AMBIENTE & SOCIEDADE 25 anos 25 años 25 years

SciELO

Discourses on sustainable forest management in the Caatinga Domain

Marcelo Silva de Lucena [I]
Maria José Brito Zakia [II]
Natalia Guerin [III]

Abstract: Sustainable forest management (SFM) can harbor different discourses on sustainability. In this paper, based on discourse theory, the main ideas, concepts and narratives that have been proposed about the SFM of the native vegetation of the Caatinga Domain (DC) were characterized. Three main speeches were highlighted: a) Bioenergetic SFM: emphasizes the production of forest biomass to supply regional energy demands; additionally, it seeks to contribute strongly to the reduction of deforestation and forest conservation; b) Silvopastoral SFM: seeks to offer alternatives to improve forage availability; c) Non-timber SFM: seeks to value traditional knowledge about biodiversity, to expand the ways of managing multiple species and strengthen strategies for coexistence with the semi-arid region. The existence of different discourses, together with the range of sustainable practices they present, offers the opportunity for policy change and institutional innovation.

Keywords: Forest discourse; bioenergy; Silvopastoral systems; non-timber products; sustainability.

[I] *São Paulo State University (UNESP), School of Agriculture, Botucatu, São Paulo, Brazil.*

[II] *São Paulo State University (UNESP), School of Agriculture, Botucatu, São Paulo, Brazil.*

[III] *São Paulo State University (UNESP), School of Agriculture, Botucatu, São Paulo, Brazil.*

São Paulo. Vol. 26, 2023

Original Article

DOI: http://dx.doi.org/10.1590/1809-4422asoc20220042vu2023L4OA

Introduction

Essentially, sustainable forest management (SFM) is conceived as management practices that result in the production of forest goods and services to meet the economic, social, and cultural demands of societies while simultaneously ensuring forest conservation and the generation of environmental benefits (MACDICKEN *et al.*, 2015; FAGGIN; BEHAGEL, 2017; LINDAHL; SANDSTRÖM; STÉNS, 2017).

However, the understanding and practices arising from the implementation of SFM can change over time and vary based on the specific location in which societies are situated. This is because SFM can be structured based on different knowledge and perspectives related to the management of forest systems, which can vary depending on different political, social, and cultural conceptions (FAGGIN; BEHAGEL; ARTS, 2017; KRÖGER; RAITIO, 2017; LINDAHL; SANDSTRÖM; STÉNS, 2017).

Therefore, SFM, similar to concepts like "development" and "sustainability," emerges as an essentially political process, and as such, it can prioritize various production goals and different understandings of how to achieve environmental, economic, and social sustainability (LINDAHL *et al.*, 2016; LINDAHL; SANDSTRÖM; STÉNS, 2017).

These different ways of conceiving SFM can be shaped by factors that encompass historical context, institutional behavior, socio-economic characteristics, and the understanding that actors have regarding the socio-ecological system[1] in which the resources are embedded (LINDAHL *et al.*, 2016; KRÖGER, 2017; SANDSTRÖM; LINDAHL; STÉNS, 2017).

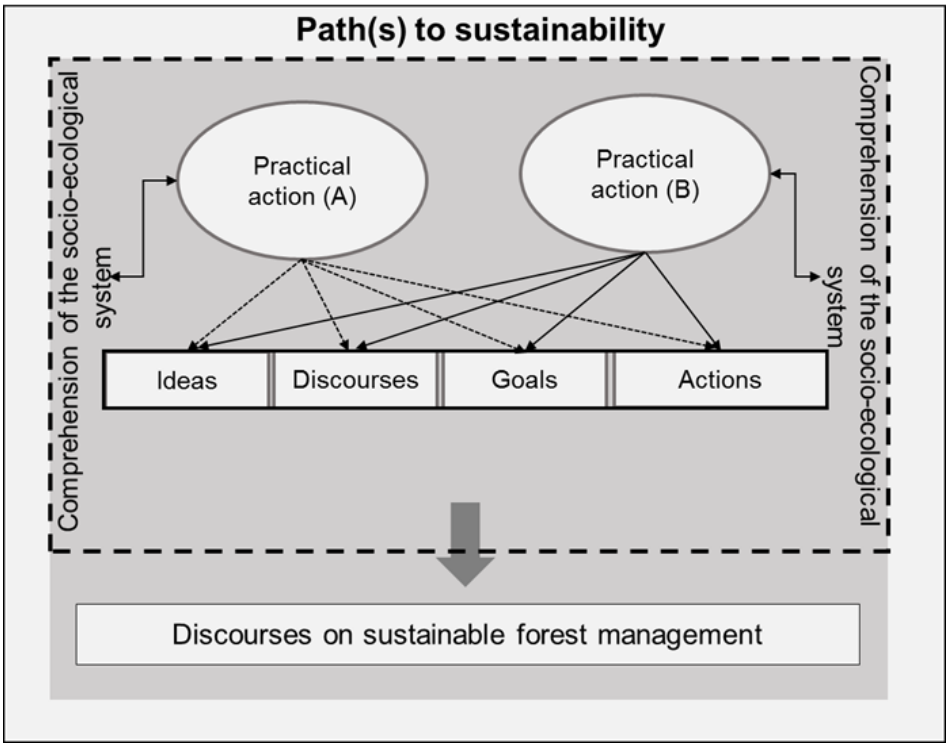
Hence, SFM has been analyzed and understood according to the discourse theory (ARTS; BUIZER, 2009; ARTS *et al.*, 2010; KRÖGER; RAITIO, 2017). Discourses are understood as ideas, concepts, and categorizations that aim, through the production, reproduction, and transformation of understandings and attitudes, to make sense of physical and social realities (HAJER; VERSTEEG, 2005; TORFING, 2005 PÜLZL; KLEINSCHMIT; ARTS, 2014).

In different countries and regions, discourses on SFM incorporate and interact with other forestry, environmental, or social discourses, and they vary depending on the influence and relationship, for example, with ideals related to "development," "growth," and "sustainability" (LINDAHL; BAKER; WALDENSTRÖM, 2013; KRÖGER, 2017; LINDHAL; SANDSTRÖM; STÉNS, 2017).

Figure 1 illustrates how different political and historical experiences can, based on the specific understanding of the socio-ecological system and various social ideals, lead to different ideas, concepts, objectives, and practical solutions that result in the conception of different discourses on SFM.

1 - Socio-ecological systems comprise the interaction of ecological and human systems that results from specific social, economic, cultural and political configurations, which are considered conditioning factors for the action of users and resource management systems (OSTROM, 2009; BUSCHBACHER, 2014; SILVA *et al.*, 2017; MARQUES *et al.*, 2020).

Figure 1 – Analytical framework: preparing speeches about SFM



Source: Lucena; Zakia and Guerin (2023)

Alternative discourses on SFM can coexist in socio-ecological contexts that encompass multiple proposals and demands regarding resource management (LINDAHL *et al.*, 2016) and this may be the case in the Caatinga Domain (CD) in the Brazilian semi-arid region. The CD is a heterogeneous region in terms of climate, soil, ecology, and social aspects (ALVARES *et al.*, 2013; QUEIROZ *et al.*, 2017; SILVA; SOUZA, 2018). It covers 12% of the national territory and is home to approximately 28 million inhabitants, of which 38% reside in rural areas (BRASIL, [S.d.]).

