COLEÇÃO

DESAFIOS DAS ENGENHARIAS:

ENGENHARIA FLORESTAL

FELIPE SANTANA MACHADO
ALOYSIO SOUZA DE MOURA
(ORGANIZADORES)

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APRESENTAÇÃO

A Engenharia Florestal ou Engenharia Silvícola é uma disciplina abrangente dentro da Engenharia que aborda, de modo geral, todos os aspectos fundamentais de ambientes florestais visando à produção de bens provenientes de florestas naturais ou cultivadas por meio do manejo para suprir a demanda de seus produtos, bem como conservação de água e solo, entre outras finalidades. No Brasil, a Engenharia Florestal é um ramo amplo que aborda uma grande área de atuação, e suas bagagens vão desde seu manejo, ao conhecimento e entendimento de ecologia (suas interações), até a conservação e preservação.

A Engenharia Florestal e suas linhas de estudos são amplamente presentes no mundo atual, pois seus produtos gerados estão intimamente ligados ao cotidiano da vida humana uma vez que não conseguimos mais prosseguir sem a presença de papel, corantes, frutos, sementes, madeira, essências de perfumes, óleos, carvão, e também na produção de mudas de árvores para a restauração de áreas já exploradas e degradadas.

Este livro “Coleção desafios das engenharias: Engenharia florestal” é uma iniciativa internacional com participação de pesquisadores de Portugal, Colômbia, e Brasil, que surge com a finalidade de destacar algumas linhas de estudos da Engenharia Florestal e para o entendimento deste segmento em micro, meso e macro escala. Portanto, este livro apresentará estudos, revisões e relatos com o objetivo de alinhar temas relacionados à área.

Reiteramos que esta obra apresenta estudos e teorias bem fundamentadas e embasadas de forma a alcançar os melhores resultados para os propostos objetivos. Desejamos que este livro possa auxiliar estudantes, leigos e profissionais a alcançar excelência em suas atividades quando utilizarem de alguma forma os capítulos para atividades educacionais, profissionais ou preservacionistas.

Ademais, esperamos que este livro possa fortalecer o movimento das engenharias, instigando profissionais e pesquisadores às práticas que contribuam para a melhoria do ambiente e das paisagens nos quais são objeto de estudo de engenheiros, aos estudantes de engenharia e demais interessados.

Felipe Santana Machado
Aloysio Souza de Moura

SUMÁRIO

CAPÍTULO 1

ECOLOGICAL RESTORATION AND SOIL AND WATER CONSERVATION WITHIN THE SCOPE OF WATER RESOURCES, FOREST AND CLIMATE CHANGE POLICIES IN BRAZIL

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ABSTRACT: The article deals with the discussion of ecological restoration and conservation of soil and water in relation to the integration and implementation of three important Public Policies in Brazil: National Policy of Water Resources, National Policy on Climate Change and Forest Policies. National Water Resources Policy, created by Law 9.433/1997, has been implemented through its instruments: grants, charges, watershed plans. National Policy on Climate Change (Law 12.187/2009) has tools, such as the National Plan and the National Fund on Climate Change. The main policy that regulates Brazilian forests is the Forest Code (Law 12.651 /2012), which presents several instruments, such as: Environmental Rural Registry (ERR), Environmental Regularization Program (ERP) and Environmental Reserve Quota (ERQ) and Program of Support and Incentive to the Preservation and Recovery of the Environment. This last program presents as a line of action the payment or incentive to environmental services as monetary retribution to the activities of conservation and improvement of ecosystems. This scope includes the Water Producer Program, implemented by the National Water Agency and partners. In analyzing the implementation of the various instruments and programs established in these three policies, there is a need for greater integration between them to ensure the participation of Society in decision-making processes. In addition, these policies need to ensure ecological restoration and soil and water conservation, as well as mitigate the adverse effects of climate change.

KEYWORDS: Policies integration, water governance, ecological restoration, soil and water conservation, forest policies.

