RISK ANALYSIS OF ROCK FALLS AT THE IBITIPOCA STATE CONSERVATION PARK AND ITS SURROUNDINGS, MINAS GERAIS STATE, BRAZIL

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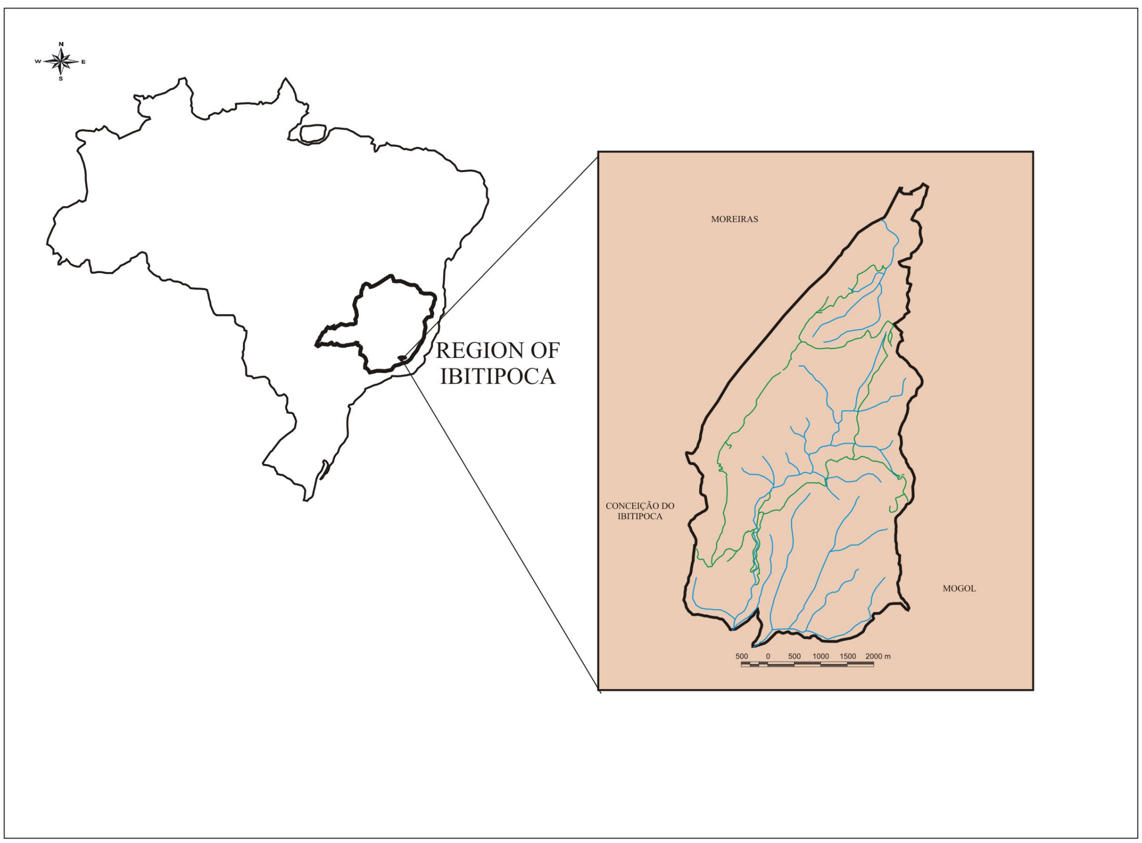
INTRODUCTION

The Ibitipoca region is located at the southeast part of Minas Gerais state, in Brazil (figure1). It is composed by the Ibitipoca State Conservation Park, a conservation unit that occupies the highest areas of the Ibitipoca Range, and by the surroundings of those mountains, with lowest topography, where there are farms and rural communities. This enveloping area of the park functions as a buffer zone, protecting the direct impact of tourism at the park, with the aid of forests and biological corridors.

Figure 1. Location of the studied area



This region occupies an area of 14000 ha, and the conservation unit itself covers 1480 ha, protecting important remainings of the Atlantic Tropical Forest, as well as endemic plants, and several caves developed in quartzites, CORREA NETO (1997); ZAIDAN (2002).