Its forest resources hold significant socioeconomic importance for both local industrial and commercial sectors (RIEGELHAUPT; PAREYN, 2010a; RIEGELHAUPT *et al.*, 2017) and the maintenance of traditional livestock production (ARAÚJO FILHO, 2013; PINHEIRO; NAIR, 2018) and other productive forms that are socially integrated into local practices (ALBUQUERQUE *et al.*, 2017; MELO, 2017).

Therefore, an understanding of the discourses about the SFM of the native vegetation in the Caatinga Domain allows us to assess the perspective they convey regarding the utilization of forest resources, how to attain environmental, ecological, and socio economic goals, and also comprehend how they are linked to forest policy, institutional actions, and proposals concerning the legal regulation of management (ARTS; BUIZER,

2009; LINDAHL; BAKER; WALDENSTRÖM, 2013; KRÖGER, 2017). Therefore, our goal is to characterize the main ideas, concepts, and narratives that make up the discourses about the SFM of the native vegetation in the Caatinga Domain.

Methodology

The present study was conducted based on a literature review and document analysis, grounded in the theory of discourses, as described below.

In the preliminary search phase, we accessed Google Scholar and searched for articles and literature reviews published up to the year 2021 using the keywords "forest management in the Caatinga," "sustainable management in the Caatinga," "sustainable forest management in the Caatinga," and "history of forest management implementation in the Caatinga".

Subsequently, we conducted a search in the CAB Direct database, covering the topics of timber forest management, silvopastoral management, and non-timber forest products management in the Caatinga Domain. The search heuristics were defined as follows: a) "Caatinga" AND "sustainable forest management"; b) "Caatinga" AND "Silvopasture" or "Caatinga" AND "silvopastoral systems" OR "Agroforestry systems"; c) "Caatinga" AND "NWFP" or "Caatinga" AND "non-timber products." We did not specify a starting date for publications, but we considered the year 2021 as the final period. Among the documents analyzed, there was no material published before the year 1980.

In the second phase, following the reading of the researched materials, we applied the "snowballing" procedure (FAGGIN; BEHAGEL; ARTS, 2017) and selected documents related to the researched topics. We also gathered information from institutional archives, including documents produced by governmental agencies, institutional reports and policies, legislative documents, opinion articles, and materials resulting from the "Public consultation for the creation of the Conama Resolution on Sustainable Forest Management in the Caatinga biome" (conducted in 2021), including their opinions, technical notes, and reports.

For the methodological classification of the documents collected in the two search phases, we adopted the definitions presented in Table 1.

Table 1 - Definitions adopted to select the evaluated documents

Bioenergetic SFM	Silvopastoral SFM	Non-timber SFM
The application of silvicultural interventions and practices based on technical knowledge (including techniques for harvesting, management, silvicultural treatments, and regeneration) on native vegetation to produce firewood, charcoal, and/or other woody products primarily used as a source of thermal/heat energy while considering the maintenance of the sustaining and/or regenerating mechanisms of the managed forest.	The application of manipulation techniques and silvicultural practices based on technical knowledge (including thinning, pollarding, and/or thinning) on woody native vegetation, aiming to provide or increase the production of woody forage and/or improve the quality and quantity of herbaceous forage, while considering the maintenance of the sustaining and/or regenerating mechanisms of the managed forest.	The application of silvicultural techniques and interventions based on technical knowledge, aiming to produce or exploit non-timber forest products, including medicinal, beekeeping, oil-bearing, fibrous, waxy, tannin-rich, ornamental, and beekeeping products, while considering the maintenance of the sustaining and/or regenerating mechanisms of the managed forest.

Source: Lucena; Zakia and Guerin (2023)

In the refinement stage, the documents were read to determine whether their content, whether technical, political, normative, or opinion-based, aligned with the scope of the SFM definitions contained in Table 1. Subsequently, the analysis aimed to identify and categorize the usage of concepts, narratives, and ideas that characterized potential discourses on SFM in the Caatinga Domain.

To do this, we based our approach on discourse theory. This theory assumes that there are multiple political realities, and these realities are the result of processes that are constructed through socio-historical elements. It emphasizes the social relationships through which phenomena are elaborated and modified, prioritizing an understanding of how a phenomenon is addressed by society (HAJER; VERSTEEG, 2005; TORFING, 2005; HAJER, 2006; BRITES, 2020).

The discourse approach asserts that language, instead of being a neutral reflection of reality, is used as a means to shape our perception of reality (HAJER; VERSTEEG, 2005; TORFING, 2005), as discourses are endowed with performative power. They shape the perspectives of actors, influence their behavior, impact their beliefs and interests, and drive institutional changes (ARTS; BUIZER, 2009; ARTS *et al.*, 2010; PÜLZL; KLEINSCHMIT; ARTS, 2014; KRÖGER; RAITIO, 2017).

Results

The discursive ideas vary depending on the objectives to be achieved by the proposed MFS types. Although there are common narratives, differences include the conception of use of forest resources and the treatment given to sustainability issues (TABLE 2).

Table 2 – Main characteristics of speeches about sustainable forest management in the Caatinga Domain

Key Ideas and Discursive Narratives	Discourses		
	Bioenergetic SFM	**Silvopastoral SFM**	**Non-timber SFM**
"Conception of use of native forest resources: main goals of SFM."	Sources of biomass energy to meet industrial, commercial, and manufacturing demands.	An alternative to improve the qualitative and quantitative forage supply, aiming to boost regional livestock productivity.	A source of multiple species, "unconventionall" forms of use, and productive materials to increase development possibilities.
Main aspects of environmental sustainability resulting from the application of the proposed SFM	a) Bioenergetic SFM proposed as an alternative to reducing deforestation. b) Subsequently, SFM proposals incorporated discourses related to biodiversity conservation, climate change mitigation, and coexistence with desertification. c) Forest conservation is presented as an outcome of SFM implementation (maintenance of structural aspects, biodiversity, and carbon stocks of native forests).	a) Facilitating the coexistence of rural populations with semi-arid conditions. b) Conservation as a tool to maintain long-term productivity, reduce pasture and soil degradation, and decrease the risk of desertification. c) Contributing to the development and environmental sustainability of semi-arid landscapes.	a) Facilitate the coexistence of rural populations with semi-arid conditions and desertification; b) Conservation of biodiversity and adaptation to climate change.
Key aspects of social sustainability resulting from the application of the proposed SFM	a) Contribute to generating income and reducing poverty among rural populations; b) prevent rural exodus.	a) Contribute to generating income and reducing poverty among rural populations; b) prevent rural exodus.	a) Contribute to generating income and reducing poverty among rural populations;
Emphasizes small rural properties	Suitable for small, medium and large properties;	Approach to regional land tenure issues	Suitable for small, medium and large properties;

Influence on formal forest management	Greater influence on formal regulation of the SFM	Little influence on formal regulation of the SFM	Little influence on formal regulation of the SFM
Main common discursive element	Difficulties in implementation and dissemination related to the characteristics of forest management operating in DC		

Source: Lucena; Zakia and Guerin (2023)

Bioenergetic SFM

The discourse on bioenergetic SFM originates from initiatives developed after the 1980s, which focused on industrial energy supply. The main purpose of this forestry production model is to legally and sustainably meet the energy demands of local industries and businesses, without resulting in the degradation and deforestation of native forests.

