

## Protection of biodiversity in Brazilian agriculture

In order to adequately protect ecosystems and forest remnants, as well as delimit Legal Reserve areas, the Brazilian Forest Code was established in 2012, which stipulates that every rural property must maintain a percentage of area with native vegetation coverage consistent with its location. This percentage varies for properties located in the Legal Amazon, from 80% for the area of forests, 35% for the area of the Cerrado biome and 20% for the area of general fields. In the rest of the country, the percentage of coverage of native vegetation that must be maintained is 20%. However, if there were no laws to specify these percentages of protected native vegetation under the Legal Reserve regime, the coverage of native areas would decrease from 85% to 61% in the Amazon, and from 63% to 13% in the Cerrado (Metzger et al., 2019). A lack of Legal Reserves would not only impact the loss of native coverage, but would also lead to the massive extinction of endemic species in both biomes (Metzger et al., 2019). According to Paolucci et al. (2019), Legal Reserves serve as habitats for several species, which contribute to seed dispersal, and facilitate the recovery and ecological restoration of degraded environments in nearby areas.

In accordance with the Forest Code, the Rural Environmental Register (from the Portuguese – *Cadastro Ambiental Rural* - CAR) was also created as a federal public registry, in order to map and integrate environmental data derived from rural properties (Law 12,651 of 2012). This register must include the location of remnants of native vegetation, Permanent Preservation Areas (*Área de Preservação Permanente* – APP), Restricted Use areas and Legal Reserves. Moreover, with the objective of recovering previously suppressed areas, the Environmental Regularization Program (*Programa de Regularização Ambiental* – PRA) was created to standardize the environmental situation of the rural property, providing control and monitoring mechanisms for environmental regeneration or compensation. Data updated in February 2022 indicate that 52% of CAR registrants have already requested membership in PRA, as a way of recovering previously degraded areas, with Espírito Santo being the state with the highest percentage of membership (94% of its rural properties). In addition, more than 6.5 million rural properties have already been registered (Table 1).

Table 1. Rural Environmental Register (CAR) numbers until February 1, 2022 (MAPA, 2022).

<b>Brazilian states</b>	<b>Number of entries</b>	<b>Registered area (in hectare)</b>	<b>Applications to join PRA</b>
Acre	41,704	13,216,480	61%
Alagoas	108,182	2,112,530	48%
Amazonas	68,081	68,501,924	75%
Amapá	8,657	5,085,111	45%
Bahia	959,823	47,011,454	38%
Ceará	289,916	10,617,467	66%
Distrito Federal	16,364	741,664	73%
Espírito Santo	104,824	3,597,642	94%
Goiás	190,796	32,295,942	69%
Maranhão	248,861	28,693,707	47%
Minas Gerais	936,039	52,422,355	57%
Mato Grosso do Sul	76,768	35,002,709	23%
Mato Grosso	161,846	82,360,787	77%
Pará	256,997	78,676,545	39%
Paraíba	162,282	4,102,389	68%
Pernambuco	318,568	7,065,735	64%
Piauí	240,458	18,681,879	64%
Paraná	483,310	18,629,921	58%
Rio de Janeiro	56,861	2,807,709	65%
Rio Grande do Norte	84,167	3,884,489	75%
Rio Grande do Sul	594,985	23,379,156	56%
Rondônia	140,355	15,224,519	62%
Roraima	20,794	8,307,347	41%
Santa Catarina	364,865	8,140,316	48%
Sergipe	88,252	1,774,777	64%
São Paulo	397,369	22,650,542	2%
Tocantins	82,716	23, 836,350	31%

In addition to the regulation of Brazilian laws helping to recover and maintain priority areas for preservation, other private incentives have been implemented in Brazil. Among the initiatives created through private institutions, we can mention those instituted by Cargill. Cargill is a company present in 70 countries and has been operating in Brazil since 1965, headquartered in São Paulo and operating in 17 Brazilian states and the Federal District (Brasília). The company offers services and products in 4 main branches. In agriculture, it operates in the sector of purchasing, processing and distributing grains for manufacturers and food products. In the food

sector, it provides ingredients that promote health. In the financial and industrial sectors, it offers financial and management solutions; in addition to serving users of industrial products, it develops, and markets sustainable products based on agricultural raw materials (Cargil, 2022a).

