

# Agrosilvopastoral systems

Sustainable Agriculture Milestones in the Americas

Relevant experiences in the region to address climate change and care for the environment and natural resources





## Agrosilvopastoral systems in the Americas combine natural resource conservation, climate change mitigation and production intensification

The continuous and simultaneous integration of trees, crops and livestock production on the same site, which fosters biological diversity and facilitates the rehabilitation of degraded areas, is an increasingly common practice among small- and medium-scale producers in the woodlands of the Americas, yielding significant environmental and production benefits.

Agrosilvopastoral systems are alternative models that increase production and sustainably use natural resources, by implementing an integrated management system that brings together trees, pastures and animals, as well as inputs appropriate to the characteristics, potential and needs of each specific site.

These systems also increase the potential of the land to store carbon, in comparison to conventional pastures, given the increased capacity of the tree biomass and soil to absorb carbon and greater

protection of the soil against erosion.

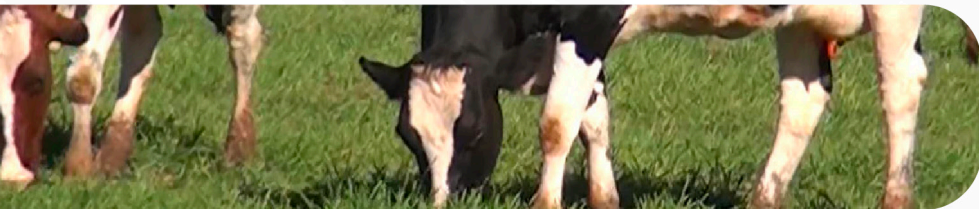
Given the fact that agrosilvopastoral systems are currently gaining importance in the region's beef cattle and sheep production chains and in the timber industry, the sectors must promote the sharing of positive experiences and best practices, as well as the generation of knowledge, through research.

In the Americas, in particular, agrosilvopastoral systems play a vital role in soil carbon sequestration, which mitigates the effects of climate change. Specialists in this field have acknowledged this fact, but also recognize that information on the true magnitude and more so the potential of this impact is still inadequate.

There are many countries in the hemisphere where this model has yielded successful results that should be disseminated.







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## Relevant cases in Latin America and the Caribbean (LAC)

Brazil has introduced different combinations of the model, demonstrating the potential for forestry, livestock and agricultural development.

Celso Moretti, President of the Brazilian Agricultural Research Corporation (EMBRAPA), explained that, "Regions where natural resource conservation is under growing pressure from agriculture should implement effective land-use practices. These approaches usually provide an alternative to the ecological, economic and social problems experienced by a large sector of the country".

"Agrifood systems have been incorporated into food production practices in Brazil, with promising results. Notable examples of the research that has fueled this expansion are studies related to nitrogen fixation in soybean and the development of technologies for agricultural production in the natural habitat of El Cerrado, which is something that was considered impossible some 50 years ago", said Moretti.

In Brazil's Amazon region, where deforestation is exerting tremendous pressure, agrosilvopastoral systems are excellent land use alternatives that are economically and environmentally sustainable.

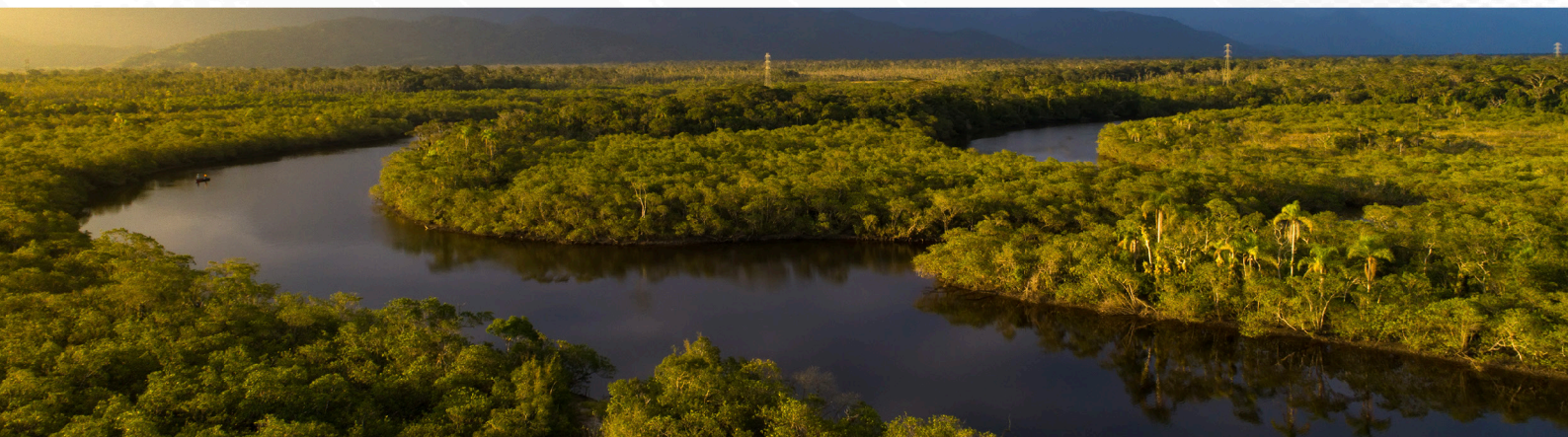
In Argentina, agrosilvopastoral systems have been able to offset the environmental impact of

