Integrated and sustainable agroecological production for medicinal plants: a proposal based on strategic management

Produção agroecológica integrada e sustentável para plantas medicinais: uma proposta a partir da gestão estratégica

Jeferson Adriano e Silva Assunção[a]

Ygor Jessé Ramos dos Santos[b]

João Carlos da Silva[c]

Nina Cláudia Barboza da Silva[d]

Danilo Ribeiro de Oliveira[e]

[a] *Master in Pharmaceutical Science and Technology, Professor, Centro de Responsabilidade Socioambiental do Jardim Botânico do Rio de Janeiro, CRS/JBRJ, Rio de Janeiro, Brazil*
E-mail: jefersonadriano.sa@gmail.com

[b] *Master in Plant Biology, Laboratory technical advisor and Professor, Centro de Responsabilidade Socioambiental do Jardim Botânico do Rio de Janeiro, CRS/JBRJ, Rio de Janeiro, Brazil*
E-mail: ygorjesse@jbrj.gov.br

[c] *Master in Evaluation, Coordinador, Centro de Responsabilidade Socioambiental do Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, CRS/JBRJ, Rio de Janeiro, Brazil*
E-mail: jcsilva@jbrj.gov.br

[d] *Doctor in Plant Biotechnology, Associate Professor II, Universidade Federal do Rio de Janeiro, UFRJ, Rio de Janeiro, Brazil*
E-mail: ninacbs@gmail.com

[e] *Doctor in Natural Products Chemistry, Associate Professor, Universidade Federal do Rio de Janeiro, UFRJ, Rio de Janeiro, Brazil*
E-mail: danilopharma@gmail.com

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ABSTRACT

A management plan based on Integrated and Sustainable Agroecological Production (Pais) technology for the cultivation of medicinal plants, through a case study. The Swot-AHP technique was adopted to

evaluate problems to agroecological cultivation, indicating stages of the implementation work, before the physical structuring of the project, integrated with a participative social action with employees of the institution who revealed the use of 64 medicinal plants, highlighting boldo, lemongrass, and lemon balm, while 174 plant species were identified in official Brazilian documents. The lack of electricity and funding delays by funders are the most significant problems, while the space for work and gardening courses are the best potential. The integration of these data has proposed the implementation of teams for fundraising and project implementation, based on a list of medicinal species to compose the future structure made with Pais social technology.

Keywords: Strategic management. Swot-AHP. Agroecology. Cultivation. Medicinal plants.

RESUMO

Foi proposto um plano de gestão baseado na tecnologia de Produção Agroecológica Integrada e Sustentável (Pais) para cultivo de plantas medicinais, por meio de um estudo de caso. Adotou-se a técnica Swot-AHP para avaliar problemas no cultivo agroecológico, indicando etapas do trabalho de implantação, antes da estruturação física do projeto, integrado a uma ação social participativa com funcionários da instituição que revelaram uso de 64 plantas medicinais, destacando-se boldo, capim-limão e erva-cidreira, enquanto 174 espécies vegetais foram levantadas em documentos oficiais brasileiros. A falta de eletricidade e o atraso da verba pelos financiadores são os maiores problemas, enquanto o espaço para trabalho e curso de jardinagem são as melhores potencialidades. Por meio da integração desses dados, foi proposta a implantação de equipes para captação de recursos e para implantação de projetos, tendo por base uma lista de espécies medicinais para compor a futura estrutura feita com tecnologia social Pais.

Palavras-chave: Gestão estratégica. Swot-AHP. Agroecologia. Cultivo. Plantas medicinais.

1 INTRODUCTION

Organic farming is used in agroecology, which is understood as the union of traditional knowledge with different sciences, to develop ecologically sustainable, economically viable, and socially just agricultural models (ALTIERI, 2004).

Based on the advances made with agroecological models for cultivation and plant production with respect for the environment, in 1999, the Agricultural Engineer Aly Ndiaye conceived with a family of rural farmers in Petrópolis-RJ a cultivation system called Integrated and Sustainable Agroecological Production (Pais). This aimed to exercise social inclusion, food security, fight hunger, extreme poverty, and implement new healthy eating habits for low-income communities by integrating plants and animals without pesticides, following the agroecological concept (NDIAYE, 2016).

Pais social technology proposed a circular-shaped mandala, integrating plant species (vegetables, aromatics, and spices) with a central chicken coop and/or fish tank so that it is possible to use bird or fish faeces for fertilisation and the remains of vegetables for animal feed. From the availability of all the materials and inputs necessary for the assembly of this agroecological cultivation technology, in addition to technical consultancy for 30 months, several systems were implemented in the national territory, mainly in small rural properties, to add security and sovereignty food, as well as income generation (NDIAYE, 2016; SEBRAE, 2008).

However, there are still few results on the systematisation of data to construct this social technology (SILVA et al., 2018).

Swot analysis (Strengths, Weaknesses, Opportunities, and Threats) is a preventive technique applied mainly in early research and projects to minimise future problems. It can help in the data systematisation

process since it lists both internal factors, Strengths, and Weaknesses, as well as external factors, Opportunities, and Threats, which facilitates the analysis of conditions that can influence negatively and positively before starting the structuring process of a given project, promoting security in future actions (SOUSA et al., 2019).

With a qualitative character, Swot is an excipient for many applications, such as General Business Administration, Marketing and Marketing, Healthcare, Cosmetics, Learning and Education, Agriculture, Forestry, Environment, Medicine and Pharmacy, Textile Industry, Tourism, Manufacturing, Transport, Library, Construction, Oil and Gas, Armed Forces, Financial Market among others (GHAZINOORY; ABDI; AZADEGAN-MEHR, 2011). Kurttila et al. (2000), observing this bottleneck, proposed the union of Swot analysis with a quantitative technique called Analytic Hierarchy Process (AHP).

To carry out this hybrid method (Swot-AHP), steps were established such as carrying out the Swot analysis, paired comparisons between Swot factors carried out in all groups within the Swot analysis, paired comparisons between the four groups within the Swot matrix (strengths, weaknesses, opportunities, and threats) and the use of results in the strategy formulation and evaluation process (GHAZINOORY; ABDI; AZADEGAN-MEHR, 2011).

Given this panorama, this work aimed to apply a tool to build a strategic management plan with Swot-AHP analysis to select and cultivate plants with medicinal properties, based on Integrated and Sustainable Agroecological Production (Pais) technology through a case study.

2 METHODOLOGICAL PROCEDURES

2.1 STUDY PLACE

The Almirante Milcíades Portela Alves Instruction Center (Ciampa) occupies an area of 4,500,000 m². It is located in the Guandu do Sapê Naval Complex, on the banks of Avenida Brasil in Campo Grande, Rio de Janeiro-RJ, housing the project Management Company Navais (Emgepron), linked to the Ministry of Defense (MOTA, 2008). Emgepron is responsible for producing ammunition and the Socio-environmental and Ecological Adequacy Program of the Guandu do Sapê Naval Complex (EMGEPRON, 2017).

2.2 PROPOSAL OF THE MANAGEMENT PROCESS

After a structural analysis of the socio-environmental sector of Ciampa, a Swot/Fofa analysis was developed, listing the positive and negative points, where it was possible to identify the internal factors (Strengths and Weaknesses) and external factors (Opportunity and Threats) to generate matrices quali-quantitative (SOUSA et al., 2019).

The initial interview with the coordinator of environmental projects at Ciampa listed all the internal and external factors of the socio-environmental sector facing the implementation of social technology Pais (ABE; MIRAGLIA, 2020). A chart with the information was created from this checklist using the Lucidchart flowchart and diagram creation software.

