegetation conservation and recovery projects aimed at enhancing water security have great potential to assist in directing resources and efforts that contribute effectively to climate change adaptation in the Atlantic Forest's metropolitan regions and to confront the recent crises of water supply.

CASE STUDY XII

Gender equity as a crosscutting theme of the project

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Miguel Moraes – UICN

3. Context

The Ministry of the Environment (MMA) understands that gender equity is essential for people who work with sustainable development and offer an online course entitled "Gender Equity and Sustainable Development" (MMA, 2013), so that its staff can incorporate this concept in a crosscutting way in their work, projects and public policies of the MMA.

GIZ, for its part, identified the crosscutting nature of gender equity as one of the key factors assuring the quality of its projects and, as a result, developed a company strategy in this field, described in the document "Safeguard + Gender Management System" (GIZ, 2017). To support its projects in this theme, GIZ in Brazil defined focal points for mainstreaming gender at the country and programmatic levels. Based on this strategy, the Tropical Forests Program (PFT) established the Gender Thematic Group, in which projects participate through a focal point and which provides support and guidance of efforts to mainstream gender. The GT offers training and coaching, and it developed a Concept Note on the relevance of gender equity in the various themes in which the PFT works, for the purpose of guiding projects and disseminating concepts and experiences.

The Biodiversity and Climate Change in the Atlantic Forest project was classified, during the project preparation phase, with a GG 0 indicator, in other words, without gender equity as a main theme and lacking a specific indicator to measure if gender mainstream is showing results. However, this does not mean that the project team should avoid the theme, but, in fact, that it should plan actions and dedicate resources, since the team understands that gender equity will help contribute to the project's success and impacts.

The Atlantic Forest project, through internal discussion, nominated a focal point person who has actively participated in the Gender Working Group of the Tropical Forests Program.

The project developed a planning matrix for actions related to gender and contributed to a planning matrix of the Gender Working Group.

Several initiatives have already been developed as part of the Atlantic Forest project, which are described as follows.

4. Target audience

The actions related to gender equity were generally carried out together with the project's partners institutions which, in turn, involved their own partners and base communities in the activities and discussions. In this way, the target audience can consist not only by technical staff at partner institutions, but also by members of base communities with which the partners work.

In dealing with discussions about public policies related to biodiversity, the target audience for mainstreaming gender may consist of, on the one hand, national women leaders of social and environmental movements that seek to influence and qualify those policies, and, on the other hand, male and female technical staff of the Federal Government, of state and municipal governments and of NGOs, as well as members of academia that are involved with developing public policies, as was the case of the discussion about and collective construction of the Brazilian EPANB.

Other actions refer to the target audience of the project's training in ecosystem-based adaptation to climate change, such as the courses on EbA or on training of EbA trainers, in which content specific to gender and EbA was developed.

5. Project accomplishments in the theme Gender Equity: Diferentiation in perceptions of climate change and climatic risk between men and women in the Montane Region of Rio de Janeiro

In partnership with the Center of Advanced Training in Rural Development (SLE) of Humboldt University in Berlin, a new analysis was carried out of the study HumaNature: Perception of risks and ecosystem-based adaptation to climate change in the Atlantic Forest, Brazil. The objective was to detect differences in the perception of men and women regarding environmental risk, mainly involving landslides. In addition, people were asked how they would respond and if the presence of the Atlantic Forest bears any relation to the magnitude of environmental risks. The results show that differences in perception indeed exist, and that women are more concerned about family welfare facing risks. As a result, women even considered moving their families away from risky places, while men focused more on engineering solutions to secure slopes, for example. On the other hand, women state that they have greater difficulty than men in accessing information and such access could enable them to deal better with environmental risks.

Diferentiation in perceptions on climate change by gender within the scope of the Municipal Plans for Conservation and Recovery of the Atlantic Forest (PMMAs)

In partnership with Parana state Secretariat of Environment (SEMA-PR), NGO S.O.S. Mata Atlântica, and IBOPE, Atlantic Forest project gathered data disaggregated by gender during a public consultation on environmental perception in seven municipalities on Parana coast that were encouraged to develop their PMMAs. The analysis of the results, which focused on perception on climate change, revealed that women perceived better than men that the climate in their municipalities is already changing and they are also more inclined to feel that

this will influence their day-to-day lives and livelihoods. Those results should be considered in the seven PMMAs that are under development with support from the Financial Module of the Atlantic Forest Project in this region.

Mainstreaming of gender equity in public policy instruments – the case of the National Strategy and Action Plan for Biodiversity (EPANB)

EPANB is an official document prepared by the Brazilian Government as part of its obligations under the Convention on Biological Diversity (CBD), of which Brazil is a signatory. CBD approved, during the 9th COP, a Gender Action Plan, based on the recognition that gender equity and empowerment of women are important pre-requisites for conservation and sustainable development. Specifically for the preparation of EPANB, CBD published guidelines for mainstreaming gender (CDB, 2010).

