

Chapter 6

Mountain agriculture

Renato Linhares de Assis
Adriana Maria de Aquino
Rachel Bardy Prado
Marcos Flávio Silva Borba
Lucíola Alves Magalhães
Jorge Tonietto

Introduction

This chapter examines the contributions of the Brazilian Agricultural Research Corporation (Embrapa) to achieve target 15.4 of the Sustainable Development Goal 15 (SDG 15) (United Nations, 2018): “By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development”.

Despite the fact that mountains have their own characteristics, as do the populations living there, the perception that mountainous environments demand different development strategies and public policies is new in the world. In Brazil, Embrapa is leading important initiatives seeking to articulate research and development proposals with local development strategies for mountainous environments.

Territorial development and implementation of a seal of origin

Since 2006, Embrapa, Associação Riograndense de Empreendimentos de Assistência Técnica e Extensão Rural (Riograndense Association for Technical Assistance and Rural Extension – Emater-RS), and research teams linked to federal universities in Rio Grande do Sul state (Federal University of Rio Grande do Sul – UFRGS, Federal University of Santa Maria – UFSM, and Federal University of Pelotas – UFPel) started a process of transforming the social and economic reality of a group of family cattle breeders. These breeders organized themselves in community associations in municipalities at the Alto Camaquã River Basin, which is the poorest region in the state.

Assuming that regional weaknesses were consequences of the inadequacy of economic models, technological formats, and indicators used in their analysis, local actors looked at opportunities and potentialities throughout the region. Thus, in 2013, they identified that more than 80% of the vegetation cover was composed by native plant species, and that livestock production was fundamentally based on pastures (Borba, 2016).

Also, considering that the production based on natural resources can be extremely effective and can create different products, they came up with a proposal linking the sustainable development of the region to valuation of social, historic, economic, cultural, and environmental resources, including the social construction of markets through short chains of value and network organization. This led to the creation of a collective territorial brand, owned by Associação para o Desenvolvimento Sustentável do Alto Camaquã (Association for the Sustainable Development of Alto Camaquã – Adac). This brand has a seal of origin to distinguish its products: the Alto Camaquã brand.

In 2015, the association was officially recognized as Local Productive Arrangement (LPA) for Sheep and Tourism of Alto Camaquã, the only LPA in sheep production officially recognized by Brazilian competent bodies. A project is currently being developed in order to strengthen governance: the creation of a territorial management committee in partnership with Emater-RS, Associação Brasileira de Criadores de Ovinos (Brazilian Association of Sheep Farmers – Arco), Embrapa, Federação dos Trabalhadores na Agricultura no Rio Grande do Sul (Federation of Agricultural Workers Rio Grande do Sul State – Fetag), University of the Campanha Region (Urcamp), Pampa Federal University (Unipampa), Getúlio Vargas College of the Alto Uruguay Institute for Educational Development (Ideau), National Service for Commercial Apprenticeship (Senac), and Brazilian Micro and Small Business Support Service (Sebrae), and with the support of Agência Gaúcha de Desenvolvimento e Promoção do Investimento (Gaúcha Agency for Development and Promotion of Investment – AGDI), an agency linked to the Secretariat of Economic Development, Science, and Technology (Sedect-RS).

The Alto Camaquã Network currently gathers 25 associations involving family cattle breeders, *quilombolas*, beekeepers, and artisans, with around 500 families in the municipalities of Bagé, Caçapava do Sul, Canguçu, Encruzilhada do Sul, Lavras do Sul, Pinheiro Machado, Piratini, and Santana da Boa Vista (Figure 1 and Table 1).

