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Multifunctions of the auxiliary vegetation structures on conservation habitat quality. A challenge for the agro and socio ecosystems redesigns

Abstract

The conservation of biodiversity and the generation of ecosystem services constitute strategies that has been promoted and executed by the institutions that manage ecological systems, which are also being assumed by the governance of socioeconomic systems. The design and appropriate integration of Auxiliary Vegetation Structures (AVS), as semi-natural spaces to improve the habit quality of the associated biodiversity and people in rural and urban areas, is argued as a promising alternative. Various plants and the design of vegetation structures that offer ecological, cultural, economic services are considered multifunctional.

Keywords: auxiliary vegetation, functional biodiversity, habitat quality, socioeconomic systems

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Introduction

Conventionally, the habitat is studied and managed according to the species or groups of biodiversity, considering their conservation and the ecosystem services. Nonetheless, socioeconomic development has been allowed the occupation of vast territories in urban and rural areas, with the consequent generation of incremented pollutant emissions, among other negative effects that as a whole, reduce the quality of the habitat for biodiversity in general, including human settlements.

The planet's biodiversity is being severely affected by the unprecedented modifications induced by human activities on ecosystems, among which are the change in land use, the alteration of biogeochemical cycles, the destruction and fragmentation of habitats, the introduction of exotic species and alteration of climatic conditions.[1]Furthermore, although it has not been so widely recognized, there is also clear evidence that changes in biodiversity are having a direct or indirect impact on human well-being, since they compromise the ecosystem functioning and their capacity to generate essential services for society.[2]

As a consequence, although in the past a good part of the biodiversity conservation initiatives was based almost exclusively on its intrinsic values or ethical criteria. in recent years more pragmatic arguments have begun to gain strength, which take into account the biodiversity contribution to the quality of life and well-being of human societies.[3]

However, this approach has been proven insufficient and today the attention is turned towards a more functional approach that it tries to establish causal relationships between the organism characteristics present and the processes and services of the ecosystems.[4,5] Nonetheless, it is evident that a more integrated vision is required at scale of agricultural and urban landscapes, due to the pressure that development exerts on anthropogenic self-extinction. Therefore, a promising alternative is the integration of vegetation structures with functional designs, such as semi-natural spaces that facilitate habitat quality for associated biodiversity and people.

Auxiliary vegetation structures (AVS)

In general, biodiversity can be described in terms of the number, abundance, composition and spatial distribution of its entities (genotypes, species, or communities within ecosystems), functional characters, as well as the interactions between its components.[4] Various plants that offer ecological, cultural, and economic services and are considered functional species; so that designs that integrates at those species can also be functional and even multifunctional.

The concept of functional diversity[6,7] has been gaining more and more popularity among the scientific community dedicated to the study of biodiversity, given its close links with ecological processes and its key role on the maintenance of life systems that it supports the planet.[3]

Auxiliary vegetation structures (AVS) are designs composed of one or more species of tree, shrub or herbaceous plants, which are planted or grow spontaneously to fulfill certain ecological and socioeconomic functions. The best AVS known are: (a) rows or strips of trees on the sides of roads and highways; (b) trees, ornamental plants and grass that are integrated into parks and other urban spaces; (c) fences or hedges around the systems of agricultural production and facilities; (d) windbreak curtains on sides of agricultural production systems and facilities; (e) living barriers lateral or interspersed in crop fields; (f) trees integrated into livestock pastures; (g) plants of different types in patios and gardens on the sides of homes and (h) patches of semi-natural vegetation that grows on unused land, among other structures. Integrating species and functional designs of AVS in rural and urban areas must be designed according to the characteristics of different land uses, considering the benefit to biodiversity, especially in human settlements, to promote functions that improve the quality of the habitat (Table 1).

AVS also facilitate soil and water conservation, carbon retention, among other functions that contributing to reducing polluting gas emissions and energy costs due to are harmoniously integrated into unused spaces. So that the AVS it complements to the productive and the socioeconomic uses of the land.