From the qualitative information (Swot analysis), quantitative analyses were performed (Analytic Hierarchy Process) to classify the relationships. This rating categorises information on a scale of 0 to 3: No relation at all (0); Weak relationship (1); Moderate relationship (2) and Strong relationship (3) (KURTTILA et al., 2000).

Two 9x9 matrices were generated in the classification of relations. The first matrix numbers the information relation and sums each column and row. The second matrix exposes all the strong ties, with divisions into priority thematic axes to resolve the problems.

This work built an investigative case study with qualitative and quantitative methodological characteristics (GL, 2008) through non-participant observation and semi-structured interviews and the maximum use of the answers, considerations, and comments obtained (FORMIGA JÚNIOR; CÂNDIDO; AMARAL, 2015).

2.3 STRATEGIC SELECTION OF MEDICINAL SPECIES

The species medicinal were selected from current normative documents that guide the research and/or use of medicinal and herbal plants within the federal government: Brazilian Pharmacopoeia – 6th ed. (2019) (FB), Form of Herbal Medicines of the Brazilian Pharmacopoeia (2018) (FFFB), Herbal Medicine Memento of the Brazilian Pharmacopoeia (2016) (MFFB), National List of Essential Medicines (2018) (Rename) and National List of Medicinal Plants of Interest to SUS (2009) (Renisus).

2.3.1 INTERVIEWS AND SALIENCE INDEX (IS)

There were 2 meetings with Ciampa officials who know medicinal plants to explain social participation in choosing medicinal species to compose the structure to be made with the Pais social technology.

In this context, semi-structured interviews were carried out with the aid of a questionnaire divided into socioeconomic questions and questions related to medicinal plants (popular name, indications of widespread use, and place of acquisition).

The list of medicinal plants mentioned in the interviews (free list) was processed to calculate the Salience Index (IS) using the Anthropac 4,983 tool (Analytic Technologies, USA) (ALBUQUERQUE *et al*., 2014).

The medicinal plants calculated using the IS were crossed with the list made using the principal regulations published by the Ministry of Health.

Due to the impossibility of collecting to identify the medicinal plants mentioned by the informants, the technique called “taxonomic clues” was used to find the scientific names of the said plant species. This technique equates the famous names of the medicinal plants mentioned with the plant species scientifically named in the literature (BOCHNER *et al*., 2012). The scientific nomenclature was updated through the Flora do Brasil list (2020), Tropicos (2020), and The Plant List (2013).

The Ethics Committee approved this research, Opinion CEP/HUCFF/FM/UFRJ nº 3.234.966. All informants signed an Informed Consent Term, giving prior knowledge and authorization to collect and use the data collected.

The data obtained were organised into tables, analysed, and presented as graphs prepared with the help of the Excel® program.

3 RESULTS AND DISCUSSION

3.1 PROPOSAL OF THE MANAGEMENT PROCESS

3.1.1 QUALITATIVE ANALYSIS

From the analysis of the interviews with the coordinator of the socio-environmental sector, it was possible to build the picture with the Swot analysis. Eighteen internal and external factors were surveyed related to the future implementation of Pais social technology.

These factors listed in the Swot analysis (Figure 1) helped to build future scenarios and action strategies capable of nullifying or mitigating possible interferences in the execution of sustainable cultivation in the moulds of Pais social technology. Therefore, visualising all positive influencing factors and negative listed consolidates the understanding of the most beneficial ideas to strengthen cultivation attributes (OLIVAL, 2016).

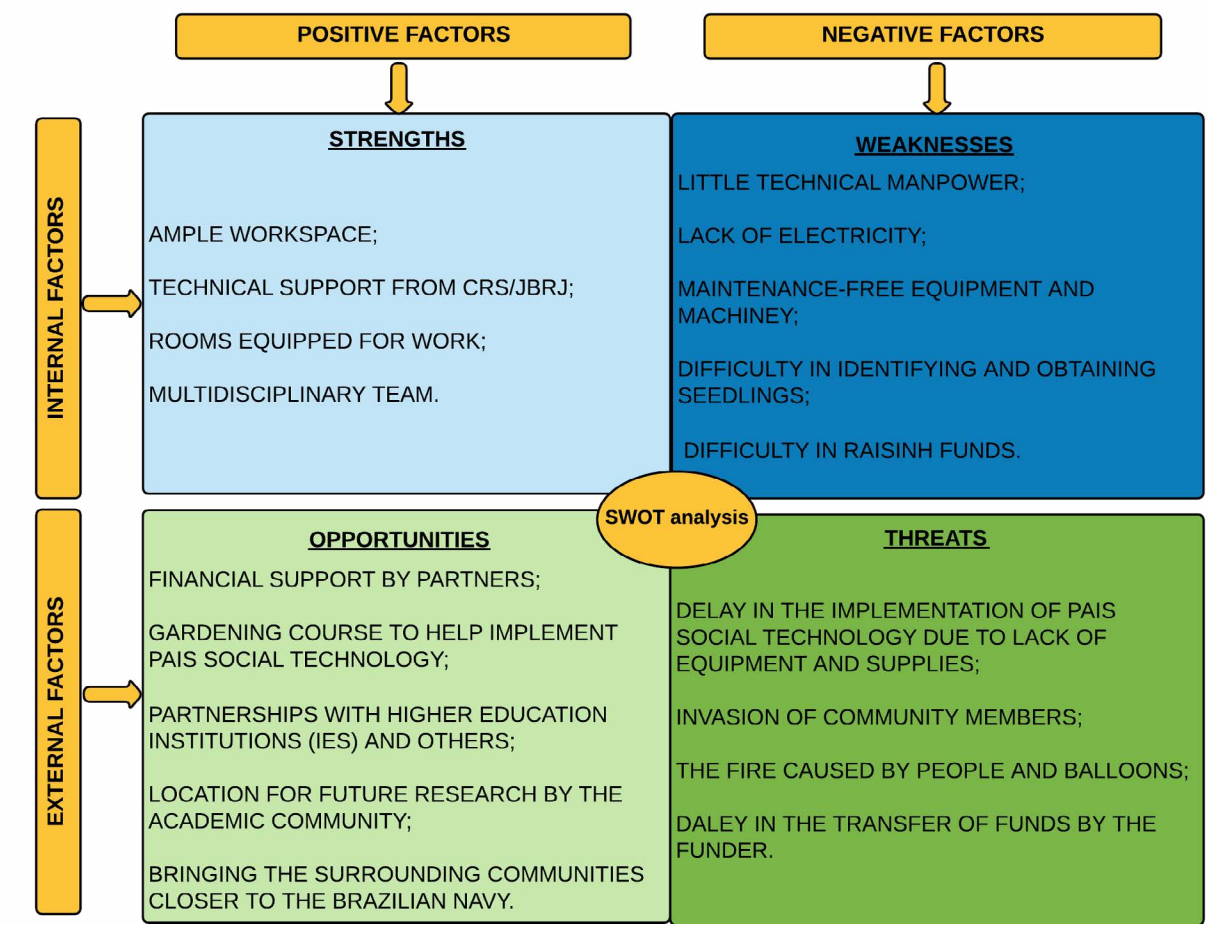

Figure 1 | Swot analysis elaborated on the main negative and positive factors related to implementing social technology Pais in the Naval Complex of the Brazilian Navy in Campo Grande/RJ.

Source: Own elaboration based on Kurttila et al. (2000).

- Weaknesses and Threats

Through the analysis of the actions, significant challenges were found, described as weaknesses, they are, “Low technical manpower”, “Lack of electricity”, “Maintenance equipment and machinery”, “Difficulty in identifying and obtaining seedlings” and “Difficulty in raising funds”.