In Brazil, the company encourages the restoration of native vegetation, to contribute to the implementation of the Forest Code and the adaptation of rural properties, in addition to mitigating the effects of climate change. For this purpose, in April 2022 it launched a call for proposals for restoration projects, with the aim of implementing actions to restore native vegetation cover on third-party properties. Through this initiative, Cargill actively supports the standardization of rural properties, contributing to Brazilian agriculture in the role of coexistence with native forests (Cargill, 2022b).

The Wildlife Research and Environmental Education Society (*Sociedade de Pesquisa em Vida Selvagem e Educação Ambiental* - SPVS) is an initiative with more than 30 years of experience in different Brazilian biomes, developing innovative and quality projects for nature conservation (SPVS, 2022a). One of the programs led by SPVS is the Deforestation Avoidance Program (*Programa Desmatamento Evitado*), which aims to protect natural heritage areas through payments for environmental and ecosystem services. This program includes owners of private reserves, companies, industries and representatives of public energy utilities, and it has already protected over 4,500 hectares. In addition, through the program, 12 Private Reserves of Natural Heritage (*Reservas Particulares do Patrimônio Natural* - RPPN) have already been created (SPVS, 2022b).

Other initiatives from SPVS are restoration projects, including the restoration of the Araucaria and Restinga Forests, in the *State Park Serra do Tabuleiro*, and also the project for the conservation of private areas and enhancement of ecosystem services in the Atlantic Forest. The Araucaria Forest restoration project was completed in 2017, and during the entire execution period, more than 86,000 seedlings of 39 native species were planted. These positive results also ensured the formalization and protection of the *RPPN Papagaio-de-peito-roxo*, a purple-breasted parrot, an endangered species (SPVS, 2022c).

During the execution of the Restinga Restoration Project in the *State Park Serra do Tabuleiro*, 350 ha of native vegetation was recovered. Furthermore, the actions of

this project are planned to continue until 2023, with potential for expansion to other degraded areas (SPVS, 2022c).

According to the Map of Sustainable Livestock Initiatives (*Mapa de Iniciativas da Pecuária Sustentável - MIPS*), several initiatives are underway, and many others have already been completed, integrating livestock and agriculture with the sustainable use of natural resources, promoting the conservation of Brazilian biodiversity. This database was developed by the Sustainable Livestock Working Group (*Grupo de Trabalho da Pecuária Sustentável - GTPS*), in order to provide transparency on sustainable livestock in Brazil. In addition, this working group provides visibility to the actions and their organizers, offering investors and sponsors guidance for investing in these actions. The projects take place throughout all Brazilian biomes and involve farmers, small and large producers, with the help of public policies and private initiatives.

CONSERV is a voluntary initiative, supported by the Environmental Research Institute of the Amazon (*Instituto de Pesquisa Ambiental da Amazônia - IPAM*), which aims to demonstrate that standing forests have value. The purpose of the CONSERV initiative is financially compensate rural producers, who preserve native vegetation that would legally be liable to suppression. This operation started in 2020 in three municipalities in Mato Grosso state and conserved about 8,400 ha, with expansion to other locations forecasted (MIPS, 2022). Other private initiatives have also shown positive results for the conservation of biodiversity in Brazil such as the ABC Cerrado project. More than 9,000 rural producers have been trained to promote sustainable technologies in production, which resulted in the recovery of 93,000 ha of degraded area since 2019.

The Confederation of Agriculture and Livestock of Brazil (*Confederação da Agricultura e Pecuária do Brasil - CNA*) with the Brazilian Agricultural Research Company (Empresa Brasileira de Pesquisa Agropecuária – *Embrapa*) developed the Biomes Project (*Projeto Biomas*) initiative, which aimed to identify sustainable ways to recover and restore original vegetation in rural properties. The project ended in 2020, but lasted 11 years, testing and presenting new technologies for tree supplementation in the rural properties to guarantee its diversification. The purpose of the project was to adapt models in the landscapes of the properties, these being models for recomposing native species, and preserving the adequacy of degraded areas of productive systems and others. During this period, more than 300 researchers from

122 institutions were involved, and more than 16,000 places were offered for on-site and distance-learning courses. In terms of environmental adaptation, over 1 million seeds were sown, and more than 100,000 seedlings were planted (Embrapa, 2022; CNA, 2022).