expanding livestock production on land originally covered by native forests, a fact that has been verified in recent decades, particularly in the Gran Chaco, the immense, forest-covered plain that also extends to Paraguay and Bolivia. Moreover, these systems offer a suitable alternative for the environment in provinces, such as Misiones, in the country's northeast region, where forestry plantations of exotic species have developed significantly.

The expansion of the agricultural frontier and the consequent encroachment of livestock production into forests inspired the creation of the Integrated Forest Management with Livestock (MBGI in Spanish) program by the National Agricultural Technology Institute (INTA), an Argentinian government institution of international renown.

In 80% of the country's forests, an environmental conservation law prohibits the clearing of trees and subsequent establishment of pastures. As such, the MBGI program is aiming to enhance production capacity, while also preserving native forests and biodiversity, through the adoption of technologies that have a low environmental impact.

The Inter-American Institute for Cooperation on Agriculture (IICA), with funding from the European Union, is undertaking the Adapted Agroforestry





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Systems for the Central American Dry Corridor (AGRO-INNOVA) project, which is contributing to increasing climate resilience and food security in the extremely vulnerable households of small farmers.

In the district of El Paraíso, Honduras, there are efforts to promote the adoption of agricultural best practices in the production of basic grains and coffee, as well as small-scale livestock farming, to assist in climate change mitigation and adaptation.

Costa Rica is encouraging the implementation of agricultural and digital technologies associated with forestry best practices.

The project, which is taking place with technical assistance from the Tropical Agricultural Research and Higher Education Center (CATIE), is working with more than 3,000 small farmers in Central America – one of the regions in the world that is most vulnerable to climate change.

In Dominican Republic, where livestock production is extremely critical to the territorial development of the country, agrosilvopastoral systems have assisted in tackling problems such as prolonged droughts, limited surface and groundwater supplies and soil degradation.

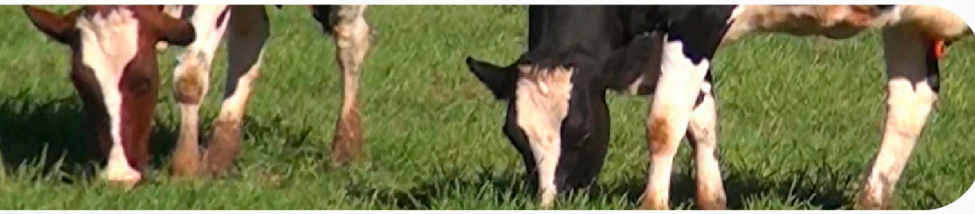
These systems have also made great strides in Mexico. In 2017, CATIE and IICA launched the project Biodiversity and Sustainable Agrosilvopastoral Livestock Landscapes (BIOPASOS) in the states of Chiapas, Campeche and Jalisco, which was implemented in collaboration with the Secretariat of Agriculture and Rural Development (SADER) and the Mexican Commission for the Knowledge and Use of Biodiversity.

The initiative worked with 1,200 small- and medium-scale livestock farmers who adopted practices to reconcile production activity and ecosystem conservation. The Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection of Germany and the International Climate Initiative funded the project.

Paraguay, Uruguay, Colombia and Chile are other LAC countries where agrosilvopastoral systems have been increasingly incorporated into the agricultural reality







## Integration of production and conservation

Agrosilvopastoral systems are not new. They have been employed since ancient times with various types of plantations intercropping annual and perennial crops, or fruit crops and timber trees.