This discourse had, over time, a strong influence on the direction of state action and on research into the development of technical-scientific knowledge necessary to achieve its objectives (FIGUEIRÔA *et al.*, 2006; SANTANA, 2017; MILLIKEN *et al.*, 2018; PAREYN *et al.*, 2020). The FAO project in the 1980s, for example, focused its research on the use of forest resources as an energy source (FAGGIN; BEHAGEL, 2017).

At the same time, environmental agencies, especially IBAMA, increased control over the use of native forest resources as a source of energy biomass, leading industries to readjust their energy supply. The increased risk of receiving fines for the use of illegal forest biomass has driven industries to purchase firewood and charcoal from licensed SFM plans (FAGGIN; BEHAGEL, 2018).

Therefore, it has been stated that, in the Caatinga Domain, the transition from extractive consumption of firewood and charcoal to forestry of exotic species and the implementation of the SFM of native forests was driven by the needs of the industrial sector, mainly red ceramic industries, cement and lime, main consumers of forest biomass energy (BICHEL; TELLES, 2021).

At the same time, the federal government encouraged the bioenergy SFM as a way to reduce deforestation and forest degradation (FAGGIN; BEHAGEL; ARTS, 2017). Concerns were based on the fact that 25 to 30% of regional energy demand was supplied by DC woody sources and that, annually, up to 80% of demand was met by unsustainable management, including deforestation and illegal logging (PAREYN, 2010a; RIEGELHAUPT; PAREYN, 2010; FAGGIN; BEHAGEL; ARTS, 2017).

In this sense, the DC SFM reveals the influence of the deforestation discourse. The global discourse on forest deforestation consolidated after the 1980s, motivated by concern about the destruction of tropical forests. It then moved towards the metadiscourse of sustainable development and began to encompass issues such as biodiversity loss, poverty reduction and climate change mitigation via reducing CO2 emissions arising from deforestation (ARTS *et al.*, 2010).

Therefore, connecting the bioenergetic SFM discourse with other global forestry discourses made it possible to integrate elements and ideas that were under develop-

ment. Thus, under the influence of the sustainable development discourse, bioenergetic SFM is proposed as a way to contribute both to the mitigation of climate change and deforestation and to improving socio-ecological resilience (RIEGELHAUPT; PAREYN; GARIGLIO, 2010; GAMA, 2021).

In this context, it is expected, with bioenergetic MFS, to initiate an energy transition to replace fossil and finite fuels, the use of which results in worsening climate change, to the use of forest biomass as a sustainable and renewable alternative (RIEGELHAUPT; PAREYN, 2010). It is also presented as a strategy for forest conservation because the biodiversity associated with native vegetation cover would be conserved in management areas, as 70-80% of the managed property area would be maintained with vegetation cover during the cutting cycle (FAGGIN; BEHAGEL; ARTS, 2017; GARLET; CANTO; OLIVEIRA, 2018; PAREYN *et al.*, 2020).

It is also argued that the bioenergetic SFM provides social advances, mainly income generation and poverty reduction for rural populations. For the speeches, its socioeconomic benefits are enhanced in the face of the social and productive conditions of traditional economic activities, seen as having low economic returns (GARIGLIO et al., 2010; GARIGLIO; BARCELLOS, 2010; FAGGIN; BEHAGEL, 2017; COELHO JUNIOR *et al.*, 2020). It is expected, therefore, that the bioenergetic SFM will enable, based on the expectation of greater gains from the sale of bioenergetic wood resources, sustainable profitability, especially for small and medium-sized landowners (RIEGELHAUPT; PAREYN; GARIGLIO, 2010; GARLET; CANTO; OLIVEIRA, 2018; COELHO JUNIOR *et al.*, 2019; GAMA, 2021).

These ideas and narratives greatly influenced institutional action and supported a forestry policy aimed at producing bioenergy originating from native vegetation. In this context, from 1980 to 2009, at least 5 Normative Instructions were published by the Federal Government to regulate the environmental licensing of bioenergy SMF plans. As of 2020, a working group (MMA; IBAMA, 2020) was established to deal with proposals to change the formal regulation of DC's timber SFM, whose provisions reaffirmed the need for the production of forest biomass for sustainable energy supply.

Thus, approximately 40 years after the initial discussions, the persistence of this perspective reflects concerns about how to sustainably meet energy demands, now coupled with debates on the need for technological investments to improve the energy efficiency of wood-burning processes in kilns or charcoal production (IBAMA, 2021c).

Silvopastoral SFM

Discourses on Silvopastoral SMF include arguments that go beyond the social relevance of the traditional pastoral use of native vegetation, historically considered as the food base for livestock. It reasons that this form of forage supply needs to be improved, because the insufficient availability and "low" quality of native forage, especially in the dry period, result in low animal productivity (MENEZES; BAKKE; BAKKE, 2009; PEREIRA FILHO; BAKKE, 2010; ARAÚJO FILHO, 2013, 2014).

The speeches state that the qualitative and quantitative availability of native forage is "limited" throughout the year. In the rainy season, the production of herbaceous forage is restricted by the soil cover by the forest canopy, while woody forage is located in canopy positions not accessible to animals. In the dry season, although forest litter is an important food source, its nutritional value is "low" and herbaceous forage is practically unavailable (PFISTER *et al.*, 1983; KIRMSE, PROVENZA, MALECHEK, 1987; ARAÚJO FILHO, 2013).

For this reason, discourses on the Silvopastoral SFM recommend the application of woody vegetation manipulation techniques as a way of improving forage availability and increasing the support capacity of pastures, aiming to achieve "high" animal production rates (PEREIRA FILHO; BAKKE, 2010; ARAÚJO FILHO, 2013), which would make it possible to satisfactorily develop livestock farming in the adverse conditions of the semi-arid region (BAKKE et al., 2010), since livestock farming is considered a central subsistence strategy for local populations (CÂNDIDO; ARAÚJO; CAVALCANTE, 2005; FAGGIN; BEHAGEL; ARTS, 2017).

In addition to ensuring the economic viability of regional livestock farming, with the Silvopastoral SFM it would also be possible to align the need for forest conservation with the continuous forage productivity of managed forests, resulting in environmental sustainability (HARDESTY; BOX; MALECHEK, 1988; ARAÚJO FILHO, 2013).

Even with the use of more intense management practices, such as thinning, environmental conservation would be promoted by maintaining at least 400 trees per hectare (equivalent to 40% of canopy coverage), while productive sustainability would be promoted by the use of a grazing intensity appropriate to local characteristics, with a maximum annual consumption of 60% of the available forage (ARAÚJO FILHO, 2013, 2014; PINHEIRO; NAIR, 2018).

In this perspective, maintaining timber cover in these silvopastoral systems would serve the preservation of native vegetation biodiversity and rain interception, contributing to soil erosion and runoff control, organic matter input, soil fertility maintenance, and providing thermal comfort. Furthermore, the maintenance of at least 40% of available forage would protect the soil against wind erosion during the dry period and the early rainy season, adding organic matter, reducing water losses, and enhancing seed bank protection (PFISTER *et al.*, 1983; ARAÚJO FILHO, 2013).

Environmental sustainability is, from the perspective of the Silvopastoral SFM, mainly related to the reduction of desertification risks due to the use of appropriate grazing practices. Such concerns are in line with the speeches and intentions of the United Nations Convention to Combat Desertification since soil degradation is identified as one of the main vectors of desertification in semi-arid regions (SIEGMUND-SCHULTZE, 2021).