These weaknesses are related to the lack of funds transfer, especially for the first three mentioned above. According to the manager of the socio-environmental sector of Ciampa, the budget for the socio-environmental program is less than its forecast. As a result, weaknesses may be delayed in resolution or not resolved as a matter of priority.

Threats can happen or not; this will depend on the relationship between threats x opportunities, threats x strengths, and threats x weaknesses, calculated in the classification of relationships.

The delay in the transfer of funds by the financier and the delay in implementing Pais social technology due to lack of equipment are closely linked. For the physical execution of the cultivation, it is necessary to acquire tools, plant species, and materials for planting. Thus, seeking financial resources from other places or forming partnerships with other institutions are relevant alternatives to prevent these threats.

The invasion of people from the local community does not generate danger for the cultivation since the area belongs to the Brazilian Navy's military corps. This invasion occurs because of animals such as horses and oxen that flee into Ciampa. Therefore, their owners enter to rescue them.

In the case of fires caused by people and balloons, there is a solution already used. The area is divided by small roads without vegetation that serves to control a possible fire.

Given this Swot analysis, it is known that alternative production models have critical challenges (threats and weaknesses) to be overcome to implement and sustain agroecological projects successfully. Therefore, there must be dialogue and collective learning (SANTO; GOMES; PIRES, 2019). Therefore, this analysis must be permanent, bring the team together to discuss the available solutions as a group and evaluate and make decisions seeking to reconcile the actions necessary for developing and elaborating goals (KLOCK; MARINI; GODOY, 2019).

- Strengths and Opportunities

The forces show that the structural part is prepared to receive a large-scale project. There is ample space for work with crowded rooms and counting on the multidisciplinary team of CRS/JBRJ through a technical cooperation agreement.

The strengths and opportunities can increase the success of the project, mitigating a large part of the weaknesses, because there is the possibility of diversifying funding sources, that is, seeking support from industries and institutions that deal with environmental projects in the surroundings of Ciampa, in addition to Furthermore, the gardening course aimed at the local community and partnerships with Higher Education Institutions (IES), will be part of the insertion of labour and the input of financial resources to assist in the implementation of Pais social technology.

The strengths and opportunities brought the visualisation of the possibilities capable of facing the weaknesses and threats that could harm the construction of the Pais social technology.

Swot analysis is a powerful tool only for the qualitative part of this project and other authors who carried out strategic management studies with medicinal plants (SILVA et al., 2017; SINGH et al., 2019).

According to the literature, it could be observed that most scientific studies build Swot matrices relating strengths, opportunities, weaknesses, and threats, without quantitatively evaluating the relationship of positive and negative factors present (MIRANDA et al., 2018; SILVA et al., 2017).

3.1.2 QUANTITATIVE ANALYSIS

The negative and positive factors were grouped using the Swot/Fofa matrix, which generated an overview of all actions that help and hinder the structuring of Pais social technology, while the quantitative analysis grouped the main negative and positive factors to rank the decision making regarding the problems of most significant to most minor importance (Weaknesses and Threats) and the greatest and smallest positive points (Strengths and Opportunities).

From the first matrix that shows the sum of each column and row of the classification of the relationships, it was possible to identify two specific negative factors: lack of electricity – 22 points and delay in the transfer of funds by funders – 23 points (Table 1). These actions may initially impede the structuring of the Pais social technology.

On the other hand, it was possible to verify two positive actions that scored the most: ample space for work – 21 points and a gardening course to help implement the Pais social technology – 23 points. With the gardening course, it is possible to minimise the impacts generated by the delay in funds. There will be a workforce to carry out the actions of structuring the Pais social technology. Activities occur naturally. Thus, the solution to the lack of electricity is the consolidation of a fundraising team, verified in Table 2.

Table 1 | Quantitative matrix of the Swot-AHP analysis with the sum of the most relevant positive and negative factors for implementing social technology Pais at the Ciampa.

		STRENGTHS				WEAKNESSES					
		Ample workspace	Rooms equipped for work	Multidisciplinary team	Technical support from CRS/JBRJ	Little technical workforce	Lack of electricity	Maintenance-free equipment and machinery	Difficulty in identifying and obtaining seedlings	Difficulty in raising funds	TOTAL OF POINTS
OPPORTUNITIES	Financial support by partners	1	1	2	1	3	3	3	2	3	19
	Gardening course to help implement PAIS social technology	3	2	2	2	3	3	3	2	3	23
	Partnerships with higher education institutions (IES) and others	3	2	2	1	2	2	1	2	3	18
	Location for future research by the academic community	3	2	2	1	2	3	1	2	3	19
	Bringing the surrounding communities closer to the Brazilian Navy	3	2	2	1	2	3	0	0	0	13
THREATS	Delay in the implementation of PAIS social technology due to lack of equipment and supplies	2	2	2	1	2	3	3	0	3	18
	Delay in the transfer of funds by the funder	3	2	2	3	3	3	3	1	3	23
	Invasion of community members	0	1	0	0	0	0	0	0	0	1
	The fire caused by people and balloons	3	3	1	0	2	2	3	0	2	15
	TOTAL OF POINTS	21	17	15	10	19	22	17	9	20	

Source: Own elaboration based on Kurttila et al. (2000) and Chang and Huang (2006).

Based on the delay or lack of transfer of financial resources, the lack of electricity is more prominent, impacting the activities to be carried out. Given this context, Rosa (2016) explains that electricity is part of the daily lives of individuals, both in public environments and at work; this change in the social consumption patterns of populations, reflected in the conformation of the living standards of the society that today depends on electricity usage. The author emphasises that the problem of access to electricity is caused by the lack of access to this service and not by the interruption of access due to the ineffectiveness of public policies to make access to electricity mandatory.

The analyses by Miranda et al. (2018) corroborate the weakness and threat of greater relevance presented here. Therefore, public management depends on financial resources to solve structural problems. It is essential to transfer funds for improvement and quality of services to be performed. Miranda et al. (2018) also highlight the importance of forming partnerships with the surrounding community in activities carried out in the public space, which somehow helps develop activities not carried out due to lack of transfer of financial resources.

The voluntary support of members of educational institutions and partner companies, together with the consolidation of the gardening course, a vitalortant role in meeting the need for personnel to prepare the Pais structure and contribute to individuals' professional and personal development. Consequently, the public department acquires several tasks that the State cannot supply; these ties between society and public bodies are strengthened (BARELI; SOUSA, 2015).

The gardening course and volunteer support will be attended by members of the surrounding communities and the general public. Some of the Ciampa employees and interns interviewed and who live nearby expressed interest in improving their knowledge in plant cultivation. Gardening courses have already taken place in the socio-environmental sector of Ciampa, and there is interest in the return of these activities; the coordinator even meets the president of the closest community association called Parque São Francisco, enabling contact to publicise the proposed activities.

In Table 2, the strong relationships (3) were able to show the need to introduce a project implementation team and a fundraising team into the socio-environmental sector of Ciampa; these teams will guide and support the progress and support of the project.

Table 2 | Quantitative matrix of the Swot-AHP analysis with emphasis on solid relationships (3). It is possible to highlight the teams necessary for the implementation of Pais social technology at the Ciampa.