RESUMO: O artigo trata da discussão da restauração ecológica e da conservação do solo e da água em relação à integração e implementação de três importantes Políticas Públicas no Brasil: Política Nacional de Recursos Hídricos, Política Nacional de Mudanças Climáticas e Políticas Florestais. A Política Nacional de Recursos Hídricos, criada pela Lei 9.433 / 1997, vem sendo implementada por meio de seus instrumentos: outorgas, cobranças, planos de bacias hidrográficas. A Política Nacional de Mudanças Climáticas (Lei 12.187 / 2009) conta com ferramentas, como o Plano Nacional e o Fundo Nacional de Mudanças Climáticas. A principal política que regulamenta as florestas brasileiras é o Código Florestal (Lei 12.651 / 2012), que apresenta diversos instrumentos, tais como: Cadastro Ambiental Rural (ERR), Programa de Regularização Ambiental (ERP) e Quota de Reserva Ambiental (ERQ) e Programa de Apoio e

Incentivo à Preservação e Recuperação do Meio Ambiente. Este último programa apresenta como linha de ação o pagamento ou incentivo aos serviços ambientais como retribuição monetária às atividades de conservação e melhoria dos ecossistemas. Este escopo inclui o Programa Produtor de Água, implementado pela Agência Nacional de Águas e parceiros. Na análise da implementação dos diversos instrumentos e programas estabelecidos nessas três políticas, é necessária uma maior integração entre eles para garantir a participação da Sociedade nos processos de tomada de decisão. Além disso, essas políticas precisam garantir a restauração ecológica e a conservação do solo e da água, bem como mitigar os efeitos adversos das mudanças climáticas.
PALAVRAS - CHAVE: Integração de políticas, governança da água, restauração ecológica, conservação do solo e da água, políticas florestais.

1 I INTRODUCTION

The Brazilian government has made an international commitment to restore, reforest and induce the natural regeneration of 12 million hectares of forests and implement 5 million hectares of integrated agricultural systems, combining farming, livestock and forests by 2030.

At the national level, the commitment is reinforced in Decree 8.972/2017, which institutes the National Policy for the Recovery of Native Vegetation (PROVEG), which, among others, aims to articulate, integrate and promote policies, programs and actions inducing the recovery of forests and other forms of native vegetation. Among the PROVEG guidelines, there are two related to this chapter: the promotion of adaptation to climate change and the mitigation of its effects, and the protection of water resources and soil conservation.

Several authors consider restoration a process with multiple purposes, from biodiversity and ecosystem services to social and economic development. In addition, restoration can contribute to mitigation and adaptation to climate change. Extensive tropical forest loss and degradation have increased awareness at the international level of the need to undertake large-scale ecological restoration, highlighting the need to identify cases in which restoration strategies can contribute to mitigation and adaptation to climate change (Harris et al., 2006; Bustamante et al., 2019). However, ecological restoration presents substantial challenges for tropical and megadiverse countries, including the need to develop plans that are technically and financially viable, as well as integrated public policies and instruments at the national and subnational levels and with other sectoral policies (Bustamante et al., 2019).

Bustamante et al. (2019) emphasizes that Brazil has an internal commitment to meet the requirements of the Native Vegetation Protection Law (Law 12651/2012, which is the main Brazilian Forest Policy. The law requires that every property preserves or restores the native preservation areas (known by the Portuguese acronym APPs) and in legal reserves (LRs). APPs represent areas at risk of generating erosion, storm water runoff,

or deterioration of the protective role of the headwaters and the edges of water bodies, whereas LRs represent the proportion of every landholding that must be maintained with native vegetation cover. If the property does not have enough land with native vegetation to comply with the LR requirement, native vegetation must be restored (Bustamante et al., 2019).

In addition to forest and climate policies, it is important to discuss watershed management. Wolka (2014) discusses how watershed management, particularly Soil and Water Conservation (SWC), supports sustainable livelihoods through reducing environmental degradation and increasing crop production. The article deals with the discussion of ecological restoration and conservation of soil and water in relation to the integration and implementation of three important Public Policies in Brazil: National Policy on Water Resources, National Policy on Climate Change and Forest Policies.

