Land Use and Global Environmental Change

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Contributor: Felipe Teixeira Dias , Gisele Mazon , Priscila Cembranel , Robert Birch , José Baltazar Salgueirinho Osório de Andrade Guerra

Global environmental changes are multifactorial and affected by multiple forms of land use. Land use is closely linked to the global dynamics of the urbanization process, especially in recent decades in which the world has gone through intense migratory processes moving from rural to the urban setting. The dynamics that involve the urbanization process have multiple aspects and presuppose multiple ways of using the land and their linking to the economic aspect.

environmental changes

land use

urban planning

sustainable development

1. Land: Possibilities and Uses

The use of land presupposes a series of "possibilities and effects" that translate into the "usefulness versus results". Some of the main effects resulting from the use of land are disconnected from effective planning about the natural, social and economic effects and impacts ^{[1][2]}. Because of this, spaces for new or functional uses must be considered and configured without causing conflicts between the economic and environmental effects. In this sense, the development of possible uses of rural and urban land must start from a strategically innovative approach ^[3]. This is because the activities of humans alter the characteristics of watersheds and cause changes in land use, e.g., the use of forest area in agriculture in Thailand caused several problems after a tropical storm in 2019. Falling trees reduced production considerably ^[4]. Additionally, when focusing on climate effects, the issue of floods goes beyond the economic damage and requires the emergency construction of sub-basins to deal with low water absorption in the soil ^[4]. Thus, for example, in Austria, issues arise that may compromise agriculture in semi-arid regions where the suggestion to store groundwater for use on the land in periods of drought is considered as a strategy to cope with the problem ^[5].

In addition to natural factors, there are factors such as social vulnerability, issues resulting from irrational use of land, valorization of areas to the detriment of others and economic priority attributed to a locality ^[6]. These vulnerabilities motivate the restructuring of land use which can be beneficial or cause an environmental and economic imbalance. For example, one of the resources that is relevant and inherent to land use is energy generation which is an important component of urbanized spaces. Due to its economic and environmental potential ^[7], it is essential to indicate the use of solar energy and the multiple possibilities of adapting such international plans to local realities ^[8].

In related perspectives, several authors convey the idea that between the binomial of "possibilities and challenges", challenges are much more visible because, logically, they are paid more attention in the plans and projects where urban planning is the driver for the rational use of land ^{[6][9][10][11][12]}. These observations add to the suggestion that a set of unique methodologies to analyze and mitigate climate change in urban areas may be developed ^[13] in addition to the alignment between policies and measures applied to urban planning ^[14]. Generally, reflections on land use focus on two aspects: environmental protection on the one hand, and its socioeconomic development resulting from an environmental exploitation on the other.

Studies being carried out are positioned in the sense that, at the strategic level and in order to promote an adequate use of land, it is necessary that there be urban policies focused on a particular context. Such policies are responsible for strategically instrumentalizing the use of natural resources inherent to the land and changes in its use ^{[1][10]}. All stakeholders should be involved including farmers, community leaders and public managers. It is these stakeholders who should contribute to the proper management of land based on the use of correct information, sense of responsibility and use of quality ecosystem services ^[15].

2. Land-Use Planning and Its Implications for Global Environmental Changes

City-based support ecosystem services are concerned with carbon storage, water management, soil nutrient treatment and retention and flood mitigation. They often suffer pressure from the need for short-term development and are unable to support people's well-being. For this reason, ecosystem services are essential to support environmental conservation planning ^[16]. Indicators of urban sustainability should also be established for the development of policies and practices, e.g., the number of non-governmental organizations, percentage of urban population and open green spaces and air quality, amongst others ^[17].

Urban expansion is discussed constantly ^[18] and, in this sense, systems should be developed that address social and ecological aspects with academics, public managers and local actors to debate changes in the use of land, water and emission of pollutants ^[18], adoption of low power LED lighting on public roads and in homes ^[19]. The issue of land use is also impacted by municipal policies that often choose to disconnect the historical and ecological aspects of rivers and streams in cities such as Aman which is a major city in Jordan. However, this practice fails to promote business related to the use of these features that, in practice, can impact a city positively through public involvement in the development of policies ^[20]. Typically, this style of planning has weaknesses such as lack of social equity and social reforms, top-down planning, and top-down targets imposed without the involvement of the population ^[3].

In this area of planning, low-carbon cities with strategies to deal with the impact of climate change also appear. For example, alternatives for carbon dioxide emissions in cars ^[11] are considered in cities with a high density of buildings and population ^[21] and socio-ecological urban zoning policies ^[22]. The expansion of large urban centers also raises concerns about greenhouse gases with residential buildings being the largest emitters. However, this situation is resolvable with policies aimed at urban areas to protect the proper uses of land, reduction in carbon

emitters and use of renewable energies, such as what is seen in the Swedish city of Stockholm ^[22]. These models can be supported by proper planning systems and involve the participation of all stakeholders in the creation of scenarios based on land use and economics. The scenarios allow the simulation and evaluation of land use ^[23], urban mobility ^[24] and the social impacts ^[18].

Discussion about water resources concerns systems for capturing and storing rainwater. This are developed according to the types of land use and characteristics as well as their influence on drainage systems. In Thailand, the issue of water is quite fragile due to the existence of built and agricultural areas near the river basins. The country suffers from floods and production losses caused by the inability of watersheds to absorb water culminating in the need to plan and create sub-basins for runoff in times of intense rainfall ^[4]. Likewise, there is a need to plan groundwater policies in view of the possibility of using these for agricultural irrigation. In Austria, for example, water scarcity reduces productivity and makes life impossible in the semi-arid regions ^[5].

To enhance land-use systems and reduce impacts suffered by climate change, ecological and economic management models can be used to guide the decision-making process and develop sustainable land use ^[15]. These systems can also have their planning organized by neighborhoods or sectors, as in the case of Germany where ways of managing water, urban energy use, building construction and maintenance and land use are all considered. These aspects can be part of a plan capable of assisting decision-making and implementing the necessary resources ^[25]. Green spaces in urban centers can still be planned according to indicators such as connectivity, multifunctionality, applicability, integration, diversity, scalability, governance, and continuity. In the capital city of Portugal, Lisbon, the green infrastructure depends on connectivity, multifunctionality and its applicability. Thus, public managers and professionals working in urbanization showed that it is essential to abandon traditional approaches and develop new strategies for planning ^[26].

Ecological land use is also able to develop cities through the creation of services capable of exploring the planning practices of neighboring communities and other cities which may lead to the overall reduction in buildings, as is the case in Italy. Thus, urban design could be considered ecological and guide the decision-making process of public managers regarding environmental and human issues inherent in infrastructure, e.g., the integration of urban vegetation, green roofs and urban community gardens ^[27]. Ecological compensation and preservation have been adopted as ways to deal with environmental impacts. In Beijing, China, public managers noted the change in soil that occurred due to urbanization, deforestation, and environmental degradation. Therefore, measures aimed at ecological management of very populated cities were adopted to preserve ecosystem services ^[28].

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