The research group on Environmental Zoning and Risk of the Federal University of Juiz de Fora has worked in the region since 1995, developing the environmental mapping of the region, with the target to furnish data as a basis for the Management Plan of the whole area.

The research has shown the extreme environmental fragility of the area, in respect not only to the biotic system, as well as to the physical components, ROCHA et all (2002); ROCHA et all (2001); ROCHA e MACIEL (2000); ROCHA et all (2000).

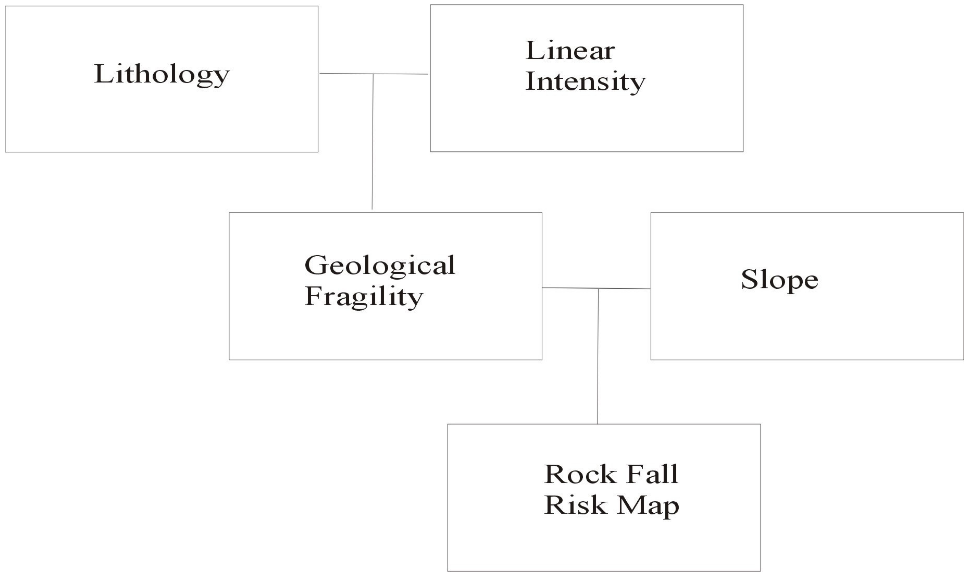
The vertiginous increment of the eco-tourism in the region, without rigid normalization of this activity, has magnified the environmental impacts, and also the risks to the tourist.

The environmental data base already done permits the assessment of several important topics to the management of the area; one of these is the risk of rock falls, a menace to the tourists and inhabitants of the region. In this way, the objective of this work is the development of the Rock Fall Risk Map of the area, as a contribution to the sustainable management of the Ibitipoca region.

MATERIAL AND METHODS

The Ibitipoca Range is composed basically by thick grained, not cemented and faulted quartzite rocks, steep slopes and field grass vegetation. Those environmental characteristics were mapped at detailed scale of 1:50000, using aerial photographs (1:30000) interpretation, field descriptions and specifically sampling for each characteristic, and laboratory procedures. As a result, it was made the following maps or planes of environmental information: lithology, slope, intensity of linear structures, hydrography and location of trails and roads. Those maps were separately inserted into a geographical information system called SAGA (XAVIER DA SILVA, 2001) and crossed two by two as showed at the decision tree (figure 2), having, as final target, the assessment of the possibility (or risk) of rock falls.

Figure 2. Decision tree



In the crossing technique it was given notes to each of the components of the single map, and weights to each map in each crossing. For example, at the crossing of lithology and intensity of linear structures, it was given weights of 50% for each map, meaning the equal importance of each one. But, the note of a dense concentration of linear structures (thinking about the risk of rock fall), is obviously higher than the note of a thin concentration of these structures. The map resulting from this process was called Rock Fall Risk Map, where it was defined five levels of risk: very high, high, medium, low and very low risk. As a way to know how the roads and trails of the region are in danger to rock falls, it was also made a complementary map focusing the trails and roads fragility to rock falls.

RESULTS AND DISCUSSION

All the thematic maps considered as planes of information (lithology, slope and linear structures) are not showed in this work, and can be obtained at ROCHA (2001) and ROCHA et all (2000).