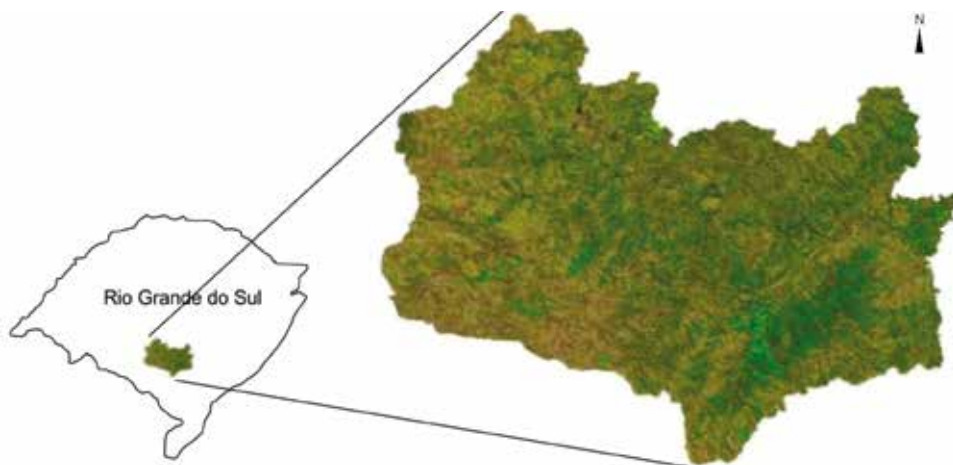


Figure 1. Location of the Alto Camaquã territory, in Rio Grande do Sul state, Brazil, which gathers 25 associations of family cattle breeders, *quilombolas*, beekeepers, and artisans.

Source: Rocha e Trindade (2015).

Table 1. Classes and areas of vegetation cover at Alto Camaquã territory, RS, Brazil.

Class	Area (km ²)	Area (%)
Water	8.0	0.06
Eucalyptus tree (<i>Eucalyptus</i> sp.)	481.9	3.61
Acacia tree (<i>Acacia</i> sp.)	250.2	1.87
Pine (<i>Pinus</i> sp.)	334.5	2.50
Natural forest	4,290.2	32.12
Field	6,750.3	50.53
Agricultural areas	1,242.4	9.30
Total	13,357.8	100.00

Geographical Indication of Serra Gaúcha wine territories

Since 1995, Embrapa Grape & Wine has led an unprecedented structuring of geographical indications (GI) in Brazil for fine wines produced in Serra Gaúcha region, Rio Grande do Sul, located on the upper hills in the northeast of the state. This vitivinicultural region features rugged terrain, some areas of mountainous terrain, hills and valleys with altitudes ranging from 300 m to more than 800 m. The geographical characteristics of the region – its altitudes and slopes cultivated

with vineyards – in some situations resemble and fit the concept of mountain viticulture used in Western Europe.

Several research and development (R&D) projects were carried out in this traditional production region, which has more than 15 thousand viticulture small properties. The projects were responsible for the structuring, recording, and operationalization of six geographical indications of fine wines under Geographical Indication (GI) or Appellation of Origin (AO). Farmers from these associations had requested these actions – Associação dos Produtores de Vinhos Finos do Vale dos Vinhedos (Vale dos Vinhedos Fine Wine Producers Association, Aprovale), Associação dos Produtores de Vinhos de Pinto Bandeira Wine Producers Association of Vinhos de Pinto Bandeira, Asprovinho), Associação de Vitivinicultores de Monte Belo do Sul (Monte Belo do Sul Winegrowers Association, Aprobelos), Associação de Produtores dos Vinhos dos Altos Montes (Altos Montes Wine Producers Association, Apromontes), and Associação Farroupilhense de Produtores de Vinhos, Espumantes, Sucos e Derivados (Farroupilhense Association of Wine, Sparkling, Juice, and Byproduct Producers, Afavin). Embrapa Grape & Wine, Embrapa Temperate Agriculture, UFRGS, and University of Caxias do Sul (UCS) supported these projects.

For each delimited GI (GI: Vale dos Vinhedos, Pinto Bandeira, Altos Montes, Monte Belo and Farroupilha; AO: Vale dos Vinhedos), studies on the [viticulture territory](#) were carried out and enabled to accomplish:

- Geographical delimitation of each GI area.
- Geological cartography, soil mapping, and zoning of viticultural potential.
- Viticultural climate zoning.
- Characterization of the use and cover of the soil.
- Terrain cartography, including altimetry, slope, and exposure.
- Creation of a georeferenced register of the vineyards of each GI, which includes vineyard database and cartography.
- Description of the historic evolution and renown of the vitiviniculture production in each GI territory.
- Characterization of the viticultural landscape.
- Structuring of the rules of use for each GI and its respective system and control plan.

- Sensory and physicochemical characterization of each GI wine.