2 | NATIONAL WATER RESOURCE POLICY - PNRH

Several studies have analyzed water resource management and the National Water Resources Policy in the light of economic, environmental, ethical and social aspects (Boff, 2003; Lobato da Costa, 2003; Porto & Lobato da Costa, 2004; Freitas, 2009; Freitas, 2010, etc.). However, the current management situation points to a crisis scenario (Haddad, 2008). The crisis around water reflects the crisis of conscience of our civilization and of the current, unequal, exclusive and depleting and exhausting world model of natural resources. In the process of building the sustainable management model of water resources in vogue, the big challenge is to establish a shared and decentralized power relationship, creating an opportunity for social participation, building consensus, settling conflicts and agreeing on unity in diversity (MMA, 2008).

Some experiences in several hydrographic basins, carried out through the implementation of the instruments of the National Water Resources Policy - PNRH (water resource rights grant, hydrographic basin master plans, charging for the use of water resources, framing of water bodies according to predominant use, etc.), as well as inspection campaigns, training programs, financing and stimulating research, to the community organization have been adopted in Brazil. However, little has been researched to verify the real impacts and effects of these plans, programs and projects, as well as the integration of this policy with climate change and forest management policies.

Observing the history of the management of water resources in Brazil, it goes back to several institutions, in most cases, responsible sometimes for some user sectors (hydro-energetic generation, sanitation, irrigation, etc.), sometimes with operations restricted to a specific region, for example of the National Department for Works Against Drought - DNOCS (created in 1909).

The increase in demand, coupled with the scarcity and deterioration of the quality

of water resources, cause serious conflicts to the multiple use of water, requiring new management paradigms. The Federal Law nº 9.433 / 1997, which instituted the PNRH, has as basic principles, among others, the recognition of water as a vulnerable, finite resource with economic value and the decentralized and participative management of water resources. The water management models, that is, the institutional (legal and organizational) and financial mechanisms, have evolved over time in three distinct phases, namely: i) the bureaucratic model; ii) the economic-financial model; and iii) the systemic model of participatory integration. Such models have a close relationship with the models of organization management and with the concept of society of Habermas' theory of modernity (Freitas, 2009).

The management of water resources is a complex task and involves several conflicting interests. Thus, the public power, without giving up its role as a managing and coordinating body, recognizes the need to promote a decentralization of management, allowing the intervention of representatives of the various segments involved. This happens through social negotiation and formation of the Hydrographic Basin Committees. The legal instruments for implementing this model are, among others, the following:

- River Basin Plans aim to support and guide the implementation of the Water Resources Policy and its management, which are prepared by river basin, by State and for the country.
- Granting the right to use water resources, which is the administrative act by which the granting public authority allows the recipient to use water resources, for a specified period, under the terms and conditions expressed in the respective act.
- Classification of bodies of water in classes, which aims to ensure the quality of water compatible with the most demanding uses.
- Charging for the use of water resources, standing out as an economic-financial instrument, aims to: i) recognize water as an economic good; ii) obtain financial resources to finance the programs and interventions contemplated in the plans.
- Water Resources Information System is a system for collecting, treating, storage and retrieving information about water resources and factors involved in their management.

The aspect of integrated public management deserves special attention, as it constitutes an instrument of institutional framework for conflicts, inevitable in a continental country with enormous diversity. It is a concept that goes back to the countless social movements, since the 1970s, they are part of the Brazilian political reality. Thus, the Federal Constitution of 1988 provided for the organization of the National Water Resources Management System - SINGREH, formed by a set of legal and administrative mechanisms with the objective of coordinating the integrated management of water resources.

The National Water Agency - ANA is an autarchy under a special regime, created by

Law No. 9.984 / 2000, endowed with administrative and financial autonomy, linked to the Ministry of the Environment, part of the National Water Resources Management System and aims to implement, in its sphere of duties, the PNRH. Several Basin Committees have already been installed in rivers in the Union, such as the São Francisco River Basin Committee, the Piancó-Piranhas-Açu River Basin Committee, the Paraíba do Sul River Basin Committee, etc. The Water Agencies are technical executive entities that will act in support of the executive secretariat of the basin committees.