Despite ending in 2020, the Biomes Project continues to have positive impact today. One example of this is the *P.R.A Valer* initiative, in the state of Amazonas, which intended to simplify the model of the Environmental Regularization Program (*Programa de Regularização Ambiental* - PRA), inserting the productive sector in the standardization process.

Despite traditional agriculture being the typical model in the country, other methods of cultivation have been encouraged and used by the Brazilian government. Agroecology, a system that optimizes integrating productive capacity, use, and conservation of biodiversity, has been widely disseminated in the last two decades. Through the creation of the National Policy on Agroecology and Organic Production (*Política Nacional da Agroecologia e Produção Orgânica* - PNAPO – Decreto 7794/2012), Brazil became the first country to create a specific state policy to encourage agroecology (Agroecologia, 2022). Its goal is to integrate, articulate and adapt policies, programs and actions based on agroecology, aiming at the sustainable development of natural resources. According to Altieri et al. (2012), the adoption of agroecological practices benefits both producers and biodiversity, since it optimizes ecosystem services and guarantees the conservation of natural resources. Based on this information, the Brazilian practice of adopting a policy aimed at encouraging agroecological production demonstrates the country's commitment to maintaining its ecosystems and preserving biological diversity.

The National Plan for Agroecology and Organic Production (*Plano Nacional de Agroecologia e Produção Orgânica* - PLANAPO), also known as Brazil Agroecológico, is one of the main instruments of the National Policy on Agroecology and Organic Production (PNAPO) mentioned previously. PLANAPO was launched in 2013, presenting initiatives to support the increase in the cultivation and consumption of organic and agroecological products in Brazil. The first cycle of this plan took place between 2013 and 2015, through four structuring axes, involving the production, use and conservation of natural resources, knowledge, and marketing and consumption. In this period, more than R\$ 2.6 billion was invested to implement public actions and policies aimed at improving agroecology (PLANAPO, 2022).

In its second version, PLANAPO 2016-2019 has six axes, adding to the previous axes land and territory as well as sociobiodiversity goals. The main initiatives are strengthening agroecological and organic production networks, and economically supporting family farming (PLANAPO, 2022). By implementing these two versions of the PLANAPO, Brazil demonstrated its commitment to public policies aiming at protecting biodiversity, through conserving its territories by adopting agroecological practices.

Within the guidelines of agroecology in Brazil, we can mention the National Agroecology Articulation (*Articulação Nacional de Agroecologia - ANA*), founded to coordinate Brazilian civil society networks and organizations engaged in the promotion of agroecology (ANA, 2022a). Currently, the ANA includes 23 states and regional networks, bringing together hundreds of groups, associations and nongovernmental organizations in the country. Since 2008, it has been working with priority themes, including biodiversity, public policies with an agroecological focus and agroenergy/agroecology.

Currently, the ANA has 3,890 registered initiatives, divided into 20 thematic areas. Among these thematic areas, education and construction of agroecological knowledge are highlighted, with a focus on food, food security and sovereignty and management of agroecosystems (Figure 1). Paraná, Rio de Janeiro, and Paraíba are the three states with the highest number of agroecological initiatives (Figure 2).