Wine GIs currently belong to the vitivinicultural policy, with the support of the Committee of Geographical Indications located at the Brazilian Institute of Wine (Ibravin). Sebrae is also an important supporter of geographical indications. Geographical indications of wines are expected to increase the strength, the identity, and the quality of Brazilian wines, raising the level of the industry's competitiveness.

In addition, bearing in mind the focus on territory, GIs stimulate sustainability actions in vitiviniculture, the preservation of its tangible and intangible cultural heritage, and the enotourism impetus. The line of work related to territorial intelligence shows strong potential for use in wine geographical indications. In this sense, the geographical and viticulture production databases that already exist will enable more complex levels of territory management in GIs (Figure 2).

Training for farmers from Rio de Janeiro mountainous region

In the mountainous region of Rio de Janeiro state, the partnership between Embrapa and the local government of Nova Friburgo established in 2005 the [Núcleo de Pesquisa e Treinamento para Agricultores \(Farmer Center for Research and Training – NPTA\)](#). Through actions of participative knowledge construction, technologies and practices are being adapted, consolidated, multiplied, and suited to the reality of the systems used in the local agriculture production.

This region stands out as an important vegetable production area. Its production is fundamental to a suitable food supply to the metropolitan region of Rio de Janeiro city, the second biggest economic and population center in Brazil. Furthermore, this area is one of the main remnants of the Atlantic Forest in the country. In this sense, NPTA is working with technicians and farmers to create technologies suitable to the reality faced by the local production systems, to ensure environmental, economic, and social sustainability in the region mountainous environments. Rotational cropping is an example of technology that has been fostered by NPTA, since it enables the production of a diversity of species of economic interest and the introduction of cover plants, especially black oat (*Avena strigosa*) (Figure 3).

A**B**

Figure 2. Viticultural landscapes in the geographical indications of fine wines Farroupilha (A) and Pinto Bandeira (B) located in Serra Gaucha region, Rio Grande do Sul state, Brazil.