Thus, in summary, SINGREH as participating bodies: i) the National Water Resources Council; ii) ANA; iii) the Water Resources Councils of the States and the Federal District; iv) the Basin Committees; v) the federal, state, Federal District and municipal government agencies whose competences are related to the management of water resources; vi) Water Agencies.

More recently, law n. 14,026, of July 15, 2020, which updates the legal framework for basic sanitation and amends Law No. 9,984, of July 17, 2000, to attribute to the National Water and Basic Sanitation Agency (ANA) the competence to edit standards of reference on the sanitation service, Law No. 10,768, of November 19, 2003, to change the name and attributions of the position of Specialist in Water Resources, Law No. 11,107, of April 6, 2005, to prohibit the provision by public service program contract referred to in art. 175 of the Federal Constitution, Law No. 11.445, of January 5, 2007, to improve the structural conditions of basic sanitation in the Country, Law No. 12,305, of August 2, 2010, to address the deadlines for environmentally adequate final disposal of tailings, Law No. 13.089, of January 12, 2015 (Statute of the Metropolis), to extend its scope of application to micro-regions, and Law No. 13.529, of December 4, 2017, to authorize the Union to participate in a fund for the exclusive purpose of financing specialized technical services.

3 | NATIONAL CLIMATE CHANGE POLICY - PNMC

In Brazil, Decree No. 2,652, of July 1, 1998, promulgates the United Nations Framework Convention on Climate Change. Decree s/n, of August 28, 2000, provides for the Brazilian Forum on Climate Change. Decree nº 5.445, of May 12, 2005, promulgates the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

In terms of federal legislation, there is also: i) Decree No. 6.263, of November 21, 2007, instituted the Interministerial Committee on Climate Change (CIM), and provided guidance on the preparation of the National Plan on Climate Change; ii) Decree No. 7343, of October 26, 2010, which regulated Law No. 12,114, of December 9, 2009, and created the National Climate Change Fund – FNMC; iii) Decree No. 7,390, of December 9, 2010, which regulated arts. 6, 11 and 12 of Law nº 12.187, of December 29, 2009, and instituted the National Policy on Climate Change – PNMC.

Law 12,187 / 2009 instituted the National Policy on Climate Change - PNMC. In

accordance with its art. 3rd, the PNMC and the resulting actions, carried out under the responsibility of political entities and public administration bodies, will observe the principles of precaution, prevention, citizen participation, sustainable development and that of common, but differentiated responsibilities, this internationally.

Regarding the measures to be adopted in its execution, the following will be considered: i) everyone has a duty to act, for the benefit of present and future generations, to reduce the impacts resulting from anthropic interference on the climate system; ii) measures will be taken to predict, avoid or minimize the identified causes of climate change with anthropic origin in the national territory, on which there is reasonable consensus on the part of the scientific and technical means engaged in the study of the phenomena involved; iii) actions at the national level to face climate change, current, present and future, must consider and integrate the actions promoted at the state and municipal levels by public and private entities.

Among the numerous PNMC guidelines, the following can be highlighted: i) the commitments assumed by Brazil in the Framework Convention, in the Kyoto Protocol and in the other documents on climate change to which it will become a signatory; ii) actions to mitigate climate change in line with sustainable development; iii) adaptation measures to reduce the adverse effects of climate change and the vulnerability of the environmental, social and economic systems; iv) integrated strategies for mitigating and adapting to climate change; v) stimulating and supporting the participation of the federal, state, district and municipal governments, as well as the productive sector, the academic environment and organized civil society, in the development and execution of policies, plans, programs and actions related to change of the climate.

Law nº 12.187, of December 29, 2009, instituted the National Policy on Climate Change and defined the concepts of adaptation and mitigation. Mitigation involves technological changes and substitutions that reduce resource use and greenhouse gas emissions and increase sinks. As an example, in terms of mitigation, the transport sector is one of the most critical, as there is great potential for reducing emissions through a more efficient urban mobility policy. Another critical sector is the agricultural sector, since the activities related to it – such as deforestation and burning – have a significant share in domestic emissions of these gases. Adaptation, on the other hand, deals with actions that reduce the vulnerability of systems in the face of predicted climate change scenarios CMMC (2013).