They can be implemented by small-, medium- or large-scale producers. The integration of production systems is a way to produce more without the need to incorporate new areas in the process, a characteristic known as the "land saving effect".

These systems provide multiple and varied results: improved quality of forage grasses in systems that include trees, greater drought tolerance of crops, increased fertilizer efficiency, increased output of grass-fed cattle, an improvement in soil quality indicators and a reduction in pests and diseases, among others.

Celso Moretti, President of EMBRAPA, maintained that, "The risks result from a lack of planning for implementation, the failure to conduct feasibility and marketing studies, limited qualified labor and climate adversities. The extent to which careful and systematized planning is done prior to implementation will determine the success or failure of the activity".

The planning process must include an assessment of soil and climate conditions, agricultural and forestry species, the species and category of animals, the management capacity (which is directly linked to the production objectives), marketing, transportation logistics for inputs and products, and the qualified labor force in the region.

The models are dynamic and complex, due to the interaction between cultures, animals and diverse practices. This creates the need for continuous research that is usually undertaken with long-term and region-specific experiments, which are necessary to ensure sustainability.



## Benefits to farmers

These systems offer many benefits to farmers, which include the following:

- They enable greater diversification of the farm's production activities, thereby reducing the risk of an overall decline in income. Food of animal origin (milk and meat) can be produced in forests, without sacrificing the land area devoted to crops. Other benefits may be derived from producing firewood, wooden posts, timber and fodder.
- Livestock farming enables the use and control of pastures and weeds that can compete with the development of young trees. Moreover, the clearing of pastures by grazing cattle facilitates the production of fruit trees and palms.
- The grazing of cover vegetation reduces the risk of fires.
- When livestock farming is integrated with crops, between 60% and 70% of the plant biomass may be used to feed the livestock, without competing with crops for human consumption.





## Requirements for the implementation of agrosilvopastoral systems

Prior to implementing these systems, each region or country must assess soil and climate conditions. In the case of Brazil, a large part of its land area is located in the tropical zone, where the distribution of rain is generally good. This means that

crops can be harvested two or three times per year and conditions are favorable for the implementation of more intensive production systems.

Given the above, Celso Moretti is of the view that the potential for use of these systems is promising in countries that do not experience severe winters and that have a mildly irregular landscape and soils that exhibit good physical and chemical characteristics.

Other factors to be considered include the availability of favorable soil; production infrastructure and storage; appropriate financing or access to credit; competence in the use of the technology used to produce the grains, cattle and timber; and access to technical assistance.

Moretti also referred to the need to strengthen lines of research, technology transfer and promotion to increase the contribution of knowledge and information to the adoption of agrosilvopastoral systems.

Agricultural research should be conducted in an integrated manner and introduced into production systems in a way that ensures an efficient transfer of the resulting technology in the shortest time possible.

The EMBRAPA President also remarked that greater expansion of these systems will require alternative studies on crops and forestry species, focusing on the technical interrelationships, economic results and respective uses (production of food, grains, fiber, energy and timber and non-timber forestry products).

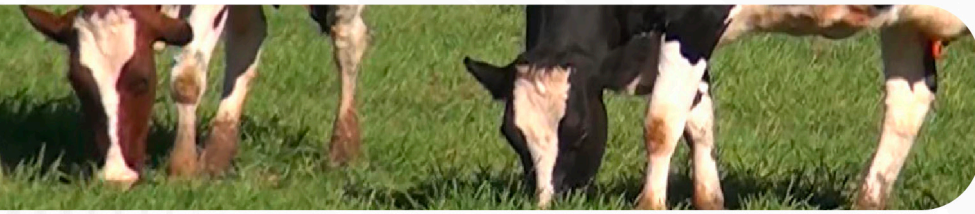
He felt that experiences over the last 30 years have demonstrated the need to develop new technical assistance and rural extension models.

Brazil appears to be blazing a trail in this area. The adoption of agrosilvopastoral systems has increased in that country, to the extent that the land area managed under these systems grew from approximately 11,500,000 ha in 2016 to 17,400,000 ha in 2021.

This growth was spurred by various research, development, innovation and public policy actions. Currently, 29% of livestock farmers and 17% of grain producers have adopted some kind of system. Of this group of primarily livestock producers, approximately 83% have adopted an agricultural integration system (crops-livestock); 9% have adopted an integrated crop-livestock-forestry system; 7% have introduced livestock-forestry integration and 1% are integrating crops and forests.