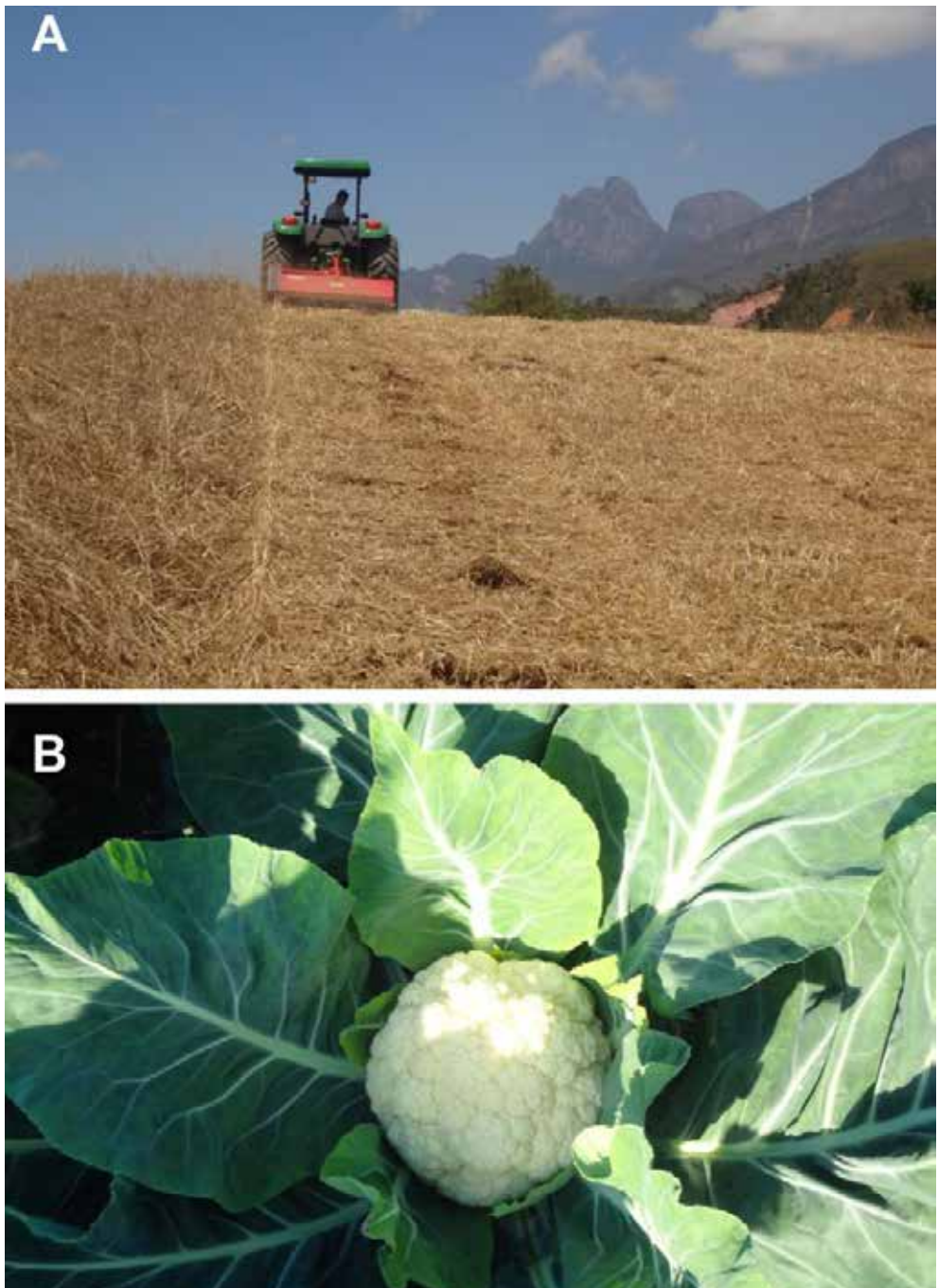


Figure 3. Harvest of black oat (*Avena strigosa*) with grinder for cover (A) and no-till cauliflower (*Brassica oleracea* var. botrytis) crop after black oat (B).

Ecosystem services in mountainous environments

Ecosystem services are the contributions of ecosystems to human beings, including climate and water regulation; pollination; water, fibers, timber, and food supply; erosion control; among others. In order to their difficult access and agricultural management, areas at the bottom of mountainous terrains still feature several fragments of preserved forests. The hydrographic basin mainsprings are located there, which makes them Permanent Preservation Areas (PPAs). Thus, their environmental protection is mandatory in accordance with the law, since they harbor great biodiversity. They may be considered regions with high potential for the generation of ecosystem services. Therefore, mountainous environments have been stressed as vital areas for research that validate and develop data to improve actions that already exist and to stimulate new initiatives for agricultural production systems concerning environmental conservation.

Embrapa has an Array of Projects called [Serviços Ambientais na Paisagem Rural \(Environmental Services in Rural Landscape\)](#). Its main purpose is to develop knowledge and tools to support actions and policies to restore, maintain, and expand ecosystem services, and to strengthen sustainable basis production systems on rural landscapes. This array addresses matters related to the ecosystem services provided by Brazilian biomes; many of its projects approach mountainous areas or plain areas that depend on water resources arising from upstream mountainous areas.

Territorial intelligence applied to Brazilian mountainous environments

Strategic territorial intelligence (STI) applied to Brazilian mountainous environments has been discussed at Embrapa since 2016 (Galinari, 2016), in order to define and map mountainous environments in Brazil to improve the performance of public policies promoting their sustainable rural development (López et al., 2011). These researches aim not only to delimit these environments, but also to qualify them on a territorial basis according to the concepts of Strategic Territorial Intelligence System (SITE). A SITE gathers information on natural, agrarian, agricultural, socioeconomic, and infrastructural frameworks, as well as their time and space intersections, aiming to assist the agricultural development considering those multiple dimensions, always based on a territorial approach.

The information to be collected by SITE will enable distinguishing several territories of mountain agriculture and support strategies for the sustainable exploitation of these environments. In addition, it will contribute to build scenarios and model public policies; to stimulate and adjust, in the territory, activities to combat rural poverty and misery; to promote productive inclusion and social interests in a coherent, convergent, and harmonic way, including approaches connected to food safety, agrobiodiversity, tourism, gastronomy, valuation of local production systems and ecosystem services; and to open new markets focused on agroindustry.

SITE will also enable to list priorities based on the equipotential and equiproblematic regions, as well as serve as a support for the appraisal or development of social technologies to the suitable production in mountainous environments. These strategic data and information collected and worked from a territory perspective will supply agents with qualified information for use in discussions and decisions based on the territorial dimension of problems to be identified.

