

Cláudia Marisse dos Santos Rotta and Lázaro Valentin Zuquette

Abstract

The changes in the environment has been intensified by anthropogenic influence, leading some areas to lose their function by degradation of the natural aspects. This work studies different basins in the central portion of São Paulo State, Brazil, where the different land uses are related to different degradations sources. Based on the topographic map, aerial photos and satellite images, we delimited 24 basins and identified their main land uses, as well as all environmental problems associated. It was observed that some types of land degradation are more common in the study area, as example, slope shape changes, slope inclination changes, soil compaction, and materials exposure. And also, the listed types of land degradation can cause other problems related with their consequences. In this way, it is possible to conclude that is necessary to consider the geological-geotechnical characteristics of the geological materials and other environmental aspects in the land uses development.

Keywords

Land uses • Land degradation • Inventory • Brazil

86.1 Introduction

The earth surface is being occupied more intensely due to direct and indirect human necessities, resulting in environmental changes that exceed the resilience of the environmental components. As consequence, we can find areas with different levels of degradation. The land degradation causes imbalance of the environmental dynamic affecting its behavior in different functions. It has been studied in different scales and ways to support recuperation process and measures for environmental sustainability.

The most works treat aspects related to flora, fauna, soil fertility, social and economic aspects. In Brazil the studies about the relation between the geological components and the geological-geotechnical characteristics with the land

degradation aspects are not common. This situation is a consequence of the lack of maps that show adequately the geological components and their intrinsic characteristics. This study shows, in a simple way, the distribution of land degradation sources and the changes of the environmental aspects for each basin. And it proposed to develop a study in a groundwater recharge area that is responsible for the water flow of the drainage channels in different basins in the central portion of São Paulo State, Brazil.

There are a lot of studies related with land degradation, and between them the inventory studies as examples those developed by: Gupta et al. (1998), Nishiyama (1998), Obi Reddy et al. (2002), Zuquette et al. (2004).

86.2 Materials and Methods

The study region was located in the topographic map (1:50,000) and 24 basins was delimited according their geomorphological aspect. Previous data about this region were collected to contribute for a chronological study of the basins. Aerial photos and satellite images, at different scales

C. M. dos Santos Rotta (✉) · L.V. Zuquette
Engineering School of São Carlos, University of São Paulo,
Av. Trabalhador São Carlense #400, Parque Arnold Schmidt,
São Carlos, SP, Brazil
e-mail: claudia_rotta@hotmail.com

and years, were also consulted in this phase. It was possible to identify the main changes in the superficial conditions and land uses, and the evolution of the drainage channels conditions in the study area. The temporal study and field works made possible to identify all environmental problems, and the affected environmental aspects, associated with the anthropogenic uses. In sequence, an inventory was made of the main problems, for all basins, considering the actual and possible future aspects of land degradation.

86.3 Study Area

The study area is located in the center of the São Paulo State, Brazil, in the isolated plateau with altitudes ranging from 500 to 1,060 m, drained by 24 basins of different orders. The geological materials are portion of the Itaqueri Formation (Sandstones, siltstones and claystones interbedded), the Serra Geral Formation (basalts), and the Botucatu Formation (Upper portion: very cemented sandstones, Lower portion: poor cemented sandstones) like is showed in Fig. 86.1. The relief consists in escarpments on the limits, and different slopes associated to plains less than 100 m width, and slope inclination varying from 1 to 50°.

86.4 Results and Analysis

Based on the aerial photos and satellite images, as well on the field works, it was identified the land uses in the 24 basins studied. The land uses are, in the most part, related

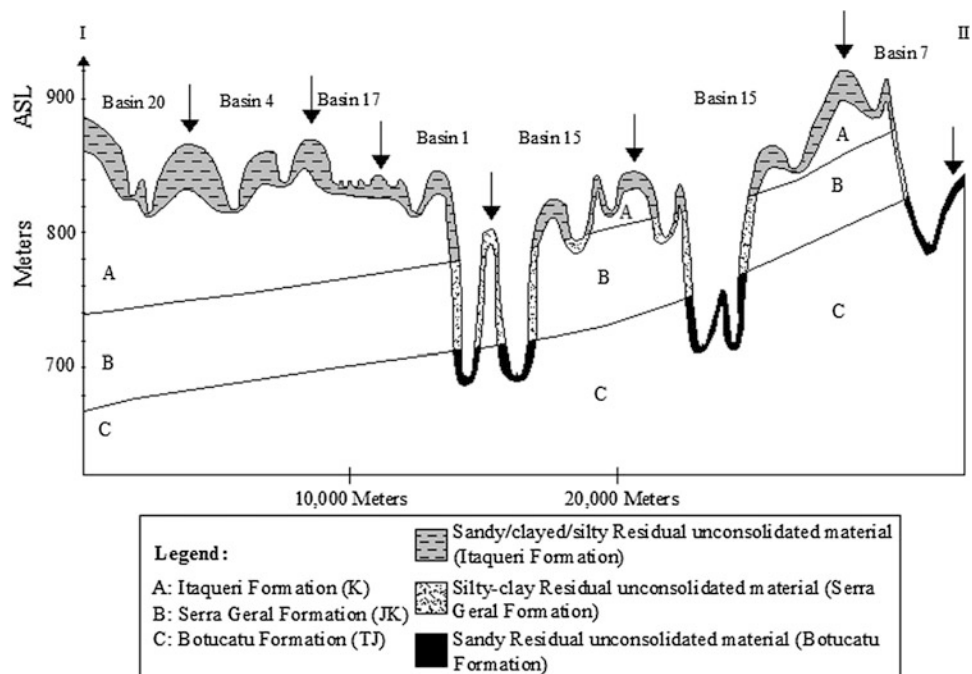
with the agricultural use and were grouped in three types: agricultural, roads and built elements. Besides that, we identified the most affected environmental aspects and the main types of land degradation resulting of them.

