DEsertification in the tropics

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Summary

This chapter analyzes two processes: desertification and sandization. The proposal is to discuss the concepts, their origins, the area of occurrence, the policies and experiences of control of these processes.

The discussion about the process of desertification and the first international initiatives relative to its control began in the United Nations (UN) Conference on the Human Environment (Stockholm, 1972) and in the conference held in Nairobi, Kenya, in 1977 that established the United Nations Environment Program (UNEP). The later defined that: "desertification is the diminution or destruction of the biological potential of land, and can lead ultimately to desert-like conditions. It is an aspect of the widespread deterioration of ecosystems, and has diminished or destroyed the biological potential, i.e. plant and animal production, for multiple use purposes at a time when increased productivity is needed to support growing populations in quest of development". The UN considers desertification as a global problem, being evident in more than 100 countries. The regions where arid, semi-arid and dry sub-humid climates occur and make up approximately 37% of the surface of the continents, and are the settings for more than a billion people (1/6 of the world population).

The sandization process occurs in the southwestern sector of Rio Grande do Sul State, south of Brazil, especially in the sub-region known as Campanha Gaúcha. The origin of this process is the reworking of non-consolidated surface sands, by water and wind. These sediments are constantly mobilized, which in turn, hinder the vegetation from fixing itself. The reworking of such quaternary deposits resulted from morphogenetic dynamics, where surface runoff, particularly the concentrated flows in gullies, expose, transport and deposit the sand. After this hydrological process there is the wind action in
The sandization process has been associated to desertification since the 1970’s. However, sandization is a single phenomenon associated to hydrological and wind processes, and associated to climate regimes that are different from those that characterize the desertification process.

1. The desertification process and its area of occurrence

The discussion on the process of desertification and the first international initiatives relative to its control originated from the United Nations (UN) Conference on the Human Environment (Stockholm, 1972) and, particularly, the conference held in Nairobi, Kenya, in 1977, establishing the United Nations Environment Program (UNEP). The later conference defined that "Desertification is the diminution or destruction of the biological potential of land, and can lead ultimately to desert-like conditions. It is an aspect of the widespread deterioration of ecosystems, and has diminished or destroyed the biological potential, i.e. plant and animal production, for multiple use purposes at a time when increased productivity is needed to support growing populations in quest of development. (UNEP, 1978)”. Dregne, 1986.

This subject, therefore, comes to the debate “when the United Nations Conference to Combat Desertification (UNCCD) recognizes that desertification as an environmental problem with high human, social and economic cost” (Hulme & Kelly, 1993). Figure 1

![Figure 1 - The world’s arid lands](Source: UNESCO - 1979)

According to these authors, the conference drafted a worldwide 20 year Convention to Combat Desertification (CCD) action plan. In the evaluation of the preceding authors, there are many indications that, after 16 years, this plan has had little success. The UN assessed the results of this plan at the Conference on Environment and Development (UNCED), the first Earth Summit – RIO 92. The CCD was adopted in June 1994 and opened for signature in Paris, October 1994.
The concern for this issue has its origin in the trend of decreasing precipitation, revealed in the Sahel (Africa). For many authors, this trend in the African region could be associated to continuous soil degradation, observed in decades prior to the 1960s.

Other scientists, such as Nichelson (1978), analyzed the degradation of this region by combining Chad Lake water level data, landscape descriptions and historical data, concluding that a dry up of one or two decades has been a characteristics of the Sahel climate, meaning that the present situation has been observed at other moments, during the last millennium.

The UN considers desertification a global problem, being evident in more than 100 countries. The regions where arid, semi-arid and dry sub-humid climates occur make up approximately 37% of the surface of the continents, and are the setting for more than a billion people (1/6 of the world population). The regions that are subject to desertification are those that present an arid index of up to 0.65. The arid index is defined by the ratio between precipitation and potential evapotranspiration, it being it an indicator to identify aridity around the world. Based on this index, the more arid the region is the smaller the arid index value, and greater is the risk of desertification, Figure 2. Besides this index, in recent studies, there are other factors to consider, that is, desertification is also associated to soil erosion and degradation, with damaging results to the fauna and flora of the afflicted areas (IBGE, 2004).

![Figure 2 - Map of areas at risk of desertification](Source: The United Nations Conference on Desertification – 1977)

2. The origin (1940) and the renewal (1970) of the concept of desertification

While searching for the comprehension of the origin and basics that assembled the definition of desertification, two principles are essential to its study: geographic space and the time of its occurrence. Besides these principles, the worry over this phenomenon has been to define the forced alterations to the dynamics of the environment, including those changes of human organization and activities.
On analyzing these two principles and the forced alterations to human societies, significant differences may be identified in the concept of desertification, as well as for the proposals to combat the phenomenon.

As for the conceptual bases of the process called desertification, according to Dregne 1986, “about 18 percent of the arid region of Africa is severely desertified, and most of that represented by grazing lands and rain-fed cropping lands on the south side of the Sahara. The other large area that is severely affected is the mountain slopes and the plains of North Africa. Moderate to high salinity affects about 30 percent of the irrigated land in Egypt (Aboukhaled et al., 1975). Ethiopia, Kenya, and the Maghreb countries of Algeria, Morocco, and Tunisia have been subjected to especially serious water erosion, whereas wind erosion has been most damaging in sub-Saharan West Africa”.

According to the map in Figure 2, in addition to the distinctive tropical regions, other areas, in other latitudes, are associated to the desertification process. This is the case for regions in Asia, North America, Australia, South America, and even in Europe.

According to Dregne 1986, such areas present the following characteristics:

- “In the arid regions of Asia is characterized by overgrazing of the rangelands of the Middle East and Central Asia, water erosion of cultivated lands from eastern China to the Mediterranean Sea, and salinization and waterlogging on a large scale in Iraq, Pakistan, China.
- There are about 450 million hectares in the arid regions of Canada, the United States, and Mexico. Approximately two-thirds of that total is moderately desertified and less than one-third severely desertified, with a considerable area of slightly desertified land and four small delineations of very severely desertified land.
- The coast of Peru is crossed by a large number of short rivers, flowing from the Andes to the Pacific Ocean. Many of the irrigated valleys are affected to some degree by salinization and waterlogging. The valleys constitute only a small part of the coast desert of Peru and even less of the Chilean desert. Most of the desert has experienced little development or desertification.
- Farther south, in the semi-arid coastal mountains of Chile, land degradation, due to overgrazing and cultivation of sloping lands, has been severe around population centers. Indiscriminate woodcutting has also been an important negative factor in the development of the region.
- In Argentina, which has more arid land than any other South American country, overgrazing has led to the degradation of range vegetation, from the high plateaus in the north to the cold Patagonian desert in the south. Wind erosion plagues both range and cultivated lands, especially in the southern half of the nation.
- Salinization and waterlogging do not affect a high percentage of the total cultivated land in Spain but important and large areas of affected soils do occur in irrigated valleys. The major salt-affected areas in the northeast are in the Ebro River watershed, in the vicinity of Zaragosa and Herida.
- Desertification is most extensive in the saltbush-bluebush (Atriplex-Maireana)
vegetation type occurring in New South Wales and South Australia, where overgrazing has caused degeneration of the plant cover. Degradation of the vegetation, due to overgrazing, has also been severe on the fine-textured lowland soils (Vertisols) of eastern Australia and in the flood plains and surrounding slopes of coastal river valleys, particularly the Gascoyne, Ord, and Victoria catchments in Western Australia and the Northern Territory.

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as the desertification in the Northeast of Brazil and sandization in the Southwest of Rio Grande do Sul.

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Biographical Sketches

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