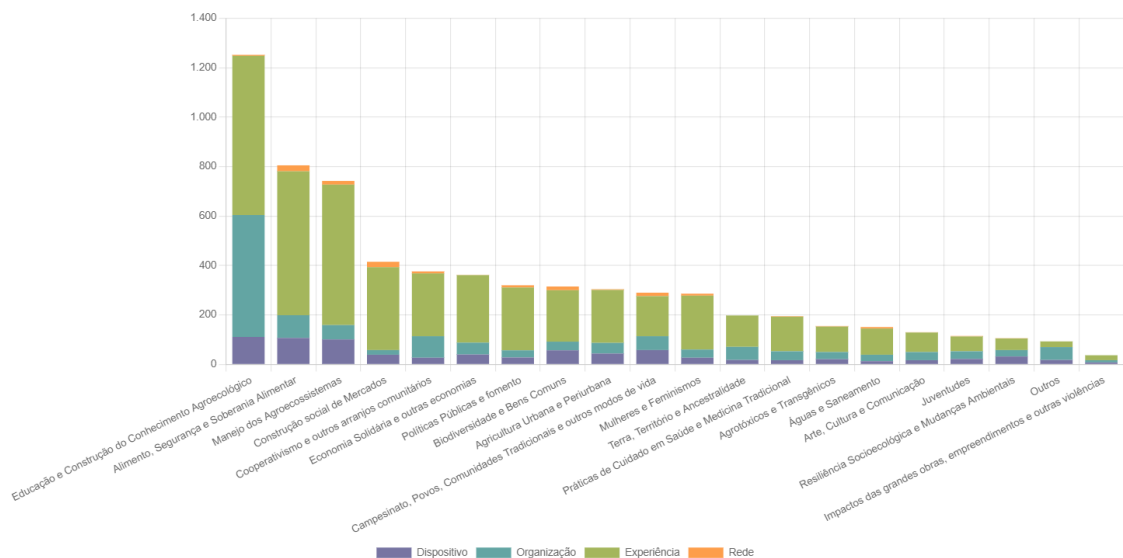


Figure 1. Initiatives mapped by the National Agroecology Articulation (*Articulação Nacional de Agroecologia - ANA*) divided by thematic areas (ANA, 2022b).

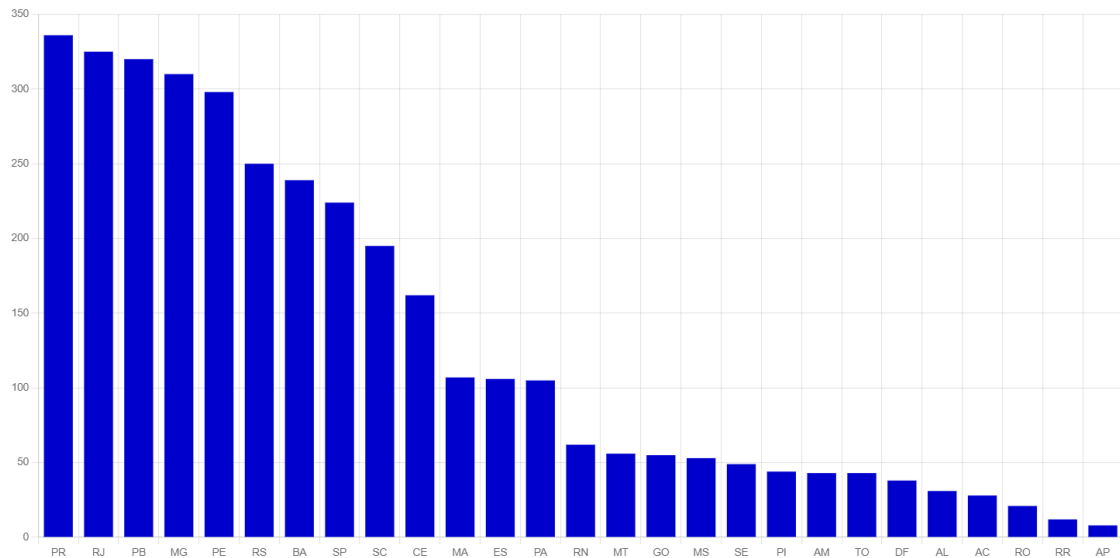


Figure 2. Number of agroecological initiatives by state of Brazil, according to the National Agroecology Articulation (*Articulação Nacional de Agroecologia - ANA, 2022b*).

In 2020, the ANA launched a survey of municipal initiatives that directly or indirectly support family farming and agroecology. More than 700 initiatives were identified, including public policies, actions, programs, laws, ordinances and normative instructions (Conexão Planeta, 2020, London et al., 2020). The survey involved 530 municipalities in 26 states, mobilizing 34 researchers over two months. Among the biomes, the Atlantic Forest has 407 mapped initiatives, followed by the Caatinga with 142, the Cerrado with 72 and the Amazon with 35 (Conexão Planeta, 2020, Londres et al., 2020).

Other initiatives have also been adopted in Brazil, such as the Integration-Crop-Livestock-Forest (ICLF), which is a way of minimizing the impacts caused by the use of land by agriculture and livestock. The ICLF integrates agricultural and livestock production with biodiversity, and it was adopted in several Brazilian states. This system follows an agricultural production strategy that integrates different production systems and the ecosystem of the same area (REDE ILPF, 2022a). This integration seeks to optimize land use, raising the productivity of cropping systems without the need to acquire new areas, in order to avoid excessive expansion. These agricultural production systems can be made by combining two or three components (Figure 3).