		FORÇAS				FRAQUEZAS				
		Amplo espaço para trabalho	Salas equipadas para trabalho	Equipe multidisciplinar	Apoio técnico do CRS/JBRJ	Pouca mão de obra técnica	Falta de energia elétrica	Equipamentos e máquinas sem manutenção	Dificuldade de identificação e obtenção de mudas	Dificuldade de captação de recursos
OPORTUNIDADES	Apoio financeiro por parceiros					3	3	3		3
	Curso de jardinagem para ajudar na implantação da tecnologia social Pais	3				3	3	3		3
	Parcerias com IES e outras	3								3
	Local para futuras pesquisas pela comunidade acadêmica	3					3			3
	Aproximação das comunidades do entorno com a Marinha do Brasil	3					3			
AMEAÇAS	Atraso na implantação da tecnologia social Pais por falta de equipamentos e insumos						3			3
	Atraso no repasse da verba pelo financiador	3			3	3	3	3		3
	Invasão de membros da comunidade									
	Incêndio provocado por pessoas e balões	3	3					3		

Source: Own elaboration based on Kurttila et al. (2000).

Santos, Negrão, and Saboya (2018) clarify that changes in public management and/or lack of financial resources generate cancellation or delay in transferring money to institutions that need it to survive. However, the authors emphasise the importance of good strategic management focused on raising and managing financial resources, on managing money in a balanced way within the institution.

The socio-environmental sector of Ciampa has the coordinator to carry out the management part, which ranges from the amount of the human resource to the financial position; that is, it assumes different roles as a manager and overloads the daily tasks. Hiring qualified personnel to help, especially fundraising and implementation, is necessary for the project to take the first structuring steps.

The implementation axis can be carried out in three ways: the first option is through the technical cooperation agreement with the CRS/JBRJ, bringing its professionals and interns to help structure the project, together with volunteers from the surrounding community, to supply the needs of the lack of personnel to carry out manual work. On the other hand, the second option depends on fundraising; that is, it will be necessary to increase the number of qualified personnel in the socio-environmental sector of Ciampa, as the lack of professionals in this sector is one of the main problems reported by the coordinator.

The third option has as alternative social participation focused on developing activities in the socio-environmental sector of Ciampa. This alternative corroborates the conclusions of Petrus, Kátia, and Pereira Júnior (2016), who clarify that social participation, correctly implemented, generates local economic, social, and political growth.

Another alternative that will sustainably help the development of activities is to carry out the structuring of the Pais social technology with materials found at Ciampa. The plastic boxes that carry the ammunition are discarded and can be reused to prepare flowerbeds and the stakes from the Sansão-do-campo trees (Mimosa caesalpiniifolia Benth.), which are located in a large area within Ciampa.

The construction of this Pais social technology will generate didactic interaction with the target audience (education and research institutions and interested people), medicinal plant-based inputs for the use of employees, and programs that work with phytotherapy, production of certified seedlings for donation, as well as carrying out organic cultivation with several plant species in a place that suffered deforestation.

3.2 SOCIAL PARTICIPATION IN THE SELECTION OF MEDICINAL SPECIES

The first meeting held on May 22, 2019, was attended by 14 employees appointed by the coordinator and the most experienced gardener in the socio-environmental sector of Ciampa. In the days following the first meeting, 11 employees agreed to a semi-structured interview.

According to the interviews carried out, it could be seen that the two sectors (socio-environmental and factory) account for the most significant percentage from the perspective of the place where the informants see the medicinal species they know and use (Figure 2), showing the relevance mainly of the Social and environmental sector in the construction of knowledge about medicinal plants.

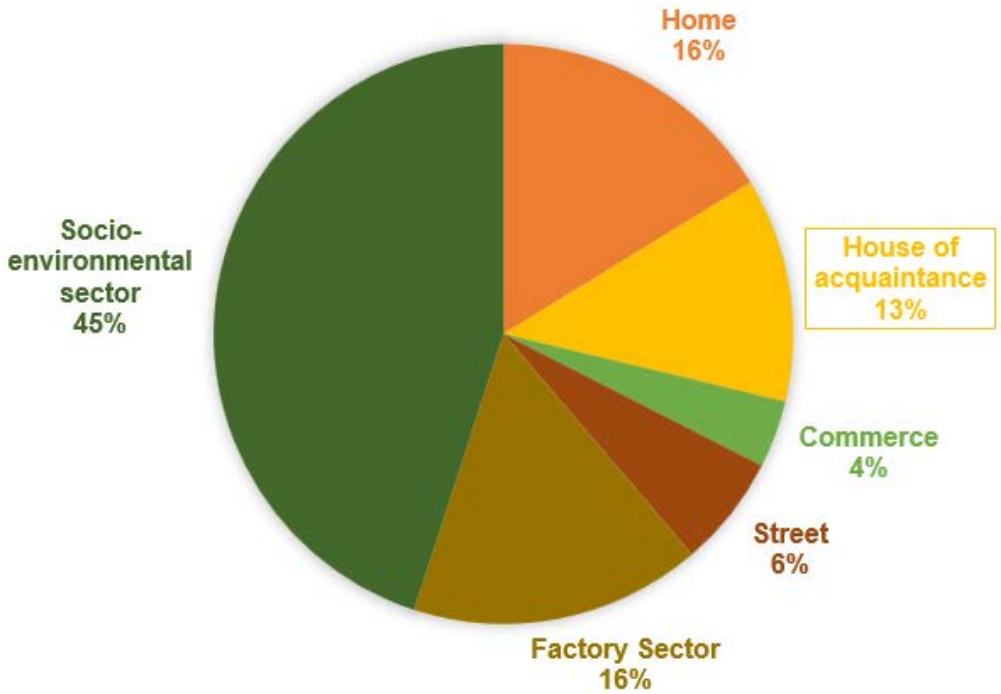

Figure 2 | Location of plants mentioned in interviews with informants from Ciampa.

Source: Authors

The study by Faria and Albuquerque (2018) on socioeconomic factors that can affect knowledge of medicinal plants clarifies that frequent contact with medicinal plants positively influences the knowledge of the population participating in the research. This conclusion corroborates this work, given that the work environment of the Ciampa informants has the two places with the highest percentages of citations, that is, most of the plants they know are planted in the workplace.

One of the factors contributing to the informants' knowledge is that Ciampa has an extensive green area, as it is part of the Marapicu-Gericinó-Mendanha (MGM) mountain range essentially has native Atlantic Forest vegetation. A good part of this location is an APA (Environmental Protection Area) (MOTA, 2008).

This extensive green area surrounds two sectors: socio-environmental and factory. In the socio-environmental sector, reforestation and studies of degraded areas occur within Ciampa. In this way, Ciampa contributes to knowledge about medicinal plants and other non-medicinal plants, considering that most informants reported having little space for planting in their homes.

64 medicinal plants were mentioned, totalling 119 citations. Considering the analyses carried out with all plants, boldo stood out for having been cited by 8 informants (8 citations = 72.7%), followed by lemongrass and lemon balm with 6 (54.5%) citations each (Figure 3).