The conservation of floristic biodiversity is considered the foundation of Silvopastoral SFM because plant communities are understood as key elements for the conservation and renewal of ecosystem resources. Therefore, not ensuring the conservation of biodiversity would fail to obtain other results. Furthermore, diverse vegetation is expected to present better resilience, more easily absorbing the effects of sudden and intense changes

in environmental factors (ARAÚJO FILHO, 2013, 2014).

As to other conservation mechanisms, the Silvopastoral SMF only presents the reduction of deforestation as an indirect effect, as it is argued that, by increasing productivity and achieving higher animal yield rates, the need to access new areas to include them in livestock production is expected to be reduced.

From a social point of view, discourses on Silvopastoral SFM refer to the fact that livestock farming is "historically integrated" into the rural way of life in DC. The approaches are based on the assumption that, as the vast majority of rural properties in DC are small in size (90% of properties are smaller than 50 hectares – IBGE, 2021), sustainable forestry-pastoral systems would play a fundamental role in ensuring the food and economic security, especially for "small producers" (ARAÚJO FILHO, 2013; PINHEIRO; NAIR, 2018).

Despite its widely recognized importance, it is argued that sustainable silvopastoral MFS lacks a consolidated and legitimized formal regulation, the absence of which poses difficulties for the diffusion of technologies and social acceptance of these systems (ARAÚJO FILHO, 2014). In fact, even though there have been times in the history of formal MFS regulation when pastoral use of managed forest areas was allowed, the majority of formal rules supporting MFS implementation are fundamentally related to fuelwood charcoal production (bioenergy-oriented MFS).

Recently, the proposal to change and update the guidelines for licensing the Sustainable Forest Management Plans-PSFM for timber purposes [bioenergy] established the permission of animals in the managed area. As expressed in the discussion process, this change reflects the need to adapt institutional protocols to the socio-environmental reality, aiming to meet timber and forage demands, through sustainable bioenergetic and Silvopastoral management. According to this regulatory change, grazing is permitted in managed areas, as long as the technical criteria for pasture support capacity are followed, defined by studies by the National Center for Goats and Sheep-Embrapa (IBAMA, 2021c), which encompasses the maintenance of woody regeneration and animal support capacity that is indicated by academic literature and expressed in the resolution (CONAMA, 2021).

Non-timber SFM

Discourses regarding non-timber SFM recognize that this form of forestry production can provide sustainable alternatives for the exploitation of vegetation, through increased knowledge about the sustainable use of so-called "unconventional"[2] species, including beekeeping, medicinal, fruit, producers of oils, waxes, tannins, ornamental and fibrous plants, as well as other uses associated with local sociocultural practices (ALBUQUERQUE; ANDRADE, 2002; PAREYN, 2010b; LUCENA *et al.*, 2012; MEDEIROS; ALBUQUERQUE, 2014).

2 - Although the authors do not clearly define the term "unconventional species", the context of the works suggests that reference is made to species that are not usually used and those for which management techniques are not known, which leads to the development of knowledge.

The perspective is that, based on the appreciation and knowledge of biodiversity, it may be possible to increase the number of species used, guarantee their conservation, provide options for family farming to diversify cultivation, provide investment alternatives for the business sector and reduce food vulnerability. Therefore, through the use of multiple species adapted to local conditions, we seek to contribute to economic and social development and promote environmental sustainability (CORADIN; CAMILLO; PAREYN, 2018; QUEIROZ *et al.*, 2018).

Strategies for the development of non-timber SFM are based on the use and improvement of knowledge that local populations have developed about multiple herbaceous and woody species over centuries of coexistence with the semiarid region (MENEZES; BAKKE; BAKKE, 2009; CORADIN; CAMILLO, 2018).

Therefore, taking advantage of this traditional knowledge, its applications and the ease of access to NTFPs, the perspective is that it is necessary to develop sustainable management alternatives to guarantee productive means "for a population devoid of viable productive alternatives" (PAREYN, 2010b), aiming to maintain the socio-ecological and economic resilience of rural populations in DC (FAGGIN; BEHAGEL, 2018).

For this reason, it is argued that non-timber SFM is related to a broader strategy of coexistence with the semi-arid region. In this sense, these initiatives are linked to the Brazilian strategy to combat desertification, in accordance with the 1995 United Nations Convention to Combat Desertification (UNCCD) (FAGGIN; BEHAGEL, 2017) and are considered a way to circumvent future limitations imposed due to variability resulting from climate change and extreme and uncertain environmental conditions (CORADIN; CAMILLO, 2018; QUEIROZ *et al.*, 2018).

The speeches propose that with the sustainable use of "unconventional" species, it is possible to contribute to conserving biodiversity, which would be an important contribution to the implementation of the Aichi National Targets (CORADIN; CAMILO; PAREYN, 2018). Thus, the non-timber SFM seeks to promote conservation, with the relevant social result of improving the living conditions of local populations (FAGGIN; BEHAGEL, 2018).

Therefore, based on the assumption that the usual conception of the SFM concept encompasses the satisfaction of the needs and interests of local communities, the need to include, in proposals for formal regulation of SFM in DC, socially incorporated practices of use of forest resources (including non-timber SFM), aiming to produce greater social legitimization of SFM by local populations (FAGGIN; BEHAGEL; ARTS, 2017). However, the formal regulation of non-timber SFM is not clearly defined by environmental agencies and, therefore, is not considered illegal or legal, even when it involves sustainable practices (FAGGIN; BEHAGEL; ARTS, 2017).

Discussion

The three main discourses highlighted address debates on sustainability (climate change, desertification, deforestation and socioeconomic benefits, for example) mainly

due to the objectives that each SFM seeks to justify, as well as its historical development and the action of the stakeholders involved in each discourse. However, even while emphasizing different practical forms of SFM implementation, many argumentative constructs are common, such as the conservation of biodiversity and poverty reduction as achievable objectives.

Another argument common to the three discourses concerns the difficulties in implementing and disseminating sustainable practices. It is argued that achieving environmental sustainability may not be feasible if there is no change in the stance of forest management operating in DC. The necessary actions would include specialized technical assistance, rural extension, strengthening the technical staff of state environmental agencies, monitoring illegal intervention practices in forests, and environmental education (NUNES; BENNETT; MARQUES, 2014; FAGGIN; BEHAGEL; ARTS, 2017; FAGGIN; BEHAGEL, 2018; SIEGMUND-SCHULTZE, 2021).

Furthermore, it is possible to state that, while bioenergetic SFM is the result of a set of social power relations between international organizations, governments, and market actors, which directly influenced research design, policy, and implementation strategies (FAGGIN; BEHAGEL; ARTS, 2017), the proposals related to the Silvopastoral SFM are mainly associated with local institutions whose central objective is to produce strategies for coexistence with the semi-arid conditions where CD primarily occurs (FAGGIN; BEHAGEL, 2017; FAGGIN; BEHAGEL, 2018).

As for non-timber SFM, it was not possible to clearly define these characteristics, although the literature indicates that this initiative is more associated with movements that are interested in providing alternatives to strengthen the productive systems of rural populations based on the development of production chains and improvement of markets for these products.

As speeches are not just empty words (ARTS; BUIZER, 2009), we note that the three speeches have different levels of influence on institutional and governmental action and, therefore, have different weights on the design of DC forestry policy management. This aspect is evidenced by the fact that, since the beginning of SFM regulation, there has been a targeted emphasis and greater institutional incentive for bioenergetic SFM, as revealed by the Normative Instructions published by federal regulatory bodies since the 1980s, although on specific occasions some Normative Instructions have sought to regulate the pastoral use of areas that were managed for the purpose of bioenergy production (similar to what occurred with the recent resolution proposal discussed by CONAMA from 2020 onwards).