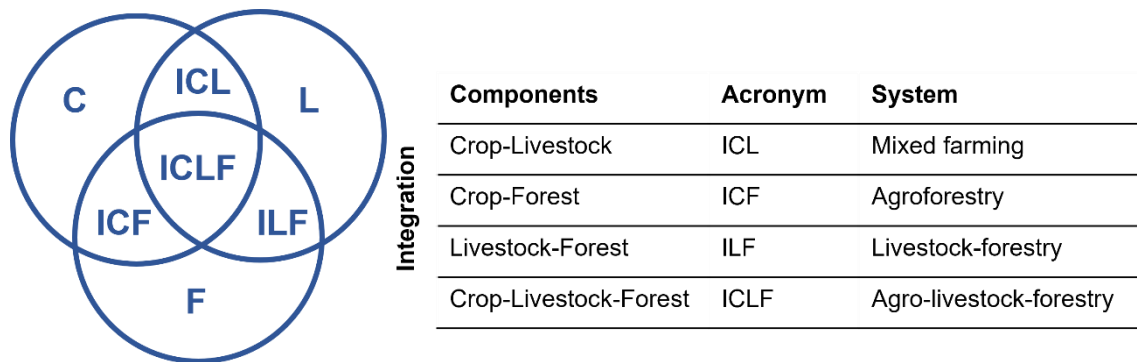


Figure 3. Components of agricultural production integration. Source: Embrapa.

There are countless benefits of using this integration system in Brazilian agriculture. We can highlight the increase in production and network income, due to the optimization of the cultivated area and the possibility of adapting the system to rural properties of all sizes and profiles. Environmentally speaking, the use of the system improves the quality and conservation of the productive characteristics of the soil, optimizing and intensifying the cycling of nutrients, as well as reducing the pressure to open new areas with native vegetation (Rede ILPF, 2022b). According to these data, from the 2015/2016 crop to the 2020/2021 crop, there was an estimated 52% increase in areas under the ICLF integration system in Brazil. According to Polidoro et al. (2020), it is estimated that in the 2020/2021 harvest, Brazil increased the area with integration systems to 17,431,533 ha (Figure 4).