However, it is worth highlighting some of the instruments of the National Policy on Climate Change, namely: i) National Plan on Climate Change; ii) the National Fund on Climate Change; iii) Action Plans for the Prevention and Control of Deforestation; iv) Brazil's National Communication to the Framework Convention, in accordance with the criteria established by that Convention and its Conferences of the Parties; v) the resolutions of the Interministerial Commission on Global Climate Change; etc. With regards for the institutional

instruments for the performance of the National Climate Change Policy, the following are included: i) the Interministerial Committee on Climate Change; ii) the Interministerial Commission on Global Climate Change; iii) the Brazilian Forum on Climate Change; iv) the Brazilian Research Network - Rede Clima; v) the Meteorology, Climatology and Hydrology Activities Coordination Commission.

According to Art. 8, the official financial institutions will provide specific lines of credit and financing to develop actions and activities aimed at inducing the conduct of private agents to observe and execute the PNMC, within the scope of their social actions and responsibilities.

In some way related to these two mentioned Policies, we can also highlight: National Environmental Sanitation Policy; National Risk and Disaster Management Plan; National Water Security Plan; National Climate Change Plan; National Adaptation Plan; Semiarid Atlas; Drought Monitor; Drought Coexistence Program. In addition, ANA prepared, in partnerships, the following studies: SDG 6 in Brazil: ANA's vision of the indicators; Cost-benefit analysis of climate change adaptation measures; Climate change and water resources: assessments and adaptation guidelines; Sewer atlas: watershed depollution.

4 | FOREST POLICY

The main policy that regulates Brazilian forests is the Forest Code (Law 12.651/2012), which aims at sustainable development and establishes, among others, general norms on the protection of vegetation, on the Permanent Preservation Areas (APP) and the Legal Reserve (RL) areas.

The establishment of APPs and RLs is fundamental for soil and water conservation. The definition of these areas is present in article 3. of Law 12.651 /*2012:*

> II - Permanent Preservation Area - APP: protected area, covered or not by native vegetation, with the environmental function of preserving water resources, the landscape, geological stability and biodiversity, facilitating the gene flow of fauna and flora, protecting the soil and ensure the well-being of human populations;
>
> III - Legal Reserve: area located within a property or rural possession, delimited under the terms of art. 12, with the function of ensuring the sustainable economic use of the rural property's natural resources, assisting in the conservation and rehabilitation of ecological processes and promoting the conservation of biodiversity, as well as the shelter and protection of wild fauna and native flora;

The law also regulates which areas are defined as APPs, in rural or urban areas: i) the marginal strips of any perennial and intermittent natural watercourse, excluding ephemeral ones, defined in meters of width according to the width of the bed channel regular river; ii) areas around natural lakes and lagoons defined according to occurrence zones; ii) the areas surrounding the artificial water reservoirs, resulting from damming or damming of natural

watercourses, within the range defined in the environmental license of the enterprise; iv) the areas surrounding the springs and perennial water holes, whatever their topographical situation, within a minimum radius of 50 (fifty) meters; v) slopes or parts thereof with a slope greater than 45º, equivalent to 100% (one hundred percent) in the line with the greatest slope; vi) sandbanks, such as fixing dunes or stabilizing mangroves; vii) mangroves, in all its extension; vii) edges of the boards or plateaus, up to the relief rupture line, in a strip never less than 100 (one hundred) meters in horizontal projections; ix) tops of hills, hills, mountains and mountains, according to the minimum height of elevation and slope; x) areas at an altitude above 1,800 (one thousand eight hundred) meters, regardless of the vegetation; xi) paths, the marginal strip, in horizontal projection, with a minimum width of 50 (fifty) meters, from the permanently marshy and waterlogged space.

Other areas may still be considered APPs, when declared of social interest by an act of the Chief of the Executive Branch, these being areas covered with forests or other forms of vegetation destined for one or more of the following purposes: i) contain soil erosion and mitigate risks of floods and landslides and rocks; ii) protect sandbanks or paths; iii) protect floodplains; iv) sheltering endangered fauna or flora; v) protect sites of exceptional beauty or scientific, cultural or historical value; vi) form protection strips along highways and railways; vii) ensure conditions of public welfare; vii) assist in the defense of the national territory, at the discretion of the military authorities.