Although it has been reaffirmed, during the discussion on changing the CONAMA Resolution that deals with bioenergetic management (MMA; IBAMA, 2020), that non-timber production, when carried out properly, contributes to socioeconomic development, generating work and income for the populations involved (IBAMA, 2021c), the recent proposal to update the standards for sustainable exploitation of DC forest resources did not cover non-timber SFM.

Although the need for approval of a forest management plan by a competent body

is not explicitly expressed in Law 12,651/2012 (BRASIL, 2012), the systemic interpretation of said Law suggests that the commercial exploitation of NTFPs must meet specific technical criteria, in accordance with the provisions of article 31 of the same Law.

This understanding is possible because:

a) although Article 3, Section X, of Law 12,651/2012 considers the extraction of NTFPS as an "occasional or low environmental impact activity," it must ensure the "preservation of the existing native vegetation cover and not harm the environmental function of the area," and is only permitted within a "community and family context";

b) Article 21 of the same Law states that, within the legal reserve area, "the collection of non-timber forest products is allowed [...], subject to the following requirements": I - compliance with collection periods and volumes established in specific regulations, when applicable; II - consideration of the fruit and seed ripening periods; III - using techniques that do not endanger the survival of individuals and the collected species in the case of collecting flowers, leaves, barks, oils, resins, vines, bulbs, bamboos, and roots;

c) Article 22 of the mentioned Law stipulates that "Sustainable forest management of the vegetation within the Legal Reserve for commercial purposes requires authorization from the competent authority and must comply with the following guidelines and instructions": I - not altering the native vegetation cover and not compromising the conservation of native vegetation in the area; II - ensuring the maintenance of species diversity; III - managing exotic species with measures that promote the regeneration of native species;

d) Article 35 of the same Law makes it clear that there is a need for the control of the origin of wood, charcoal, and other forest products or by-products. The implementation of this control should include a national system that integrates data from different federal entities, coordinated, monitored, and regulated by the competent federal body of the Sisnama.

From the understanding of the characterized discourses, it is possible to affirm that Brazilian forest management presents paths to sustainability based on the management of native vegetation that go beyond what Kröger (2017) called the "brown economy" discourse - the replacement of native vegetation for the implementation of large-scale crops and forestry plantations to produce, mainly, agricultural and forestry commodities for export (KRÖGER, 2017).

However, discourses on the DC SFM share many of the widespread desires for the "brown economy", especially when they argue that the sustainability challenges involve providing productive alternatives to reduce poverty, provide greater development and progress, and produce social well-being (KRÖGER, 2017; LINDAHL; SANDSTRÖM; STÉNS, 2017).

Finally, the discourses on DC's SFM strongly represent the implementation of the principles of the ecological modernization discourse, whose operation is based on the idea that continued economic growth and development can be aligned with environmental

protection. Therefore, instead of seeing natural resources as limited, environmental degradation and externalities are considered as a problem that can be solved through strong technological progress and technical development (BAKER, 2007; ARTS *et al.*, 2010; PÜLZL; KLEINSCHMIT; ARTS, 2014).

Final considerations

We found the existence of three main discourses on DC SFM: bioenergetic SFM, Silvopastoral SFM and non-timber SFM, which, in general, present many common ideas and narratives, but also harbor parallel and, at times, competing forms on how to address the environmental and social aspects of SFM.

The differences in discourse primarily arise as the objectives that each discourse seeks to justify vary, and therefore, from the incorporation and connection to different environmental discourses that can reinforce the sustainability potentials that each proposal encompasses.

We found a strong relationship between the three discourses and the ideals proposed by the meta-discourse of ecological modernization since the three proposals seek to employ continuously improved technical knowledge to increase forestry production with a view to socioeconomic growth, because they understand that it is perfectly possible to align economic growth with environmental conservation.

However, the discursive arguments bring restricted considerations about the limitations that semi-arid conditions impose on the proposed production models, as negative externalities are expected to be solvable through technological progress and scientific knowledge that support management actions.

Formal regulation has prioritized bioenergetic SFM, disregarding that the existence of different discourses on SFM offers an opportunity for political change, institutional innovation, and the appreciation of potentially sustainable practices that different visions of multiple-use SFM represent.

Therefore, the development of public policies to regulate and encourage SFM in DC must incorporate actors who represent different discourses on SFM, so that their propositions, demands, and proposed solutions are evaluated to meet the needs of different users of forest products, aiming to promote greater levels of environmental sustainability.

It is always necessary to evaluate and develop new research to avoid misalignment between the discourses and the results of the implementation of silvicultural practices proposed by the different paths for SFM since the search for sustainability involves the equation of situations and realities that are complex and changeable.

Acknowledgments

To the Coordination for the Improvement of Higher Education Personnel - Brazil (CAPES) - Financing Code 001. To Frans Pareyn, the Associação Plantas do Nordeste (APNE) and the Forest Hydrology Laboratory of the Foundation for Agricultural and Forestry

Studies and Research.

Referências

ALBUQUERQUE, U. P. et al. People and Natural Resources in the Caatinga. In: SILVA, J. M. C.; LEAL, I. R.; TABARELLI, M. (org.). **Caatinga**: The Largest Tropical Dry Forest Region in South America. Cham: Springer International Publishing, 2017. p. 303–333. doi: 10.1007/978-3-319-68339-3_11

ALBUQUERQUE, U. P.; ANDRADE, L. D. H. C. Conhecimento botânico tradicional e conservação em uma área de caatinga. **Acta Botanica Brasilica**, [s. l.], v. 16, n. 3, p. 273–285, 2002. doi: 10.1590/S0102-33062002000300004

ALVARES, C. A. et al. Köppen's climate classification map for Brazil. **Meteorologische Zeitschrift**, [S. l.], v. 22, n. 6, p. 711–728, 2013. doi: 10.1127/0941-2948/2013/0507

ARAÚJO FILHO, J. A. **Manejo Pastoril Sustentável da Caatinga**. Recife: Projeto Dom Helder Câmara, 2013. 200p.

ARAÚJO FILHO, J. A. **Proposta Para a Implementação Do Manejo Pastoril Sustentável da Caatinga**. [S. l.]: Ministério do Meio Ambiente, 2014. 135p.

ARTS, B.; BUIZER, M. Forests, discourses, institutions. A discursive-institutional analysis of global forest governance. **Forest Policy and Economics**, [s. l.], v. 11, n. 5–6, p. 340–347, 2009. doi: 10.1016/j.forpol.2008.10.004

ARTS, B. et al. Discourses, actors and instruments in international forest governance. In: RAYNER, J.; BUCK, A.; KATILA, P. (org.). **Embracing complexity**: Meeting the challenges of international forest governance. A global assessment report. Vienna: International Union of Forest Research Organizations, 2010. p. 57–74. Disponível em: < https://edepot.wur.nl/163887>

BAKER, S. Sustainable development as symbolic commitment: Declaratory politics and the seductive appeal of ecological modernisation in the European Union. **Environmental Politics**, [s. l.], v. 16, n. 2, p. 297–317, 2007. doi: 10.1080/09644010701211874

BAKKE, O. A. et al. Produção e utilização da forragem de espécies lenhosas da Caatinga. In: GARIGLIO, M. A. et al. (org.). **Uso sustentável e conservação dos recursos florestais da Caatinga**. Brasília: Serviço Florestal Brasileiro, 2010. p. 160–173.