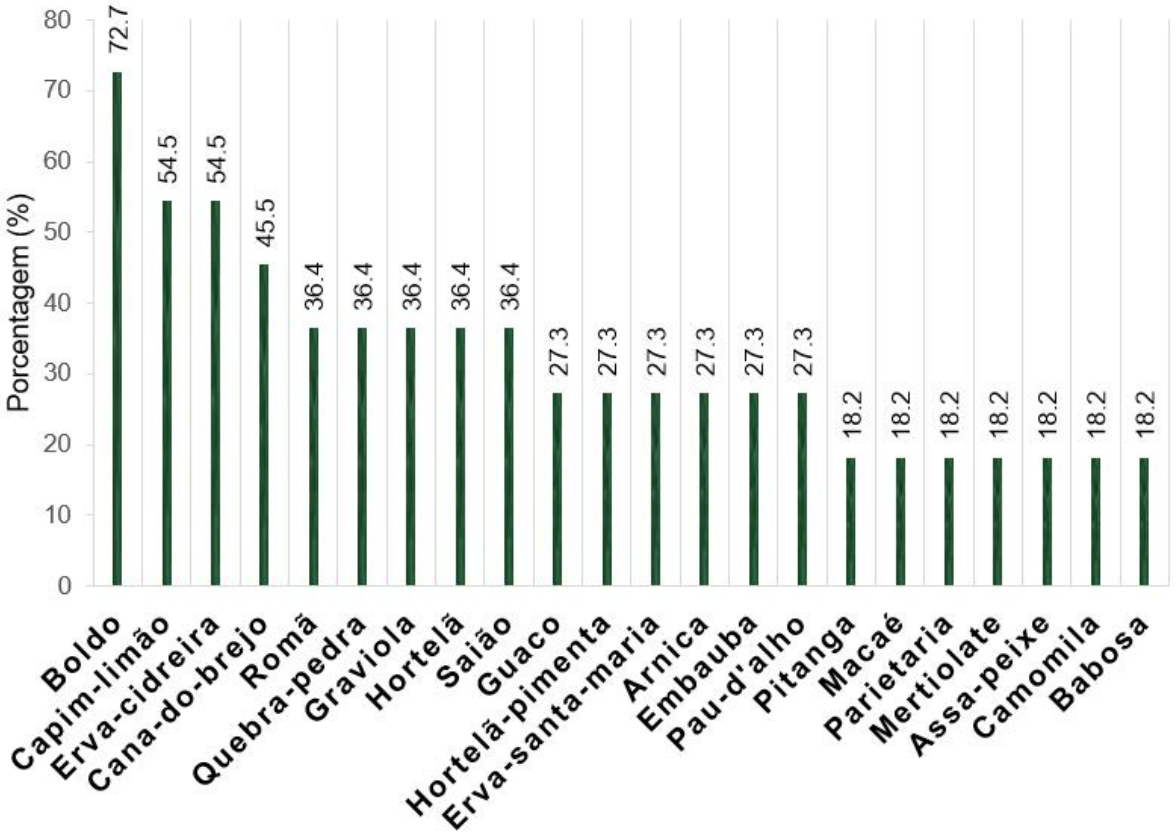

Figure 3 | Frequency of citations of plants was obtained through interviews carried out with informants from the Ciampa. Simplified graph with a minimum of 2 quotes.

Source: Authors.

The species popularly named boldo are among the most cited in ethnobotanical studies in Brazil (GOIS *et al*., 2016). Borges and Moreira (2016) surveyed medicinal species used by family members of students attending courses at the Federal Institute of Mato Grosso Campus Confresa, where boldo (*Plectranthus barbatus* Andr.) obtained 10.6%, lemongrass (*Cymbopogon citratus* (DC.) Stapf) 9.5% and *Aloe vera* (L.) Burn f) 7.7% of citations.

Through the order of citation of each informant, the Salience Index (IS) was calculated for the plants of greatest cultural importance, namely: boldo (IS = 0.649), followed by lemongrass (IS = 0.435) and lemon balm (IS = 0.360). With this, it is possible to demonstrate the importance of local knowledge of the species popularly known as boldo, lemongrass, and lemon balm (Table 3), which are precisely the same species that had the highest number of citations.

Table 3 | List of species classified by the Salience Index (IS), obtained from citations from the Ciampa informants.

SPECIES	*IS*	*SPECIES*	*IS*
Boldo	0,649	Marissol	0,061
Capim-limão	0,435	Carqueja	0,061
Erva-cidreira	0,360	Sabugueiro	0,059
Saião	0,214	Erva-doce	0,059
Cana-do-brejo	0,196	Canela	0,057
Arnica	0,193	Aveloz	0,053
Quebra-pedra	0,177	Poejo	0,053
Guaco	0,177	Coloral	0,051
Embaúba	0,171	Hamamelis virginiana	0,051
Babosa	0,152	Beterraba	0,045
Macaé	0,140	Gengibre	0,045
Camomila	0,135	Pitanga	0,043
Graviola	0,130	Arruda	0,040
Hortelã	0,130	Melancia	0,040
Pau-d'alho	0,128	Picão	0,034
Mertiolate	0,127	Rosa-branca	0,032
Erva-de-santa-maria	0,119	Alecrim-do-campo	0,032
Romã	0,108	Agrião	0,030
Hortelã-pimenta	0,099	Limoeiro	0,030
Boldo-do-chile	0,091	Jojoba	0,030
Pinhão-roxo	0,091	Rosa-mosqueta	0,020
Jaborandi	0,091	Dormideira	0,020
Penicilina	0,086	Aroeira	0,017
João-duro	0,086	Arnica-da-horta	0,016
Dente-de-leão	0,081	Abacate	0,015
Cordão-de-frade	0,080	Alho	0,015
Insulina	0,080	Joazeiro	0,013
Mamão-macho	0,071	Maracujá	0,011
Melão-de-são-caetano	0,064	Novalgina	0,010
Assa-peixe	0,062	Goiabeira	0,010
Parietária	0,061	Cravo-da-índia	0,006
Mangueira	0,061	Erva-de-bicho	0,005

Source: Authors.

In a survey of medicinal plants in 4 districts of the municipality of Resende/RJ, it was observed that the boldo was are among the 10 most culturally important species (BALDINI, 2015).

The importance of the species named boldo is remarkable. In ethnobotanical surveys in Brazil (GOIS *et al*., 2016), both urban and peri-urban communities. It made necessary the knowledge of the species with the same popular name and a deep understanding of their medicinal and adverse effects.

3.3 LIST OF SELECTED MEDICINAL SPECIES

The survey carried out through documents made available by the federal government resulted in 174 medicinal species. In comparison, the list of plants surveyed with Ciampa informants after applying the "taxonomic clues" methodology resulted in 85 species. After processing and joining both lists, it was possible to obtain the quantity of 209 species, of which 66 are native (Table 4). This list will be used to elaborate the cultivation, following the norms of the Pais social technology. However, the technical staff of CRS/JBRJ will screen to choose the species that best adapt to the region of Campo Grande/RJ.

Table 4 | List of medicinal species mentioned by informants from the Ciampa correlated to documents made available by the federal government.

Nº	*Scientific Name*	*Common Name*	*Cit*	*Na*	*Ex*	*Nat*	*Cul*	*FB*	*FFFB*	*MFFB*	*RENAME*	*RENISUS*
1	*Absinthium vulgare* Lam. = *Artemisia absinthium* L.	Losna					X					X
2	*Achillea millefolium* L.	Mil-folhas	X			X			X			X
3	*Achyrocline satureioides* (Lam.) DC.	Macela		X				X	X			
4	*Aconitum napellus* L.	Acônito			X			X				
5	*Actaea racemosa* L.	Erva-de-são--cristóvão			X				X	X		
6	*Aesculus hippocastanum* L.	Castanheiro--da-índia					X	X	X	X		
7	*Allium sativum* L.	Alho	X				X	X	X	X		X
8	*Aloe africana* Mill.	Babosa	X				X	X				
9	*Aloe ferox* Mill.	Babosa	X				X	X				
10	*Aloe spicata* L. f	Babosa	X				X	X				
11	*Aloe vera* (L.) Burm. f.	Babosa	X				X	X		X	X	X
12	*Aloysia polystachya* (Griseb.) Moldenke	Burrito			X				X			
13	*Alpinia zerumbet* (Pers.) B.L. Burtt & R.M. Sm	Colônia					X		X			X
14	*Alternanthera brasiliana* (L.) Kuntze	Penicilina	X	X								
15	*Althaea officinalis* L.	Malva-branca			X			X				
16	*Anacardium occidentale* L.	Cajueiro		X								X
17	*Anadenanthera colubrina* (Vell.) Brenan	Angico-branco		X				X				
18	*Ananas comosus* (L.) Merril	Abacaxi		X								X
19	*Anethum graveolens* L.	Endro				X		X				
20	*Annona muricata* L.	Graviola	X				X					