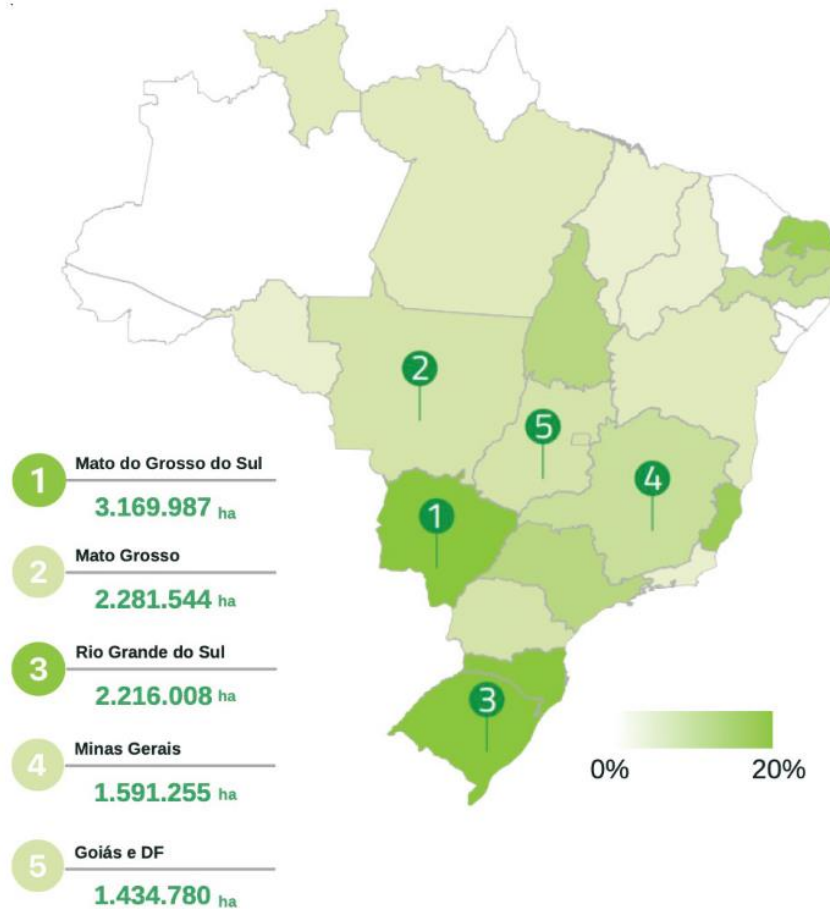


Figure 5. Map of Brazilian states indicating the percentage increases in the area with crop-livestock-forest integration. The state of Mato Grosso do Sul has the greatest increase in ILPF area in Brazil (3,169,987 ha), followed by Mato Grosso (2,281,544 ha) and Rio Grande do Sul (2,216,008 ha) (Rede ILPF, 2022b).

For producers who wish to join the ICLF system, it is necessary to seek help from trained professionals coordinated by Embrapa and the *Rede ILPF*. In addition, the federal government has credit lines that can be used in ICLF projects, such as the National Program for Strengthening Family Agriculture (*Programa Nacional de Fortalecimento da Agricultura Familiar - PRONAF*) and the *ABC Program*, the latter mainly focusing on recovering degraded areas.

All proposals and initiatives presented in this study are available for consultation and adherence efforts. These data show us the engagement of Brazil, a world leader in agricultural production, in protecting biodiversity in agriculture in its diverse ecosystems through a number of initiatives. High productivity is increasingly being combined with methodologies and projects that aim to reduce the impact caused by

suppression, restoring degraded areas and combining technology with new cultivation methodologies.

## References:

Agroecologia. Pnapo: Política Nacional de Agroecologia e Produção Orgânica. Portal Agroecologia.gov. Disponível em: <http://www.agroecologia.gov.br/politica>. Acesso em: 03 mai. 2022.

Altieri, M. A.; Funes-Monzote, F. R.; Petersen, P. Agroecologically efficient agricultural systems for smallholder farmers: contributions to food sovereignty. *Agronomy for Sustainable Development*, 32: 1-13. 2012.

ANA – ARTICULAÇÃO NACIONAL DE AGROECOLOGIA. Agroecologia em rede. Disponível em: < <https://agroecologiaemrede.org.br/busca/>>. Acesso em: 24 mai. 2022. 2022b.

ANA – ARTICULAÇÃO NACIONAL DE AGROECOLOGIA. Disponível em: <<https://agroecologia.org.br/o-que-e-a-ana/>>. Acesso em: 24 mai. 2022. 2022a.

Brasil. Lei nº 12.651, de 25 de maio de 2012. Dispõe sobre a proteção da vegetação nativa; altera as Leis nºs 6.938, de 31 de agosto de 1981, 9.393, de 19 de dezembro de 1996, e 11.428, de 22 de dezembro de 2006; revoga as Leis nºs 4.771, de 15 de setembro de 1965, e 7.754, de 14 de abril de 1989, e a Medida Provisória nº 2.166-67, de 24 de agosto de 2001; e dá outras providências.. Brasília, DF: Presidência da República, 2012. Disponível em: [http://www.planalto.gov.br/ccivil\\_03/\\_ato2011-2014/2012/lei/l12651.htm](http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12651.htm) Acesso em: 03 mai. 2022.

Cargill. Chamada para projetos de restauração. Edital nº 01/2022. Disponível em: <<https://editalrestauracao2022.com.br/>>. Acesso em: 23 mai. 2022. 2022b.

Cargill. Página inicial. Disponível em: <[https://www.cargill.com.br/pt\\_BR/in%C3%ADcio](https://www.cargill.com.br/pt_BR/in%C3%ADcio)> Acesso em: 23 mai. 2022. 2022a.

CNA - Confederação da Agricultura e Pecuária do Brasil. Projeto Biomas. Disponível em: <<https://www.cnabrasil.org.br/projetos-e-programas/projeto-biomas>>. Acesso em: 24 mai. 2022. 2022.