BICHEL, A.; TELLES, T. S. Spatial dynamics of firewood and charcoal production in Brazil. **Journal of Cleaner Production**, [S. l.], v. 313, p. 127714, 2021. doi: 10.1016/j.jclepro.2021.127714

BRASIL. **Lei nº 12.651, de 25 de maio de 2012**. Dispõe sobre a proteção da vegetação nativa; e dá outras providências.

BRASIL. **O Semiárido Brasileiro** [s. l.], [s. d.]. https://www.gov.br/mcti/pt-br/rede-mcti/insa/

semiarido-brasileiro. Acesso em: 14 dez. 2021.

BRITES, A. D. A implementação do novo Código Florestal no estado de São Paulo: uma análise de discurso. **Revista Brasileira de Meio Ambiente**, [s. l.], v. 045, p. 23–45, 2020. Disponível em: <https://revistabrasileirademeioambiente.com/index.php/RVBMA/article/view/516/251>

BUSCHBACHER, R. A Teoria da Resiliência e os Sistemas Socioecológicos: como se preparar para um futuro imprevisível? **Boletim Regional, Urbano e Ambiental**, [s. l.], v. 09, p. 11–24, 2014. Disponível em: < https://repositorio.ipea.gov.br/handle/11058/5561>

CÂNDIDO, M. J. D.; ARAÚJO, G. G. L.; CAVALCANTE, M. A. B. Pastagens no ecossistema semi-árido brasileiro: atualização e perspectivas. **Revista da Sociedade Brasileira de Zootecnia**, [s. l.], v. 42, p. 85–94, 2005. Disponível em: <https://www.alice.cnptia.embrapa.br/alice/bitstream/doc/155827/1/Pastagensnoecossistemasemiaridobrasileiro...v.42p.8594Class363R444a.pdf>

COELHO JUNIOR, L. M. et al. Regional Concentration of The Gross Production Value of Firewood in Paraíba. **Floresta e Ambiente**, [S. l.], v. 26, n. 3, p. 20170887, 2019. doi: 10.1590/2179-8087.088717

COELHO JUNIOR, L. M. et al. Avaliação do uso do solo e dos recursos florestais no semiárido do estado da Paraíba. **Ciência Florestal**, [S. l.], v. 30, n. 1, p. 72, 2020. doi: 10.5902/1980509830381

CONAMA – CONSELHO NACIONAL DO MEIO AMBIENTE. **Minuta de Resolução CONAMA para o Manejo Florestal Sustentável da Caatinga**. Brasília, 2021.

Disponível em: < https://www.gov.br/ibama/pt-br/assuntos/notas/2021/ibama-abre-consulta-publica-para-criacao-de-resolucao-conama-sobre-201cmanejo-florestal-sustentavel-no-bioma-caatinga201d/20211029Sei_Ibama_10977124Minuta_de_Resolucao_Conama.pdf>

CORADIN, L.; CAMILLO, J. Introdução. In: CORADIN, L.; CAMILLO, J.; PAREYN, F. G. C. (org.). **Espécies nativas da flora brasileira de valor econômico atual ou potencial:** plantas para o futuro - região Nordeste. Brasília: Ministério do Meio Ambiente; Secretaria de Biodiversidade, 2018. p.17–30.

CORADIN, L.; CAMILLO, J.; PAREYN, F. G. C. (org.). **Espécies nativas da flora brasileira de valor econômico atual ou potencial:** plantas para o futuro: região Nordeste. Brasília: Ministério do Meio Ambiente; Secretaria de Biodiverisdade, 2018. 1311p.

FAGGIN, J. M.; BEHAGEL, J. H. Translating Sustainable Forest Management from the global to the domestic sphere: The case of Brazil**. Forest Policy and Economics**, [s. l.], v. 85, n. January, p. 22–31, 2017. doi: 10.1016/j.forpol.2017.08.012

FAGGIN, J. M.; BEHAGEL, J. H.; ARTS, B. Sustainable Forest Management and Social-Ecological Systems: An Institutional Analysis of Caatinga, Brazil. **Forests**, [s. l.], v. 8, n. 11, p. 454, 2017. doi: 10.3390/f8110454

FAGGIN, J. M.; BEHAGEL, J. H. Institutional bricolage of sustainable forest management im-

plementation in rural settlements in Caatinga biome, Brazil. **International Journal of the Commons**, [s. l.], v. 12, n. 2, p. 275–299, 2018. doi:10.18352/ijc.872

FIGUEIRÔA, J. M. de et al. Effects of cutting regimes in the dry and wet season on survival and sprouting of woody species from the semi-arid caatinga of northeast Brazil. **Forest Ecology and Management**, [s. l.], v. 229, n. 1–3, p. 294–303, 2006. doi: 10.1016/j.foreco.2006.04.008

GAMA, D. C. Manejo florestal sustentado da Caatinga: aspecto legal e técnico-científico. **Advances in Forestry Science**, [s. l.], v. 8, n. 1, p. 1363–1376, 2021. doi: 10.34062/afs. v8i1.10844

GARIGLIO, M. A. et al. **Uso sustentável e conservação dos recursos florestais da Caatinga**. Brasília: Serviço Florestal Brasileiro, 2010. 368p. Disponível em: <http://www.florestal.gov.br/documentos/1788-uso-sustentavel-e-conservacao-dos-recursos-florestais-da-caatinga>

GARIGLIO, M. A.; BARCELLOS, N. D. E. Manejo florestal sustentável em assentamentos rurais na Caatinga - um estudo de caso na Paraíba e Pernambuco. In: GARIGLIO, M. A. et al. (org.). **Uso sustentável e conservação dos recursos florestais da Caatinga**. Brasília: Serviço Florestal Brasileiro, 2010. p. 116-127. Disponível em: <http://www.florestal.gov.br/documentos/1788-uso-sustentavel-e-conservacao-dos-recursos-florestais-da-caatinga>

GARLET, A.; CANTO, J. L.; OLIVEIRA, P. R. S. O Manejo Florestal Comunitário da Caatinga em Assentamentos Rurais no Estado Da Paraíba. **Ciência Florestal**, [s. l.], v. 28, n. 2, p. 735–745, 2018. doi:10.5902/1980509832086

HAJER, M.; VERSTEEG, W. A decade of discourse analysis of environmental politics: Achievements, challenges, perspectives. **Journal of Environmental Policy and Planning**, [s. l.], v. 7, n. 3, p. 175–184, 2005. doi:10.1080/15239080500339646

HAJER, M. Doing Discourse Analysis: Coalitions, Practices, Meaning. In: VAN DEN BRINK, M.; METZE, T. (org.). **Words matter in policy and planning**: discourse theory and method in the social sciences. Utrecht: Netherlands Geographical Studies, 2006. p. 65-74.