Nº	Scientific Name	Common Name	Cit	Na	Ex	Nat	Cul	FB	FFFB	MFFB	RENAME	RENISUS
21	*Arctium lappa* L.	Bardana				X			X			
22	*Arctostaphylos uva-ursi* (L.) Spreng.	Uva-ursi			X			X				
23	*Arnica montana* L.	Arnica	X		X			X				
24	*Atropa belladonna* L.	Beladona			X			X				
25	*Attalea speciosa Mart. ex Spreng. = Orbignya speciosa* (Mart.) Barb. Rodr.	Babaçu		X								X
26	*Baccharis articulata* (Lam.) Pers.	Carqueja-doce	X	X								
27	*Baccharis dracunculifolia* DC.	Alecrim-do--campo	X	X								
28	*Baccharis trimera* (Less.) DC.	Carqueja	X	X				X	X			X
29	*Bauhinia affinis* Vogel	Pata-de-vaca		X								X
30	*Bauhinia forficata* Link	Pata-de-vaca		X								X
31	*Bauhinia variegata* L.	Pata-de-vaca					X					X
32	*Beta vulgaris* L.	Beterraba	X				X					
33	*Bidens alba* (L.) DC.	Picão-branco	X	X								
34	*Bidens pilosa* L.	Picão-preto				X						X
35	*Bixa orellana* L.	Urucum	X	X								
36	*Bryophyllum pinnatum* (Lam.) Kurz	Folha-da-for-tuna	X		X							
37	*Buxus chinensis* Link = *Simmondsia chinensis* (Link) C.K. Schneid.	Jojoba	X		X							
38	*Calendula officinalis* L.	Calêndula					X	X	X	X		X
39	*Carapa guianensis* Aubl.	Andiroba		X								X
40	*Carica papaya* L.	Mamoeiro	X			X						
41	*Casearia sylvestris* Sw.	Guaçatonga		X								X
42	*Cecropia ficifolia* Warb. ex Snethl.	Embaúba	X	X								
43	*Centella asiatica* (L.) Urb.	Centelha-asiá-tica				X		X				
44	*Cinchona calisaya* Wedd.	Quina			X			X				
45	*Cinnamomum cassia* (L.) J. Presl	Canela-da--china	X				X	X				
46	*Cinnamomum verum* J. Presl	Canela	X		X			X				

Nº	Scientific Name	Common Name	Cit	Na	Ex	Nat	Cul	FB	FFFB	MFFB	RENAME	RENISUS
47	*Cissus sicyoides* L. = *Cissus verticillata* (L.) Nicolson & C.E.Jarvis	Insulina-vegetal	X	X								
48	Citrullus lanatus *(Thunb.) Matsum. & Nakai*	Melancia	X				X					
49	*Citrus ×limon* (L.) Osbeck	Limão	X			X		X				
50	*Citrus aurantium* L. subsp. Aurantium	Laranjeira-azeda					X	X				
51	*Citrus sinensis* (L.) Osbeck	Laranjeira-doce					X	X				
52	*Cola nitida* (Vent.) Schott & Endl.	Noz-de-cola			X			X				
53	*Copernicia prunifera* (Mill.) H.E. Moore	Carnaúba		X				X				
54	*Coriandrum sativum* L.	Coentro				X		X				
55	*Corymbia citriodora* (Hook.) K.D. Hill & L.A.S. Johnson	Eucalipto-limão					X	X				
56	*Costus scaber* Ruiz & Pav.	Cana-do-brejo	X	X								X
57	*Costus spicatus* (Jacq.) Sw.	Cana-do-brejo	X		X							X
58	*Crataegus azarolus* L.	Crataegus			X			X	X			
59	*Crataegus laevigata* (Poir.) DC.	Pilriteiro			X			X	X			
60	*Crataegus monogyna* Jacq.	Pilriteiro			X			X	X			
61	*Crataegus nigra* Waldst. & Kit.	Espinheiro-húngaro			X			X	X			
62	*Crataegus pentagyna* Waldst. & Kit. ex Willd.	Espinheiro-preto			X			X	X			
63	*Crataegus rhipidophylla* Gand.	Espinheiro-alvar			X			X	X			
64	*Croton cajucara* Benth.	Marassacaca		X								X
65	*Croton grewioides* Baill. = *Croton zehntneri* Pax & K. Hoffm.	Alecrim-de-cabloca		X								X
66	*Curcuma longa* L.	Açafrão-da-terra					X	X	X			X
67	*Cymbopogon citratus* (DC.) Stapf	Capim-limão	X			X		X				
68	*Cymbopogon martini* (Roxb.) W. Watson	Palmarosa	X				X	X				
69	*Cynara scolymus* L.	Alcachofra			X			X	X	X	X	X
70	*Dalbergia subcymosa* Ducke	Verônica		X								X
71	*Datura stramonium* L.	Castanheiro-do-diabo				X		X				

Nº	Scientific Name	Common Name	Cit	Na	Ex	Nat	Cul	FB	FFFB	MFFB	RENAME	RENISUS
72	*Dysphania ambrosioides* (L.) Mosyakin & Clemants = *Chenopodium ambrosioides* L.	Erva-de-santa-maria	X			X						X
73	*Echinacea angustifolia* DC.	Equinácea			X				X			
74	*Echinacea purpurea* (L.) Moench	Equinácea			X				X	X		
75	*Echinodorus grandiflorus* (Cham. & Schltdl.) Micheli	Chapéu-de-couro		X				X				
76	*Elettaria cardamomum* (L.) Maton	Cardamomo			X			X				
77	*Equisetum arvense* L.	Cavalinha			X				X	X		
78	*Eucalyptus globulus* Labill.	Eucalipto					X	X	X			
79	*Eugenia uniflora* L.	Pitangueira	X	X				X				
80	*Euphorbia prostrata* Ailton.	Quebra-pedra-rasteiro	X	X								
81	*Euphorbia tirucalli* L.	Quebra-pedra	X				X					
82	*Foeniculum vulgare* Mill.	Funcho	X			X		X	X			
83	*Frangula purshiana* (DC.) A. Gray	Cáscara-sagrada			X			X	X			
84	*Fridericia chica* (Bonpl.) L.G. Lohmann = *Arrabidaea chica* (Bonpl.) Verl.	Crajiru		X								X
85	*Gallesia integrifolia* (Spreng.) Harms	Pau-d'alho	X	X								
86	*Gentiana lutea* L.	Genciana-amarela			X			X				
87	*Ginkgo biloba* L.	Ginkgo-biloba					X			X		
88	*Glycine max* (L.) Merr.	Soja					X		X	X	X	
89	*Glycyrrhiza glabra* L.	Alcaçuz			X			X	X			
90	*Glycyrrhiza inflata* Batalin	Alcaçuz			X				X			
91	*Glycyrrhiza uralensis* Fisch.	Alcaçuz			X				X			
92	*Gossypium hirsutum* L.	Algodoeiro				X		X				
93	*Gymnanthemum amygdalinum* (Delile) Sch.Bip. ex Walp.	Boldo	X			X						X
94	*Hamamelis virginiana* L.	Hamamélis	X		X			X				
95	*Handroanthus impetiginosus* (Mart. ex DC.) Mattos = *Tabebuia avellanedae* Lorentz ex Griseb.	Ipê-roxo		X					X			X