The pavement, secondary and farm roads affect the same environmental aspects: slope, drainage channels and superficial geological materials. The consequent types of land degradation are: shape slope and inclination change, channel cross section change, soil compactation and materials exposure.

Among the built elements, it was observed different environmental aspects affected and types of land degradation. The tourism affects slope, drainage channels and superficial materials, causing slope shape and slope inclination change, channel cross section change, water contamination and superficial water change. The numerous reservoirs affect the groundwater depth and the drainage channels; causing slope instability on the riverbanks, channel cross section change and shape riverbank change. The urbanization causes slope shape and slope inclination change, materials exposure, and channel hydraulic properties change, like rectification. The land degradation caused by wells includes the groundwater level lowering and the water contamination that affect the groundwater depth and the water quality. And finally, the contour bunds, associated agricultural uses, affect the slope, superficial geological materials, drainage channels and groundwater, causing problems like slope shape and slope inclination change, soil compactation and materials exposure.

On the other hand, the agricultural uses like general crops, sugar cane crop and reforestation affect aspects as the slope, superficial geological materials, drainage channels

Fig. 86.1 Cross section shows the geological materials distribution and position of some basins



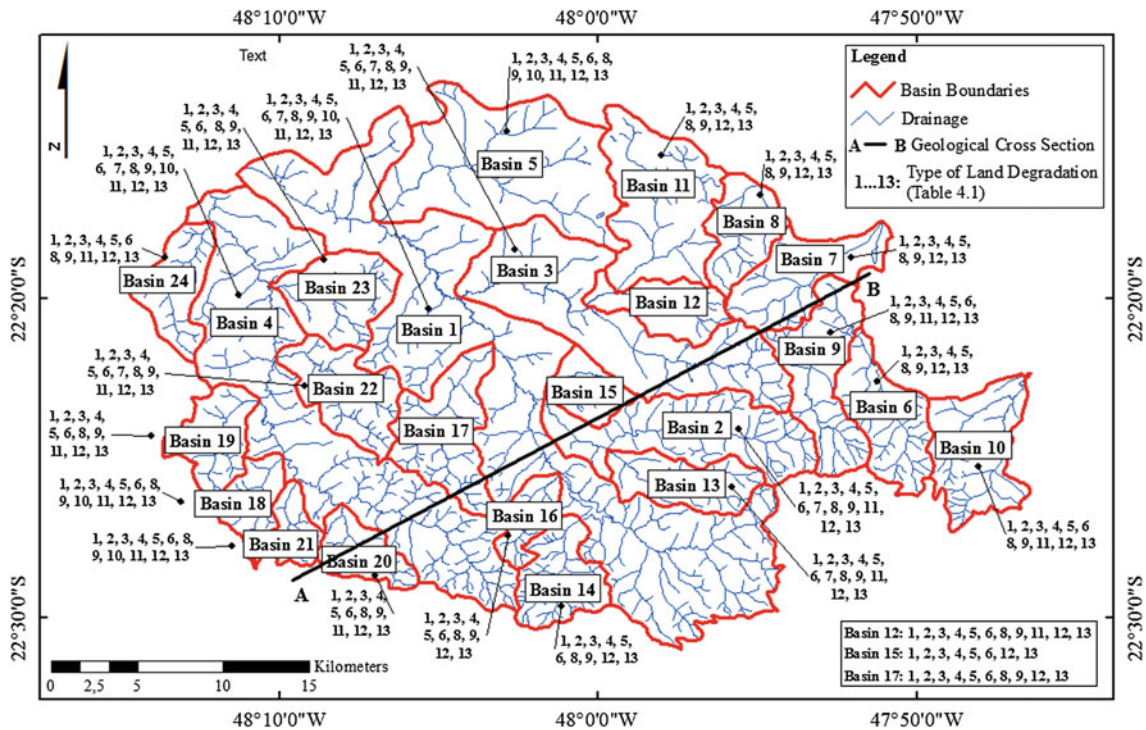


Fig. 86.2 Types of land degradation for all basins in the study area

and groundwater, causing shape slope and slope inclination change, soil compactation, materials exposure and hydraulic properties change. And also, the use of fertilizer products can affect the groundwater and superficial water, causing water contamination and aquatic ecosystem disturbance.

Analyzing the results we observed that some types of degradation are equal for different land uses and occur more frequently in the study area. The most common land degradation are: shape slope change, slope inclination change, channel cross section change, soil compactation, and materials exposure. But some problems like slope and riverbank instability, aquatic ecosystem disturbance, water potability change and hydraulic properties change, although are associated with few land uses, occur in the most of the basins.

These changes in the environmental aspects, associated with the geological-geotechnical characteristics, especially of the residual unconsolidated material of Itaqueri Formation, causes other types of degradation in the study area, like large linear erosion, creep and silting. And the land exploration, with removal of the riparian vegetation associated with shape slope and slope inclination change, channel cross section change, soil compactation and materials exposure, lead to a water availability change, and disappearance of water spring,

in the mostly part of all the basins, especially related to a sugar-cane crop and contour-bonds uses (Fig. 86.2).

86.5 Conclusion

Anthropogenic changes have been made to the environment without taking account the geological-geotechnical characteristics of the geological materials and other impact factors. The most part of the cited land degradation types can cause changes in the rates of runoff and infiltration, explaining problems like erosion, silting and water availability. It is also important analyze problems like water contamination and water potability change. Even though this types of degradation are less frequently, their consequences are very serious, especially to the tourism growth and to water supply.

All these cited problems lead to environmental damages that could affect the quality of the land uses and also cause economic losses, justifying this study as a tool to guide process of recuperation and future land uses.

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