HARDESTY, L. H.; BOX, T. W.; MALECHEK, J. C. Season of Cutting Affects Biomass Production by Coppicing Browse Species of the Brazilian Caatinga. **Journal of Range Management**, [S. l.], v. 41, n. 6, p. 477, 1988. doi: 10.2307/3899520

IBAMA - INSTITUTO BRASILEIRO DO MEIO E DOS RECURSOS NATURAIS RENOVÁVEIS. **Parecer Técnico no 1/2021-CGBIO/DBFLO**. Brasília: [s. n.], 2021. Disponível em: < https://www.gov.br/ibama/pt-br/assuntos/notas/2021/ibama-abre-consulta-publica-para-criacao-de-resolucao-conama-sobre-201cmanejo-florestal-sustentavel-no-bioma-caatinga201d/20211029_Sei_Ibama_9784013_Parecer_Tecnico_12021_CGBio_DBFlo.pdf>

IBGE - INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Censo Agropecuário 2017 - Resultados definitivos**. [S. l.], 2021.

KIRMSE, R. D.; PROVENZA, F. D.; MALECHEK, J. C. Clearcutting Brazilian caatinga: assessment of a traditional forest grazing management practice. **Agroforestry Systems**, [s. l.], v. 5, n. 4, p. 429–441, 1987. doi:10.1007/BF00047177

KRÖGER, M. Inter-sectoral determinants of forest policy: the power of deforesting actors in post-2012 Brazil. **Forest Policy and Economics**, [s. l.], v. 77, p. 24–32, 2017. doi: 10.1016/j.forpol.2016.06.003

KRÖGER, M.; RAITIO, K. Finnish forest policy in the era of bioeconomy: A pathway to sustainability? **Forest Policy and Economics**, [s. l.], v. 77, p. 6–15, 2017. doi: 10.1016/j.forpol.2016.12.003

LINDAHL, K. B. et al. Theorising pathways to sustainability. **International Journal of Sustainable Development and World Ecology**, [S. l.], v. 23, n. 5, p. 399–411, 2016. doi: 10.1080/13504509.2015.1128492

LINDAHL, K. B.; SANDSTRÖM, C.; STÉNS, A. Alternative pathways to sustainability? Comparing forest governance models. **Forest Policy and Economics**, [s. l.], v. 77, p. 69–78, 2017. doi: 10.1016/j.forpol.2016.10.008

LINDAHL, K.; BAKER, S.; WALDENSTRÖM, C. Place Perceptions and Controversies over Forest Management: Exploring a Swedish Example. **Journal of Environmental Policy and Planning**, [s. l.], v. 15, n. 2, p. 201–223, 2013. doi: 10.1080/1523908X.2012.753316

MACDICKEN, K. G. et al. Global progress toward sustainable forest management. Forest **Ecology and Management**, [s. l.], v. 352, p. 47–56, 2015. doi: 10.1016/j.foreco.2015.02.005

MARQUES, A. R. et al. Water governance in vale do paraíba paulista: network of actors and socioecological systems. **Ambiente & Sociedade**, [s. l.], v. 23, p. 2–24, 2020. doi: 10.1590/1809-4422asoc20190139r1vu2020l2de

MEDEIROS, M. F.; ALBUQUERQUE, U. Food flora in 17th century northeast region of Brazil in Historia Naturalis Brasiliae. **Journal of Ethnobiology and Ethnomedicine**, [s. l.], v. 10, n. 1, p. 50, 2014. doi: 10.1186/1746-4269-10-50.

MELO, F. P. L. The Socio-Ecology of the Caatinga: Understanding How Natural Resource Use Shapes an Ecosystem. In: SILVA, J. M.C.; LEAL, I. R.; TABARELLI, M. (org.). **Caatinga:** The Largest Tropical Dry Forest Region in South America. Cham: Springer International Publishing, 2017. p. 369–382. doi: 10.1007/978-3-319-68339-3_14

MENEZES, R. S. C.; BAKKE, O. A.; BAKKE, I. A. Potencialidades para a implantação de sistemas agrosilvipastoris em regiões semi-áridas. In: BAKKE, I. A. et al. (org.). **Sistemas Agrosilvipastoris no Semi-árido**. Patos: CSTR-UFCG, 2009. p. 1–30.

MILLIKEN, W. et al. Impact of management regime and frequency on the survival and productivity of four native tree species used for fuelwood and charcoal in the caatinga of northeast Brazil. **Biomass and Bioenergy**, [s. l.], v. 116, p. 18–25, 2018. doi: 10.1016/j.biombioe.2018.05.010

MMA - MINISTÉRIO DO MEIO AMBIENTE; IBAMA - INSTITUTO BRASILEIRO DO MEIO E DOS RECURSOS NATURAIS RENOVÁVEIS. **PORTARIA Nº 1002, DE 24 DE ABRIL DE 2020**. Brasília: 24 abr. 2020. Disponível em: <https://www.gov.br/ibama/pt-br/assuntos/notas/2021/ibama-abre-consulta-publica-para-criacao-de-resolucao-

-conama-sobre-201cmanejo-florestal-sustentavel-no-bioma-caatinga201d/20211029Sei_Ibama_7474003Portaria_1002_2020.pdf>

NUNES, B.; BENNETT, D.; MARQUES, S. Sustainable agricultural production: An investigation in Brazilian semi-arid livestock farms. **Journal of Cleaner Production**, [s. l.], v. 64, p. 414–425, 2014. doi: 10.1016/j.jclepro.2013.07.023

OSTROM, E. A General Framework for Analyzing Sustainability of Social-Ecological Systems. **Science**, [s. l.], v. 325, n. 5939, p. 419–422, 2009. doi:10.1126/science.1172133

PAREYN, F. G. C. Os recursos florestais nativos e sua gestão no estado de Pernambuco - o papel do manejo florestal sustentável. In: GARIGLIO, M. A. et al. (org.). **Uso sustentável e conservação dos recursos florestais da caatinga**. Brasília: Serviço Florestal Brasileiro, 2010a. p. 99–113. Disponível em: <http://www.florestal.gov.br/documentos/1788-uso-sustentavel-e-conservacao--dos-recursos-florestais-da-caatinga>

PAREYN, F. G. C. A importância da produção não-madeireira na Caatinga. In: GARIGLIO, M. A. et al. (org.). **Uso Sustentável e conservação dos recursos florestais da Caatinga**. Brasília: Serviço Florestal Brasileiro, 2010b. p. 131–139. Disponível em: <http://www.florestal.gov.br/documentos/1788-uso-sustentavel-e-conservacao-dos-recursos-florestais-da-caatinga>

PAREYN, F. G. C. et al. What controls post-harvest growth rates in the caatinga forest? **Agricultural and Forest Meteorology**, [s. l.], v. 284, p. 107906, 2020. doi: 10.1016/j.agrformet.2020.107906

PEREIRA FILHO, J. M.; BAKKE, O. A. Produção de forragem de espécies herbáceas da Caatinga. In: GARIGLIO, M. A. et al. (org.). **Uso Sustentável e conservação dos recursos florestais da Caatinga**. Brasília: Serviço Florestal Brasileiro, 2010. p. 145–157. Disponível em: <http://www.florestal.gov.br/documentos/1788-uso-sustentavel-e-conservacao-dos-recursos-florestais--da-caatinga>

PFISTER, J. A. et al. Rangelands and Small Ruminant Production in Ceara' State, Northeastern Brazil. **Rangelands**, [s. l.], v. 5, n. 2, p. 72–76, 1983. Disponível em: < https://pdf.usaid.gov/pdf_docs/PNAAS111.pdf>

PINHEIRO, F. M.; NAIR, P. K. R. Silvopasture in the caatinga biome of Brazil: A review of its ecology, management, and development opportunities. **Forest Systems**, [s. l.], v. 27, n. 1, p. 1–16, 2018. doi: 10.5424/fs/2018271-12267

PÜLZL, H.; KLEINSCHMIT, D.; ARTS, B. Bioeconomy - an emerging meta-discourse affecting forest discourses? **Scandinavian Journal of Forest Research**, [s. l.], v. 29, n. 4, p. 386–393, 2014. doi:10.1080/02827581.2014.920044

QUEIROZ, L. P. et al. Diversity and Evolution of Flowering Plants of the Caatinga Domain. In: SILVA, J. M. C.; LEAL, I. R.; TABARELLI, M. (org.). **Caatinga:** The Largest Tropical Dry Forest Region in South America. Cham: Springer International Publishing, 2017. p. 23–63. doi: 10.1007/978-3-319-68339-3_2

QUEIROZ, R. T. de et al. A região Nordeste. In: CORADIN, L.; CAMILLO, J.; PAREYN, F. G. C. (org.). **Espécies nativas da flora brasileira de valor econômico atual ou potencial:** plantas para o futuro - região Nordeste. Brasília: Ministério do Meio Ambiente; Secretaria de Biodiversidade, 2018. p. 75–104.