Nº	Scientific Name	Common Name	Cit	Na	Ex	Nat	Cul	FB	FFFB	MFFB	RENAME	RENISUS
96	*Harpagophytum procumbens* DC. ex Meissn.	Garra-do-diabo			X			X	X	X	X	
97	*Harpagophytum zeyheri* Decne	Garra-do-diabo			X			X	X	X		
98	*Helianthus annuus* L.	Girassol					X	X				
99	*Hydrastis canadensis* L.	Hidraste			X			X				
100	*Hyoscyamus niger* L.	Meimendro--negro			X			X				
101	*Hypericum perforatum* L.	Erva-de-são--joão			X				X	X		
102	*Illicium verum* Hook. f.	Anis-estrelado					X	X				
103	*Jatropha gossypiifolia* L.	Pinhão-roxo	X	X								
104	*Jatropha multifida* L.	Flor-de-coral	X				X					
105	*Justicia pectoralis* Jacq.	Chambá		X				X				
106	*Kalanchoe brasiliensis* Cambess.	Saião	X	X								
107	*Krameria lappacea* (Dombey) Burdet & B.B. Simpson	Ratânia-peruana			X			X				
108	*Lavandula angustifolia* Mill.	Alfazema					X	X				
109	*Leonotis nepetifolia* (R.Br.) W.T. Aiton	Cordão-de--frade	X			X						
110	*Leonurus cardiaca* L.	Agripalma			X			X				
111	*Leonurus japonicus* Houtt.	Rubim	X			X						
112	*Libidibia ferrea* (Mart. ex Tul.) L.P. Queiroz = *Caesalpinia ferrea* Mart. ex Tul.	Pau-ferro		X								X
113	*Lippia alba* (Mill.) N.E. Br. ex Britton & P. Wilson	Cidreira	X	X				X				
114	*Lippia sidoides* Cham. = *Lippia origanoides* Kunth	Alecrim-pimenta		X				X		X		X
115	*Malva sylvestris* L.	Malva			X							X
116	*Mangifera indica* L.	Mangueira	X				X					
117	*Matricaria chamomilla* L.	Camomila	X				X			X		X
118	*Maytenus aquifolia* Mart. = *Monteverdia aquifolia* (Mart.) Biral	Espinheira--santa		X						X		X
119	*Maytenus ilicifolia* Mart. ex Reissek = *Monteverdia ilicifolia* (Mart. Ex Reissek) Biral	Espinheira--santa		X				X		X	X	X
120	*Melaleuca alternifolia* (Maiden & Betche) Cheel	Árvore-do-chá					X	X				

Nº	Scientific Name	Common Name	Cit	Na	Ex	Nat	Cul	FB	FFFB	MFFB	RENAME	RENISUS
121	*Melissa officinalis* L.	Erva-cidreira	X				X	X				
122	*Mentha arvensis* L.	Hortelã-japonesa					X	X				
123	*Mentha crispa* L.	Menta	X			X						X
124	*Mentha pulegium* L.	Poejo	X			X						X
125	*Mentha villosa* Huds.	Hortelã	X		X							X
126	*Mentha x piperita* L.	Menta-piperita	X				X	X			X	X
127	*Mikania glomerata* Spreng.	Guaco	X	X				X			X	X
128	*Mikania laevigata* Sch.Bip. ex Baker	Guaco	X	X				X			X	X
129	*Mimosa pudica* L.	Dormideira	X	X								
130	*Momordica charantia* L.	Melão-são-caetano	X			X						X
131	*Myristica fragrans* Houtt.	Moscadeira			X			X				
132	*Myroxylon balsamum* (L.) Harms var. balsamum	Bálsamo-de-tolu		X				X				
133	*Myroxylon balsamum* (L.) Harms var. pereirae (Royle) Harms	Bálsamo-do--peru		X				X				
134	*Nasturtium officinale* W.T. Aiton = *Rorippa nasturtium-aquaticum* (L.) Hayek	Agrião	X				X					
135	*Ocimum gratissimum* L.	Alfavacão				X						X
136	*Olea europaea* L.	Oliveira					X	X				
137	*Operculina macrocarpa* (L.) Urb.	Batata-de-purga		X				X				
138	*Parietaria officinalis* L.	Parietária	X				X					
139	*Passiflora alata* Curtis	Maracujá	X	X				X				X
140	*Passiflora edulis* Sims	Maracujá-doce	X	X				X				X
141	*Passiflora incarnata* L.	Maracujá	X				X	X		X		X
142	*Paullinia cupana* Kunth	Guaraná		X						X		
143	*Pectis brevipedunculata* (Gardner) Sch. Bip.	Capim-limão--de-flor	X	X								
144	*Persea americana* Mill.	Abacateiro	X			X						X
145	*Petroselinum sativum* Hoffm.	Salsa					X					X
146	*Peumus boldus* Molina	Boldo-do-chile	X		X					X		
147	*Phyllanthus niruri* L.	Quebra-pedra	X	X				X				X
148	*Phyllanthus tenellus* Roxb.	Quebra-pedra	X	X								X

Nº	Scientific Name	Common Name	Cit	Na	Ex	Nat	Cul	FB	FFFB	MFFB	RENAME	RENISUS
149	*Phyllanthus urinaria* L.	Quebra-pedra	X	X								X
150	*Pilocarpus microphyllus* Stapf ex Wardlew.	Jaborandi	X	X								
151	*Pimpinella anisum* L.	Erva-doce	X				X					
152	*Piper anisum* (Spreng.) Angely	Jaborandi	X	X								
153	*Piper methysticum* G. Forst	Kava-kava					X			X		
154	*Plantago major* L.	Transagem				X		X				X
155	*Plantago ovata* Forssk.	Transagem			X						X	
156	*Plectranthus amboinicus* (Lour.) Spreng.	Hortelã-grossa	X				X					
157	*Plectranthus barbatus* Andrews	Boldo-de-jardim	X				X	X				X
158	*Polygala senega* L.	Polígala			X			X				
159	*Polygonum hydropiperoides* Michx.	Erva-de-bicho	X	X								X
160	*Polygonum punctatum* Elliott = *Polygonum acre* Kunth	Erva-de-bicho		X								X
161	*Portulaca pilosa* L.	Amor-crescido		X								X
162	*Prunus domestica* L.	Ameixeira-europeia					X	X				
163	*Psidium guajava* L.	Goiabeira	X			X				X		X
164	*Punica granatum* L.	Romã	X			X		X				X
165	*Quillaja saponaria* Molina	Quilaia			X			X				
166	*Rauwolfia serpentina* (L.) Benth. ex Kurz	Rauwolfia-serpentina			X			X				
167	*Rhamnus purshiana* DC.	Cáscara-sagrada			X					X	X	X
168	*Rheum officinale* Baill.	Ruibarbo-chinês			X			X				
169	*Rheum palmatum* L.	Ruibarbo			X			X				
170	*Rosa alba* L.	Rosa-branca	X				X					
171	*Rosa rubiginosa* L.	Rosa-mosqueta	X				X					
172	*Ruta graveolens* L.	Arruda	X		X							X
173	*Salix alba* L.	Salgueiro-branco					X				X	X
174	*Salix daphnoides* Vill.	Salgueiro-violeta			X			X				
175	*Salix fragilis* L.	Salgueiro-frágil			X			X				