The Atlantic Forest Project supported the preparation of EPANB and participated, along with the Life Web and TEEB projects, in an effort to qualify EPANB by mainstreaming gender equity in the document. With support of the Convention on Biological Diversity (CBD), International Union for the Conservation of Nature (IUCN) and MMA organized a workshop with female leaders of environmental and social movements to prepare suggestions for strengthening Brazilian EPANB with a more inclusive vision from a social and cultural viewpoint, highlighting women's role in conserving biodiversity. Subsequently, during the workshop for the preparation of EPANB, representatives of this group of women participated with the objective of deepening and guaranteeing gender mainstreaming in EPANB's actions. In relation to the National Targets for Biodiversity (Aichi Targets, CBD, 2020), several gender-specific actions and objectives were included in Brazilian EPANB.

Support to partners – establishment and consolidation of Pact for the Restoration of the Atlantic Forest´s (Pacto) Gender Working Group

During the joint participation in the workshops on gender and forest restoration and on mainstreaming gender in EPANB, Atlantic Forest Project supported, along with the Gender Working Group of GIZ´s Tropical Forests Program and IUCN Brazil, the establishment and strengthening of Pact for the Restoration of the Atlantic Forest´s Gender Working Group. The objective was to encourage the deepening of gender equity in Pacto's governance structure and tools, involving its members and those of its partner entities that work with restoration in the different regions of the Atlantic Forest. One of the actions supported was the organization of a training course on gender in Pacto's projects and strategies, which took place in June 2017 in Lagamar Mosaic region. The course aimed to raise awareness of leaders and strategic actors involved in restoration about gender equity, aligning it with Pacto's concepts and mission, enabling the insertion of the most significant concepts in the governance and in all Pacto´s and its members´ spheres of action . In Pacto's assessment, the course contributed for the consolidation of the Working Group and the theme.

Integration of gender equity in the courses on Ecosystem-based Adaptation to Climate Change by the Atlantic Forest Project

In its work to mainstream gender in the main project activities, and considering that both, UNFCCC and CBD, seek to promote gender equity and to encourage equal participation of men and women in different entities and platforms of the conventions, as well as in decisions involving adaptation and mitigation, and capacity building, the Atlantic Forest project developed a specific module on the importance of considering gender equity in the planning

processes that highlight EbA. This module was offered initially in two courses on EbA in Olinda, in Pernambuco state, and soon should be part of the collection of teaching materials on EbA developed by the Atlantic Forest Project.

6. Results

The main results of the Atlantic Forest project involving gender mainstreaming are as follows:

a) Information about the differentiated perception between men and women regarding climate change, climatic risks and the ways to confront them. These findings enabled the Atlantic Forest Project and its partners to plan and act in a differentiated way with the target audiences mentioned above;

b) Mainstreaming gender equity in public policies. In the concrete case of preparing the Brazilian EPANB, Atlantic Forest Project contributed, along with TEEB and Life Web projects, to the incorporation in the official document submitted to CBD of issues linked to the balanced consideration of interests, needs and contributions of men and women;

c) Support to the partners to consolidate the theme of gender equity: in a concrete way, the support of the project resulted in the consolidation of Pacto's Gender Working Group and in the strengthening of the theme in its member institutions; and

d) In the incorpoation of gender equity in the project's actions and capacity building, a module on gender and EbA was prepared for the methodological course and the course on training of trainers in EbA.

7. Lessons learned

The experience of the Atlantic Forest Project shows that, independently of the gender classification as GG 0 during its development and approval, the theme can be addressed in a crosscutting way and lead to significant project results.

At times, resistance arose regarding the relevance of gender equity in relation to other project themes, such as occurred in the case of mainstreaming gender in EPANB or of in incorporating gender in courses on EbA, but this resistance could be overcome by additional clarification and discussions about the benefits of gender equity for biodiversity conservation and the work on territorial planning instruments.

8. Recommendations and follow-up

CBased on the positive results achieved, it is important that the work on gender mainstreaming be continued during the second phase of the project, which counts on investments from the Financial Cooperation module:

- ☑ Consideration of the differentiated perceptions of men and women regarding climate change and risk, in the development of territorial planning instruments such as PMMAs and management plans for Conservation Units;
- ☑ Refinement and implementation of the Brazilian EPANB; and
- ☑ The activities of Pacto's Gender Working Group in the institution's internal functioning and external actions, as well as in collaboration with local partners of the Pact's member institutions.

9. References

CDB 2010: Sasvari, A., Aguilar, L., Khan, M., Schmitt, F. (2010). Guidelines for Mainstreaming Gender into National Biodiversity Strategies and Action Plans. Gland, Switzerland: IUCN. viii + 97pp, CBD Technical Series No. 49.

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Figure 17. Photographic registry of the Course on Gender Issues in the Projects and Strategies of Pact for Restoration of the Atlantic Forest, June 2017, Antonina, Parana.

Mata Atlântica
Biodiversidade e Mudanças Climáticas

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