Technical-scientific coordination

In the article *Agricultura de montanha: uma prioridade latente na agenda da pesquisa brasileira* (Mountain agriculture: a latent priority in the Brazilian research agenda), López et al. (2011) stated, in a provocative way, that “mountain agriculture” is still a latent theme in the Brazilian research agenda. In 2011, there were already various research and development initiatives with a systemic view of mountainous environments in the country, but it was necessary to coordinate them, not only in the national as well as in the international scenario. It is important to exchange experiences and information to subsidize and enrich different local initiatives.

To promote this coordination, Embrapa organized in Nova Friburgo, RJ, the two first editions of the *Workshop on Sustainable Development in Mountainous Environments* in 2010 and 2013. These events enabled strengthening the national researcher network coordination that was involved and motivated by the mountain theme; they also started the international coordination of this network, notably with the Centro de Investigação de Montanha (Mountain Research Center – Cimo), located in Bragança, Portugal. Thus, the creation of the [Rede de Investigação de Montanha da Lusofonia \(Lusophony Mountain Research Network – Lumont\)](#) became possible; it aimed to promote the disclosure and sharing of information between researchers and research institutions concerned with mountain topics, and it worked to create more and better partnerships and cooperation opportunities.

The launch of Lumont happened at Cimo's headquarters during the *International Conference on Research for Sustainable Development in Mountain Regions* (Mountains, 2016), which was organized by the Portuguese institution with Embrapa participation, which, at that time, committed to organize *Mountains 2018* in Brazil. The event will occur in December 2018 in Nova Friburgo, RJ, and consisted of the *II International Conference on Research for Sustainable Development in Mountain Regions* and the *Third Workshop on Sustainable Development in Mountain Environments*. Besides strengthening the exchange among Portuguese speaking countries, *Mountains 2018* also aims to expand the exchange among Latin American and Caribbean countries, and to promote the definitive inclusion of Brazil in the international scientific community studying mountain topics.

The process of organizing *Mountains 2018* has included Embrapa in the discussions on mountain environments dynamics. It was promoted by the United Nations (UN) through the association of Embrapa Agrobiology with *Mountain Partnership*, which consists in an initiative of the Food and Agriculture Organization of the United Nations (FAO) to add institutions (government and society) committed to work for the sustainable development of mountain environments in the whole world.

References

- BORBA, M. F. S. Desenvolvimento territorial endógeno: o caso do Alto Camaquã. In: WAQUIL, P. D.; MATTE, A.; NESKE, M. Z.; BORBA, M. F. S. (Org.). *Desenvolvimento territorial endógeno: o caso do Alto Camaquã. Pecuária familiar no Rio Grande do Sul: história, diversidade social e dinâmicas de desenvolvimento*. Porto Alegre: Ed. da UFRGS, 2016. p. 187-214.
- GALINARI, G. Inteligência territorial. **XXI Ciência para a vida**, n. 3, p. 55, 2016. Available at: <<http://ainfo.cnptia.embrapa.br/digital/bitstream/item/146456/1/Revista-XXI-n13-AINFO.pdf>>. Accessed on: Dec. 7, 2017.
- LÓPEZ, A.; AQUINO, A. M. de; ASSIS, R. L. de. Definição de montanha. In: LÓPEZ, A.; AQUINO, A. M.; ASSIS, R. L. (Org.). **Agricultura de montanha: uma prioridade latente na agenda da pesquisa brasileira**. Brasília, DF: Embrapa Informação Tecnológica, 2011. p. 15-20. (Texto para discussão, 14). Available at: <<https://www.alice.cnptia.embrapa.br/alice/bitstream/doc/901579/4/Texto41.pdf>>. Accessed on: Dec. 10, 2017.
- ROCHA, D. S. da; TRINDADE, J. P. P. **Cobertura vegetal e geomorfologia do Alto Camaquã, RS**. Bagé: Embrapa Pecuária Sul, 2015. 26 p. (Embrapa Pecuária Sul. Documentos, 143). Available at: <<http://ainfo.cnptia.embrapa.br/digital/bitstream/item/137913/1/DT-143-online.pdf>>. Accessed on: Mar. 26, 2018.
- UNITED NATIONS. **Life on land**: protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss. Available at: <<https://sustainabledevelopment.un.org/sdg15>>. Accessed on: Mar. 26, 2018.