CONEXÃO PLANETA. Estudo destaca iniciativas municipais de agricultura familiar e busca compromisso de políticos eleitos em 2020. Disponível em:

<<https://conexaoplaneta.com.br/blog/estudo-destaca-iniciativas-municipais-de-agricultura-familiar-e-busca-compromisso-de-politicos-eleitores-em-2020/#fechar>>. Acesso em: 24 mai. 2022.

EMBRAPA - Empresa Brasileira de Pesquisa Agropecuária. Projeto Biomas: Contribuições para a proteção e uso sustentável das paisagens brasileiras. Disponível em: <<https://www.embrapa.br/en/busca-de-projetos/-/projeto/205747/projeto-biomas-contribicoes-para-a-protecao-e-uso-sustentavel-das-paisagens-brasileiras>>. Acesso em: 24 mai. 2022.

Londres, F. et al. (orgs). Municípios agroecológicos e políticas de futuro: iniciativas municipais de apoio à agricultura familiar e à agroecologia e de promoção da segurança alimentar e nutricional. Recurso eletrônico. Rio de Janeiro, 1ª ed. (ANA – Articulação Nacional de Agroecologia). 39 p. Disponível em: <[https://agroecologia.org.br/wp-content/uploads/2020/10/SUMARIO\\_agroecologia-nas-eleicoes\\_23.10.20.pdf](https://agroecologia.org.br/wp-content/uploads/2020/10/SUMARIO_agroecologia-nas-eleicoes_23.10.20.pdf)>

MAPA. Regularização Ambiental: Boletim Informativo. Disponível em: <https://www.florestal.gov.br/documentos/car/boletim-do-car/5601-boletim-car-fevereiro-2022/file>. Acesso em: 03 mai. 2022.

Metzger, J. P. et al. Why Brazil needs its Legal Reserves. *Perspectives in ecology and conservation*, 17: 91-103. 2019.

MIPS - Mapa de Iniciativas da Pecuária Sustentável. CONSERV. Disponível em: <<https://gtps.org.br/mips/iniciativas/conserv/>>. Acesso em: 24 mai. 2022.

Paolucci, L. N. et al. Lowland tapirs facilitate seed dispersal in degraded Amazonian forests. *Biotropica*, 51 (2): 245-252. 2019.

PLANAPO. Plano Nacional de Agroecologia e Produção Orgânica. Disponível em: <[http://www.agroecologia.gov.br/plano#:~:text=Um%20dos%20principais%20instrumentos%20da,%2C%20conhecido%20como%20Brasil%20Agroecol%C3%B3gico](http://www.agroecologia.gov.br/plano#:~:text=Um%20dos%20principais%20instrumentos%20da,%2C%20conhecido%20como%20Brasil%20Agroecol%C3%B3gico.)>. Acesso em: 24 mai. 2022.

Polidoro, J. C., et al. The impact of plans, policies, practices and technologies based on the principles of conservation agriculture in the control of soil erosion in Brazil. *Authorea*, DOI: 10.22541/au.158750264.42640167. 2020.

REDE ILPF – Rede Integração Lavoura-Pecuária-Floresta. Benefícios da ILPF. Disponível em: <<https://www.redeilpf.org.br/index.php/rede-ilpf/beneficios-da-ilpf>>. Acesso em: 24 mai. 2022. 2022a.

REDE ILPF – Rede Integração Lavoura-Pecuária-Floresta. ILPF em números. Disponível em: <<https://www.redeilpf.org.br/index.php/rede-ilpf/ilpf-em-numeros>>. Acesso em: 24 mai. 2022. 2022b.

SPVS - Sociedade de Pesquisa em Vida Selvagem e Educação Ambiental. Sobre. Disponível em: <<http://www.spvs.org.br/sobre-a-spvs/>>. Acesso em: 24 mai. 2022. 2022a.

SPVS - Sociedade de Pesquisa em Vida Selvagem e Educação Ambiental. Projeto Desmatamento Evitado. Disponível em: <<http://www.spvs.org.br/projetos/programa-desmatamento-evitado/>>. Acesso em: 24 mai. 2022. 2022b.

SPVS - Sociedade de Pesquisa em Vida Selvagem e Educação Ambiental. Plantio Compensatório. Disponível em: <<http://www.spvs.org.br/projetos/plantio-compensatorio/>>. Acesso em: 24 mai. 2022. 2022c.