With regard for RL, all rural property must maintain an area covered by native vegetation, as a Legal Reserve, without prejudice to the application of the rules on APPs. The minimum size of the RL is defined in relation to the area of the property, taking into consideration its location in the country and insertion biome.

According to the law, the location of the Legal Reserve area within the rural property must take into consideration: i) the hydrographic basin plan; ii) Ecological-Economic Zoning; iii) the formation of ecological corridors with another Legal Reserve, with a Permanent Preservation Area, with a Conservation Unit or with another legally protected area; iv) the areas of greatest importance for the conservation of biodiversity; and v) the areas of greatest environmental fragility.

As shown in the previous two paragraphs, APPs and RLs are the main areas to be preserved or conserved when seeking to conserve soil and water. Law 12,651/2012 is the main instrument for regulating these areas. This law also deals with the protection regime of APPs that must be maintained by the owner of the area, possessor or occupant in any capacity, individual or legal entity, under public or private law. It also addresses the RLs protection regime, which, in turn, must be preserved with native vegetation coverage by the owner of the rural property, owner or occupant in any capacity, individual or legal entity, public or private.

Law 12.651 /2012 innovates by establishing the Environmental Rural Registry (ERR), a national electronic public registry, mandatory for all rural properties, with the purpose

of integrating environmental information on rural properties and possessions, composing a database for control, monitoring, environmental and economic planning and combating deforestation.

The ERR must contain the identification of the property by means of a floor plan and descriptive memorial, containing the indication of the geographic coordinates with at least one mooring point on the perimeter of the property, informing the location of the remnants of native vegetation, the Permanent Preservation Areas, the Restricted Use Areas, the consolidated areas and, if any, also the location of the Legal Reserve. From the registration of the property in the ERR, the owner or possessor of a property that has a preserved Legal Reserve whose area exceeds the minimum required by this Law, may use the excess area for the purposes of establishing the Environmental Reserve Quota (ERQ), among others similar instruments.

The ERQ is also presented as an innovation of Law 12,651/2012, which is a nominative title representing an area with native vegetation, existing or in the process of recovery: i) under an environmental easement regime; ii) corresponding to the Legal Reserve area voluntarily established on vegetation that exceeds the percentages; iii) protected in the form of a Private Natural Heritage Reserve – RPPN; iv) existing on a rural property located within a Conservation Unit in the public domain that has not yet been expropriated.

From the registration of the property in the ERR, the owner or possessor of a property that has a Legal Reserve with a size smaller than the minimum required by this Law, must recompose the area, based on the establishment of the Environmental Regularization Program (ERP) regulations that will come being implemented by the Union and by the Federative Units.

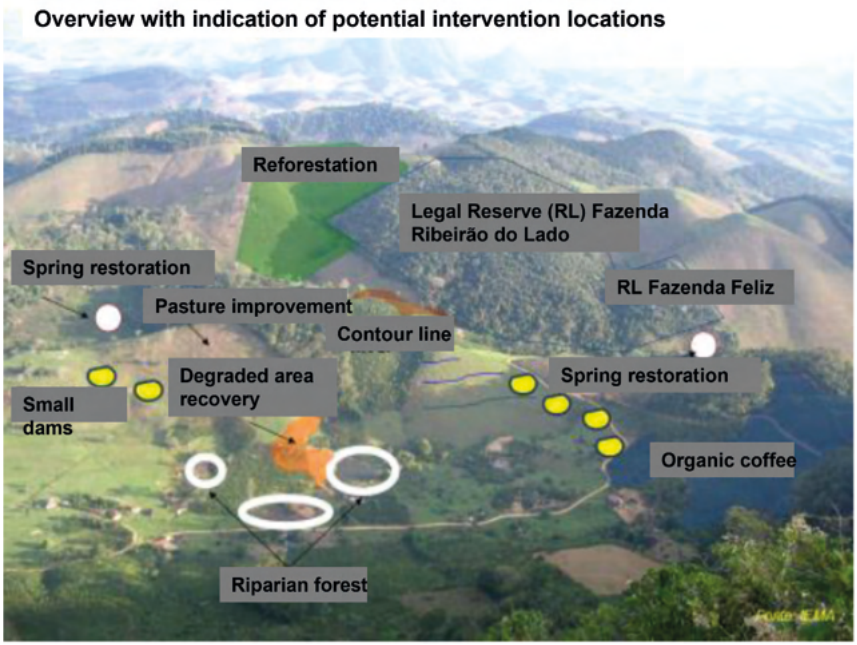

Figure 1: Informative Note – Water Producer Program (2018)