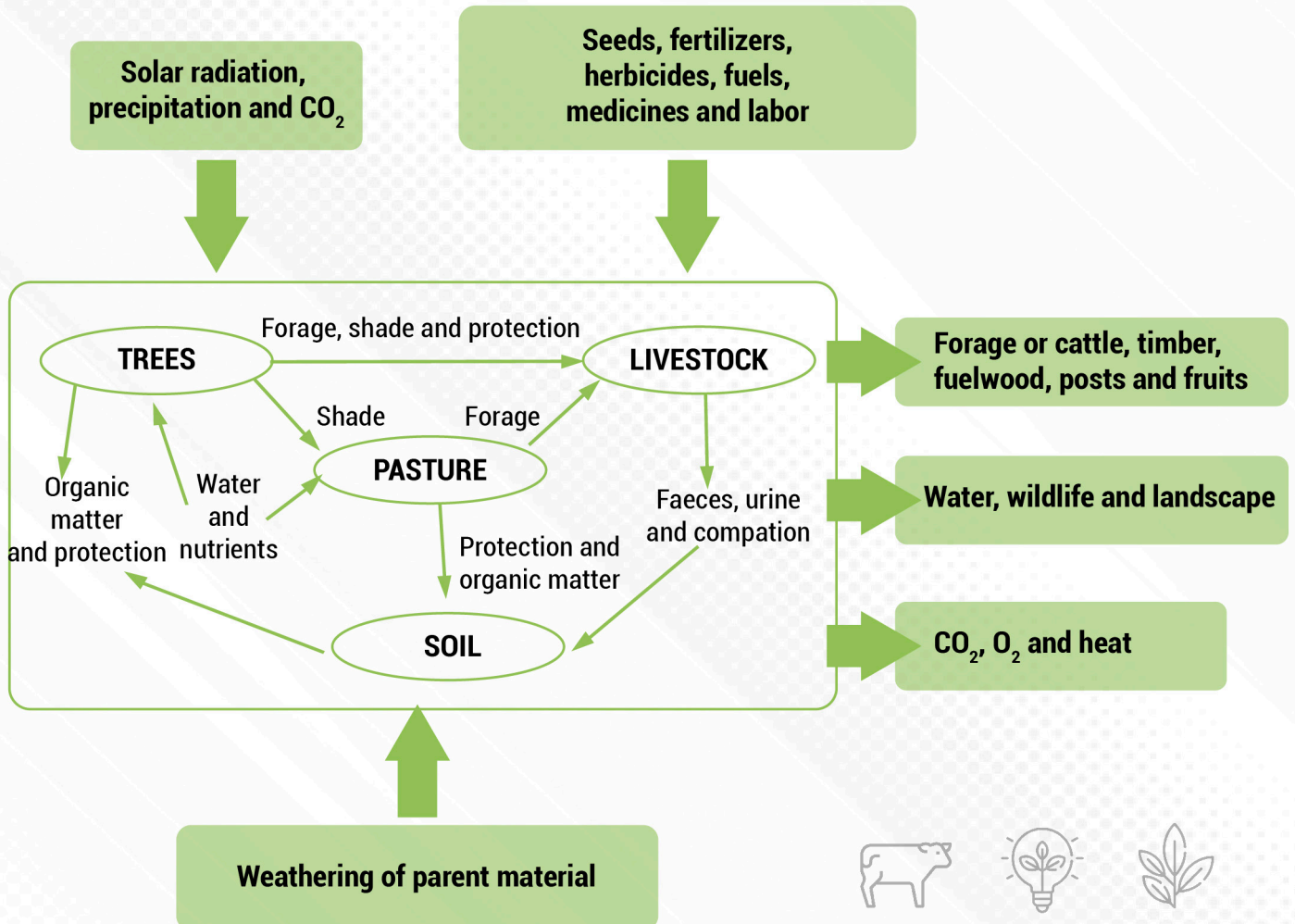




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## Interaction between components of the agrosilvopastoral system



Source: Adapted from Bronstein. Available at <http://usi.earth.ac.cr/glas/sp/90010027.pdf>, p. 2.

Agrosilvopastoral systems are already enabling thousands of small and medium-sized farms in Latin America to engage in more sustainable activity. However, in order to expand their growth, efforts must be undertaken in different spheres: research on traditional knowledge, improvement in farmers' perception of how agrosilvopastoral systems can facilitate their activities; and the development of the most suitable regulations and governmental policies.





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