RIEGELHAUPT, E. M.; PAREYN, F. G. C. A questão energética. In: GARIGLIO, M. A. et al. (org.). **Uso Sustentável e Conservação dos Recursos Florestais da Caatinga**. Brasília: Serviço Florestal Brasileiro, 2010. p. 65–77. Disponível em: <http://www.florestal.gov.br/documentos/1788-uso-sustentavel-e-conservacao-dos-recursos-florestais-da-caatinga>

RIEGELHAUPT, E, M. et al. **Biomassa para energia no Nordeste:** atualidade e perspectivas**.** 1ªed. Recife: APNE - Associação Plantas do Nordeste, 2017.

RIEGELHAUPT, E. M.; PAREYN, F. G. C.; GARIGLIO, M. A. O Manejo Florestal como Ferramenta para o Uso Sustentável e Conservação da Caatinga. In: GARIGLIO, M. A. et al. (org.). **Uso sustentável e conservação dos recursos florestais da Caatinga**. Brasília: Serviço Florestal Brasileiro, 2010. p. 249–366. Disponível em: <http://www.florestal.gov.br/documentos/1788--uso-sustentavel-e-conservacao-dos-recursos-florestais-da-caatinga>

SANDSTRÖM, C.; LINDAHL, K. B.; STÉNS, A. Comparing forest governance models. **Forest Policy and Economics**, [s. l.], v. 77, p. 1–5, 2017. doi: 10.1016/j.forpol.2016.10.007

SANTANA, O. A. Minimum age for clear-cutting native species with energetic potential in the Brazilian semi-arid region. **Canadian Journal of Forest Research**, [s. l.], v. 47, n. 3, p. 411–417, 2017. doi: 10.1139/cjfr-2016-0392

SIEGMUND-SCHULTZE, M. A multi-method approach to explore environmental governance: a case study of a large, densely populated dry forest region of the neotropics. **Environment, Development and Sustainability**, [s. l.], v. 23, p. 1539–1562, 2021. doi: 10.1007/s10668-020-00635-y

SILVA, A. C.; SOUZA, A. F. Aridity drives plant biogeographical sub regions in the Caatinga, the largest tropical dry forest and woodland block in South America. **PLoS ONE**, [s. l.], v. 13, n. 4, p. 1–22, 2018. doi: 10.1371/journal.pone.0196130

SILVA, J. M.C. et al. The Caatinga: Understanding the Challenges. In: SILVA, J. M. C.; LEAL, I. R.; TABARELLI, M. (org.). **Caatinga:** The Largest Tropical Dry Forest Region in South America. Cham: Springer International Publishing, 2017. p. 3–19. doi: 10.1007/978-3-319-68339-3_1

TORFING, J. Discourse Theory: Achievements, Arguments, and Challenges Jacob Torfing. In: HOWARTH, D.; TORFING, J. (org.). **Discourse Theory in European Politics:** Identity, Policy and Governance. 1. ed. London: Palgrave Macmillan UK, 2005. p. 1–32. doi: 10.1057/9780230523364

Marcelo Silva de Lucena

✉ marceloslucenarn@gmail.com

ORCiD: https://orcid.org/0000-0002-7478-7980

Maria José Brito Zakia

✉ zeze.zakia@gmail.com

ORCiD: https://orcid.org/0000-0002-9920-6230

Natalia Guerin

✉ na.guerin@gmail.com

ORCiD: https://orcid.org/0000-0002-9545-7729

Submitted on: 31/05/2022

Accepted on: 23/08/2023

2023;26:e0042

AMBIENTE & SOCIEDADE 25 anos 25 años 25 years

SciELO

Discursos sobre o manejo florestal sustentável no Domínio da Caatinga

Marcelo Silva de Lucena
Maria José Brito Zakia
Natalia Guerin

Resumo: O manejo florestal sustentável (MFS) pode abrigar diferentes discursos sobre a sustentabilidade. Neste trabalho, a partir da teoria do discurso, foram caracterizadas as principais ideias, conceitos e narrativas que têm sido propostos sobre o MFS da vegetação nativa do Domínio da Caatinga (DC). Foram constatados três principais discursos: a) MFS bioenergético: enfatiza a produção de biomassa florestal para abastecer as demandas energéticas regionais; adicionalmente, procura contribuir fortemente para a redução do desmatamento e conservação florestal; b) MFS silvo-pastoril: busca fornecer alternativas para melhorar a disponibilidade forrageira; c) MFS não madeireiro: procura valorizar os conhecimentos tradicionais sobre a biodiversidade, para ampliar as formas de manejo de múltiplas espécies e fortalecer as estratégias de convivência com a região semiárida. A existência de diferentes discursos, juntamente com o leque de práticas sustentáveis que eles apresentam, oferece a oportunidade para a mudança política e inovação institucional.

Palavras-chave: Discursos florestais; bioenergia; sistemas silvo-pastoris; produtos não madeireiros; sustentabilidade.

São Paulo. Vol. 26, 2023

Artigo Original

AMBIENTE & SOCIEDADE 25 anos 25 años 25 years

SciELO

Discursos sobre manejo forestal sostenible en el Dominio Caatinga

Marcelo Silva de Lucena
Maria José Brito Zakia
Natalia Guerin

São Paulo. Vol. 26, 2023
Artículo Original

Resumen: El manejo forestal sostenible (MFS) puede albergar diferentes discursos sobre la sostenibilidad. En este trabajo, basado en la teoría del discurso, se caracterizaron las principales ideas, conceptos y narrativas que se han propuesto sobre lo MFS de la vegetación nativa del Dominio de la Caatinga (DC). Se encontraron tres discursos principales: a) MFS bioenergético: enfatiza la producción de biomasa forestal para abastecer las demandas energéticas regionales; además, busca contribuir fuertemente a la reducción de la deforestación y la conservación de los bosques; b) MFS silvopastoril: busca proporcionar alternativas para mejorar la disponibilidad forrajera; c) MFS no maderable: busca valorar los conocimientos tradicionales sobre la biodiversidad, ampliar las formas de manejo de múltiples especies y fortalecer las estrategias de convivencia con el semiárido. La existencia de diferentes discursos, junto con la gama de prácticas sostenibles que presentan, ofrece la oportunidad para el cambio de políticas y la innovación institucional.

Palabras-clave: Discurso forestal; bioenergía; sistemas silvopastoriles; productos no madereros; sustentabilidad.