

## Box C8

### Nature and culture on a small agricultural enterprise in southeast Brazil

P. Bonfils

<https://www.naturavali.com/>

Just nine crops cover two-thirds of the world's food requirements (FAO 2019). Agriculture based on economies of scale and mechanisation produces food at the lowest possible cost, while biodiversity is lost. The Food and Agriculture Organization (FAO) provides an alarming picture of the situation in 2019. Not only the actual crops are affected, but also the associated biodiversity, which provides valuable ecosystem services for agriculture (FAO 2019). Natural ecosystems such as forests continue to be cleared in a haphazard manner, even though they represent source and retreat areas for biological diversity (Betts *et al.* 2017). The tropics, which host more than three-quarters of the world's plant and animal diversity, are particularly affected by such impacts (Barlow *et al.* 2018). With this in mind, Pat-

rick Bonfils takes us on a tour of his small agricultural enterprise (Sitio) in southeastern Brazil.

The Sitio Beija Flor is situated in a hilly landscape on the edge of the Cinturão Verde, the green belt surrounding the metropolis of São Paulo. The main landscape elements characterising the Sitio are forests, pasture, and cultivated areas, but there are also buildings for work, production, and living. The spatial distribution, combination, and design of all these basic elements of landscape are decisive for the economic and ecological balance of the farm (fig. 1).

Forests influence temperature, humidity, wind, and light conditions on adjacent areas (e.g. pastures, cultivated fields, gardens). Their effects are, however, not limited to only physical aspects. Parts of the farm are also managed as agroforestry production systems (fig. 2). Trees are pruned and cut to use the leaf material for soil cover and as a fertiliser (Götsch 1992). The aim is to increase the amount of organic matter in the soil (humus), thus creating optimal structures for water and nutrient retention. Furthermore, this contributes to improved conditions for soil organisms. Through this, the soil will become a living organism and biodiversity a produc-



Fig. 1. Diverse, small-structured landscape. Forest, pasture, orchards, and tree gardens provide more than a dozen different agricultural products and are a storehouse for a vast array of biodiversity (Photo: Patrick Bonfils).



Fig. 2. Agroforestry. Tree vegetation has established itself in an abandoned plantation with turmeric (*Curcuma longa*). It grows well in the fresh microclimate in semi-shade. Without fundamentally changing this state, the amount of light on the site should be increased, the tree vegetation cut regularly, and the leaf mass used as ground cover and fertiliser. Turmeric root can be easily marketed at a good price (Photo: Patrick Bonfils).

tion factor supporting energy and resource-efficient food production.

More and more small farms such as *Sitio Beija Flor* are opting for (bio-)diversity-based management. This includes the cultivation of a wider range of crops. The crops are spatially arranged and combined so that they complement each other and can be grown in rotation (fig. 3). In addition to maintaining soil fertility, the development should also reduce the occurrence of pests and plant diseases. The costs of artificial fertilisers and plant protection products have risen sharply in recent years and need to be reduced. In the case of organic production, they should be eliminated almost completely. Product diversity supports not only ecological but also economic, and thus social, resilience; the more complex a system, the more resilient it becomes (Agenda Götsch 2015). Farm animals also play a pivotal role. This is true in particular for cows. In addition to the possibility to produce milk and cheese, they provide manure which is a highly valued raw material for producing compost and compost-like organic fertilisers (fig. 4).

The coexistence of nature and production is quite challenging, especially in the tropics and subtropics. The nocturnal work of the leaf-cutting ant or the ravenous hunger of the slaty-breasted wood rail (*Aramides saracura*) can cause considerable damage to crops and gardens. Blood-sucking vampire bats can induce anaemia even in adult cattle, and they are also vectors for spreading serious diseases (e.g. rabies). The list of questions becomes extensive when addressing the close coexistence of natural and cultural landscapes. Besides investments such as fences or stables, dealing with such challenges requires, above all, an in-depth understanding of both the prevailing ecosystems and possibilities of adequate production and management measures.

There is a lively debate about which type of agricultural production best meets the mix of ecological, economic, and social challenges of today (FAO 2017). With regard to biodiversity, however, it can be stated that conventional agriculture based on industrial logic has failed to date (FAO 2019). Alternative farming methods, such as those offered





Fig. 3. Risk compensation. On the Sitio, maize, beans, and pumpkins are grown as mixed crops on the same area. They each use different soil horizons and are not in competition above ground. The bean, being a legume, binds nitrogen. In 2019, it was very dry when the maize was sown corn, and so it did not grow well throughout the entire region. However, the beans and pumpkins hardly suffered. On the right side of the image there is an Annatto shrub (*Bixa orellana*; alternative common name – Urucum). The seeds of its fruit are used as a spice and natural colouring of food (Photo: Patrick Bonfils).

by agroforestry systems, are attracting increased interest (FAO and ICRAF 2019). Today, creativity, practical understanding, knowledge, and courage are expected, not only from agricultural producers, but also from politicians, administrators, and especially from consumers. New thinking and behaviour are urgently needed; failing to preserve biodiversity will endanger humankind's future (Glaubrecht 2019).

## References

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Fig. 4. Farm animals. Cows are important for organic farming. Milk and cheese can be marketed easily. Cow dung is used as fertiliser (Photo: Patrick Bonfils).