Live fences are used by many wild animals at some point in their life cycle, providing habitats for their reproduction and food,[8,9] they also serve for plants conservation, insects, birds and small mammals and it can contribute to the structural connectivity (Figure 1) of the agro landscape.[9] Live fences it can potentially function as biological corridors in agricultural landscapes characterized by the fragmentation of natural habitats.[10]

Urban green spaces can provide vegetation structures (Figure 2) and biodiversity for ecosystem functions and services, across fragmented habitats un spatial scales.[11] Several studies indicate that the inclusion of green spaces in urban environments promotes psychological well-being, reduces stress and improves the perception of health of its residents.[12]

The complexity of the systems designs of mixed cultivations (polycultures, polyfruits and others) and the integration of some auxiliary vegetation structures how ecological corridors and alive barriers, further of the practices of control biological would facilitate the dispersion of natural enemies.[13] The way trees are managed influences both their usefulness and the conservation of associated biodiversity, by providing habitats and preserving a certain level of landscape connectivity.[14]

Table 1 Multifunctions that the AVS it integrates into socioeconomic ecosystems. Elaboration based on results of own projects carried out in rural and urban areas

Function	Rural	Urban
Microclimate regulation	Regulates surface air currents Retains moisture in the soil	Maintains of a cool environment
Ecological filter of contaminants (chemical, physical and biological)	Reduces access to drifts from chemical pesticide sprays Reduces dust access Reduces the spread of harmful organisms to crops, animals and people	Reduces the displacement of toxic gases and their access to homes Reduces the spread of harmful organisms to people
Reservoir and ecological corridor of biodiversity	Birds Natural enemies of crop pests and diseases Pollinators	
Semi-natural food source	Diversity of semi-natural fruit plant species (free of agrochemicals and suppliers of microbiota that enriches the human microbiome)	
Sociocultural plant sources (family tradition)	Provides families with a diversity of plant species that are traditionally used as medicines, for making infusions, condiments and aromatics). Plants that provide flowers are integrates Ornamental plants are integrates	
Physical work (cultural work, irrigation and harvest) and semi-natural recreation (walking, recreation)	Complement work in offices, home and study Exercise, sun exposure and semi-natural breathing for older adults Complement in the education of children and young people Well-being in parks, avenues and other places of leisure and recreation.	
Resilience in the face of extreme events (climate change, pandemics, economic crisis, others)	Ability to resist physical effects of climatic events. Ability to resist other events by providing sources of food, medicine, insulation, etc. Ability to self-sufficient in food during and after events	

Figure 1 Perimeter living fences that facilitate the structural connectivity of biodiversity on farms.

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Figure 2 Different tree and shrub vegetation structures integrated into urban spaces.

Habitat quality

The habitat must be valued as a space where biodiversity coexists in a broad sense, regardless of whether each species has its requirements regarding quality. Nature provides humans with multiple benefits; in fact, our existence on Earth depends on the good state of conservation of ecosystems. This last provide resources such as food, energy, oxygen and water, furthermore that perform essential functions for the proper functioning of the planet such as regulating of climate, preventing floods and pollination. Ecosystems provide essential strategic and services for the economic prosperity, security, health and well-being of society. Ecosystem services are understood as the benefits that people obtain from them.[3]

In fact, human health is closely related to the environmental factors.[15] The different models on health determinants consider the environment as an important factor to take into account.[16] Considering that the city is the main environment in which the life of a large part of the population takes place and that, as has already been seen, it is possible that it will increasingly accommodate a greater number of people, it seems advisable to study how to make these ecosystems healthy spaces.[15]

Sustainable quality of life, although it is a highly complex socioeconomic challenge for health, can be considered one of the priorities for the survival of human populations. It is a holistic approach to health conservation, which is particularly different in urban, peri-urban and rural systems, where factors that determine the quality of the habitat, healthy eating and natural medication converge.[17]

AVS, which are traditional in peasant agriculture and peri-urban communities, constitute a promising ecological buffer system, because they facilitate various functions that increase the quality of the habitat and the resilience capacity in said systems.

Biodiversity is an important component of any ecological system, promoting functional diversity and improving ecological stability by influencing resilience and resistance to environmental changes and is therefore crucial for overall quality of life.[18]

The green structure is multifunctional, since as we have seen it goes from social to ecological functions.[18] Understanding biodiversity as a fundamental component of socio-ecological systems, whose dynamics go through different phases or adaptive cycles, requires strengthening an integrated work approach from different perspectives.[19]

The factors negative extern at human development, whose pressure approaches the threshold of tolerance and resistance of socioeconomic systems, especially rural and urban human settlements, suggests the need to appropriately design and integrate vegetation structures as ecological buffers.

Conclusion

Various vegetation structures, made with multifunctional design, facilitate habitat quality for biodiversity and people in rural and urban socioeconomic systems.

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Conflicts of interest

Authors declare that there is no conflict of interest.

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