Additionally, Law 12,651/2012 establishes the Program of Support and Incentive to the Preservation and Recovery of the Environment as a form of promoting ecologically sustainable development, including, among others, lines of action regarding the payment or incentive for environmental services in return , monetary or not, to activities for the conservation and improvement of ecosystems and that generate environmental services, such as, individually or cumulatively: a) the sequestration, conservation, maintenance and increase of the stock and reduction of the carbon flow; b) the conservation of natural scenic beauty; c) the conservation of biodiversity; d) the conservation of water and water services; e) climate regulation; f) cultural appreciation and traditional ecosystem knowledge; g) soil conservation and improvement; h) the maintenance of Permanent Preservation Areas, Legal Reserve and restricted use.

This last program presents as a line of action the payment or incentive to environmental services as monetary retribution to the activities of conservation and improvement of ecosystems. This scope includes the **Water Producer Program**, implemented by the National Water Agency and partners. Figure 1 presents an overview with indication of potential intervention locations in typical properties in the southeast region of Brazil, with several actions to be performed, such as: reforestation, spring restoration, pasture improvement, riparian forest protection, degraded area recovery, etc.

5 | ECONOMIC SUSTAINABILITY, INTEGRATION, GOVERNANCE AND POLICIES

In terms of economic sustainability, as sources of funds can be mentioned: primary resources (concrete sources or firm revenues); derived resources (sources and financing mechanisms resulting from sectoral and regional development policies); traditional resources (financing resources); private resources (private banks, capital markets, insurance, futures markets) and international resources (resources from international financing agencies). Preliminary studies show that the potential for collecting water resources in Brazil is R$ 520 million / year, with a large concentration in the Paraná River Basin. However, the implementation of the collection entails several previous steps, in addition to relatively high transaction costs.

In addition, the following possibilities for expanding the resources and financial sustainability of SINGREH follow: advances in collection, both in terms of methodology, and in the implementation in new basins; improvement in the implementation of the PNMC, especially in mitigation and adaptation actions to climate change and REDD+; improving the articulation of water resources management with forest management; Improvement of the articulation of water resources management with land use and conservation management; greater links with States, Municipalities, state and sector funds and banks. Sources of funds for forest development stand out: National Fund for Forest Development (FNDF), Amazon Fund and National Environment Fund (FNMA).

As for the management of water resources in Brazil, this has developed in a fragmented and centralized way. In addition, each user sector (electricity, navigation, irrigated agriculture, sanitation) carried out its planning and actions in an individualized and disconnected manner. Since the 1980s, there has been an increasing progress towards decentralization and the participation of society in the decision-making process. In this sense, numerous technical tools of management (instrumental rationality) and negotiation (dialogical rationality) have been used in the instruments of Law 9.433 / 1997. Such instruments should be the stage for constant improvement and incorporation of new scientific and technological advances. In the case of forestry policy, in contrast to the water resources policy, it has been fragmented into several public bodies and has been decentralized since the last decade.

6 | FINAL CONSIDERATIONS

It appears that there must be greater integration between the PNRH and the PNMC and the Forest Policy. Therefore, an increase in the participation of civil society should be sought, in quantity and quality, in the Basin Committees, in the State Councils, in the National Water Resources Council - CNRH, in the Brazilian Forum on Climate Change and in the Management Commission Public Forests. In analyzing the implementation of the various instruments and programs established in these three policies, there is a need for

greater integration between them to ensure the participation of Society in decision-making processes. In addition, these policies need to ensure ecological restoration and soil and water conservation, as well as mitigate the adverse effects of climate change.

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