Nº	Scientific Name	Common Name	Cit	Na	Ex	Nat	Cul	FB	FFFB	MFFB	RENAME	RENISUS
176	*Salix purpurea* L.	Salgueiro-de--casca-roxa			X			X				
177	*Salvia officinalis* L.	Sálvia					X	X				
178	*Salvia rosmarinus* Schleid. = *Rosmarinus officinalis* L.	Alecrim					X	X				
179	*Sambucus australis* Cham. & Schltdl.	Sabugueiro	X	X								
180	*Sambucus nigra* L.	Sabugueiro	X			X		X				
181	*Schinus terebinthifolia* Raddi	Aroeira	X	X							X	X
182	*Senna alexandrina* Mill.	Sene				X				X		
183	*Serenoa repens* (W. Bartram) Small	Saw-palmetto			X			X		X		
184	*Silybum marianum* (L.) Gaertn.	Cardo-mariano				X		X				
185	*Solanum paniculatum* L.	Jurubeba		X								X
186	*Solidago chilensis* Meyen = *Solidago microglossa* DC.	Arnica-brasi-leira	X	X								X
187	*Stevia rebaudiana* (Bertoni) Bertoni	Estévia		X				X				
188	*Strychnos nux-vomica* L.	Noz-vómica			X			X				
189	*Stryphnodendron adstringens* (Mart.) Coville	Barbatimão		X						X		X
190	*Styrax benzoin* Dryand.	Benjoeiro			X			X				
191	*Syzygium aromaticum* (L.) Merr. & L.M. Perry	Cravo-da-índia	X				X					
192	*Syzygium cumini* (L.) Skeels	Jamelão				X						X
193	*Tagetes minuta* L.	Cravo-de-de-funto				X						X
194	*Tanacetum parthenium* (L.) Sch.Bip.	Tanaceto					X	X				
195	*Taraxacum officinale* F.H. Wigg.	Dente-de-leão	X			X		X				
196	*Theobroma cacao* L.	Cacau				X		X				
197	*Thymus vulgaris* L.	Tomilho					X	X				
198	*Trifolium pratense* L.	Trevo-dos-pra-dos				X		X		X		X
199	*Uncaria tomentosa* (Willd. ex Roem. & Schult.) DC.	Unha-de-gato		X				X		X	X	X
200	*Vaccinium macrocarpon* Aiton	Arando			X			X				
201	*Valeriana officinalis* L.	Valeriana					X	X		X		

Nº	Scientific Name	Common Name	Cit	Na	Ex	Nat	Cul	FB	FFFB	MFFB	RENAME	RENISUS
202	*Vanilla planifolia* Jacks. ex Andrews	Baunilha		X				X				
203	*Varronia curassavica* Jacq. = *Cordia curassavica* (Jacq.) Roem. & Schult.	Erva-baleeira		X								X
204	*Vernonanthura polyanthes* (Sprengel) Vega & Dematteis	Assa-peixe	X	X								X
205	*Vernonanthura membranacea* (Gardner) H. Rob. = *Vernonia ruficoma* Gardner	Assa-peixe	X	X								X
206	*Vitex agnus-castus* L.	Vitex				X		X				
207	*Zea mays* L.	Milho					X	X				
208	*Zingiber officinale* Roscoe	Gengibre	X				X	X		X		X
209	*Ziziphus joazeiro* Mart.	Joazeiro	X	X								

Sources Researched: FB: Brazilian Pharmacopoeia (6th edition), FFFB: Brazilian Pharmacopoeia Herbal Medicines Form (1st edition - First Supplement), MFFB: Herbal Medicine Memento of the Brazilian Pharmacopoeia, Rename: National List of Essential Medicines, Renisus: National List of Medicinal Plants of Interest to the Unified Health System (SUS).

Subtitle: Cit: *Medicinal species that have a popular name identical to those mentioned by the informants,* **Na:** *Native species,* **Ex:** *Exotic species,* **Nat:** *Naturalized species,* **Cul:** *Cultivated species.*

The National Policy on Medicinal Plants and Herbal Medicines (PNPMF) advises intensifying research and developing new technologies in native and exotic medicinal plants adapted from the Brazilian flora and sustainably using them (BRASIL, 2016).

Within this context, guideline 5 prioritises the epidemiological needs of the population. In contrast, sub guideline 7.3 encourages research to increase the number of native species of the Brazilian flora in the Brazilian Pharmacopoeia (BRASIL, 2016).

The plant species listed above (Table 4) fit the biodiversity profiles that the PNPMF suggests for the development of research and the rational use of species already studied.

The general list meets the objective developed by the technical staff of CRS/JBRJ, which uses plant species with medicinal properties in a space that adds human resources training and permeation of sociocultural values to current therapeutic needs.

Each species has a history, which can be worked on during and after implementing Pais social technology.

The National Policy on Integrative and Complementary Practices (PNPIC) has perspectives similar to the PNPMF; this can be seen through the PMF7 (Medicinal Plants and Phytotherapy) guideline because it talks about encouraging research and technological developments based on the traditional use of medicinal species, prioritising the epidemiological needs of the population with an emphasis on native species (BRASIL, 2015).

The general list presented in Table 4 aligns with the two public policies PNPMF and PNPIC, because most of the medicinal species listed are native and exotic cultivated in the Brazilian territory. In addition, there

was the participation of the local population that indicated native species with traditional uses, such as – *A. brasiliana*, *B. dracunculifolia*, *B. trimera*, *B. alba*, *B. orellana*, *C. ficifolia*, *E. uniflora*, among others.

It is essential to emphasise the relevance of the Pais social technology precepts, which follow an agroecological cultivation pattern capable of grouping different species in a single location. Therefore, it is ideal for deployment in the socio-environmental sector of Ciampa, as the site has space to receive a large number of plant species.

The vision and mission of Ciampa's socio-environmental sector are compatible with sustainability objectives through the reforestation activities carried out in the degraded areas of the surroundings. And the structuring of this crop creates an unprecedented opportunity to develop teaching and research activities in the agroecological area with medicinal plants.

3.4 ADAPTATION OF SWOT-AHP METHODOLOGY

The Swot-AHP methodology adapted to this work identified the strengths and weaknesses of the strategic and operational system of the socio-environmental sector in an integrated manner (FORMIGA JR.; CÂNDIDO; AMARAL, 2015). It was able to originate new methodological paths.

Figure 4 shows the management strategies used to structure and compile medicinal species with cultural importance, added with medicinal species that have national significance for the Ministry of Health (MS).

Figure 4 | Methodological steps focus on the structuring and compiling of medicinal species to implement a social technology involving cultivation.

Source: A self elaboration.

4 FINAL CONSIDERATIONS

The Swot-AHP method played a vital role in developing activities in Ciampa's socio-environmental sector and organising the necessary paths for implementing sustainable cultivation based on the technology of Integrated and Sustainable Agroecological Production (Pais).

This methodology is applicable in the environmental area. It must be part of the management of the socio-environmental sector to develop the activities necessary for the sector's growth, especially the development of Pais social technology with medicinal plants.

One of the main factors clarified so far concerns the identification of strategic and fundamental points the need to implement a fundraising team and another to implementation of projects, highlighting the selection of medicinal species of national public interest, taking into account local traditional knowledge, to compose the future structure made with Pais social technology.

The next step is the choice of species through the general list to build the design of the mandala beds based on the particularities of cultivation of each species. Within this context, the idea is that biomes group the species to develop educational activities on naturalised and cultivated native and exotic Brazilian biodiversity.

The implantation of an agroecological crop in the socio-environmental sector of Ciampa depends on the completion of the gardening course, the voluntary support of the local community proposed by the coordinator, and the technical support of CRS/JBRJ. These are great opportunities that must be worked on at the beginning of the cultivation's implantation and the continuity of activities in the sector.

Thanks to the adaptation of the Swot-AHP method to the present work, it was possible to organise absolute paths for the development of jobs in the area of sustainability that have the purpose of

managing or setting up an environmental sector based on the cultivation of medicinal plants.

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