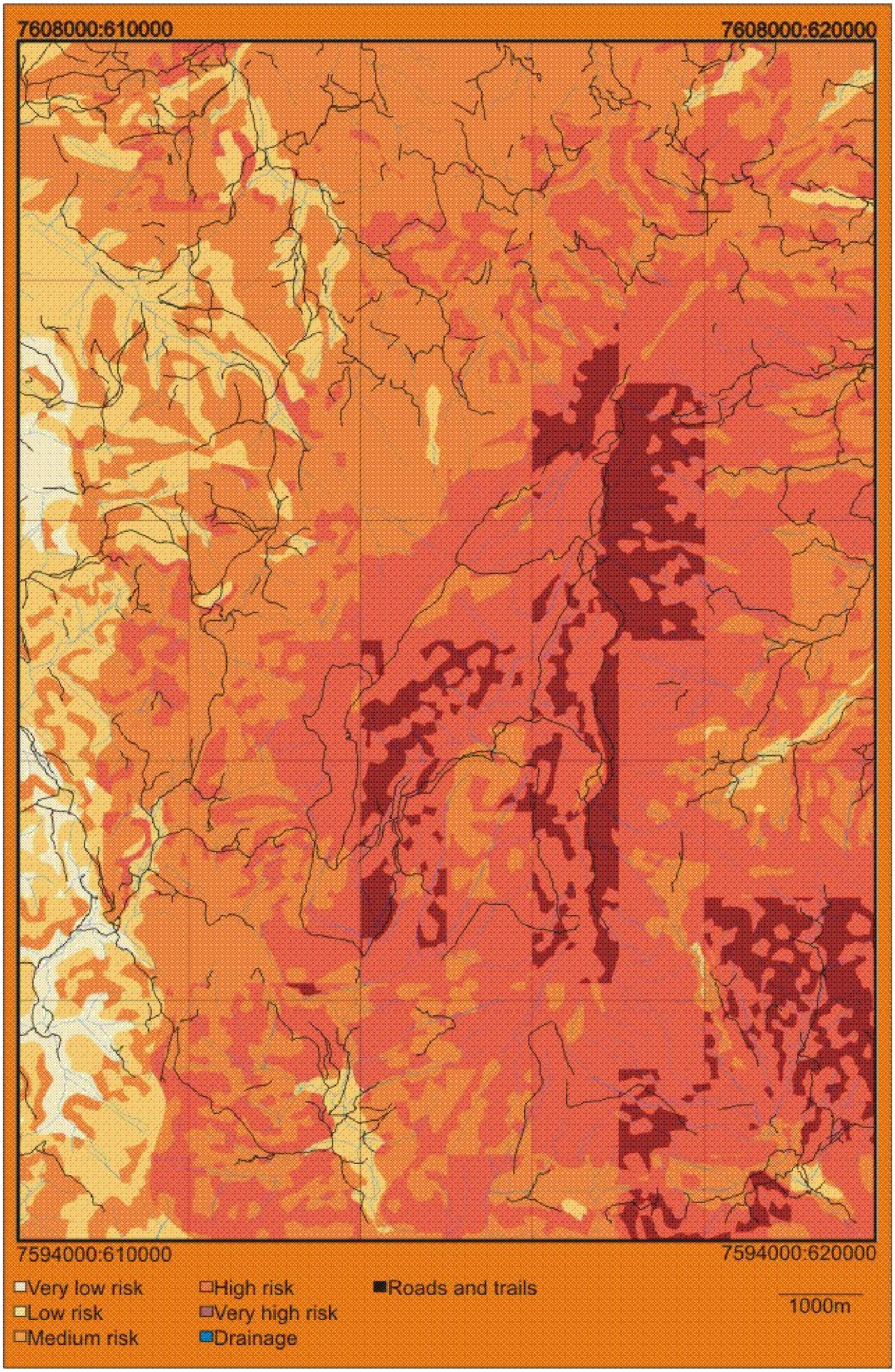
The figure 3 shows the Rock Fall Risk Map for the area studied, already crossed with the trails and roads map. It can be observed the extreme fragility of the region due to the menace of rock falls. The digital system permits the calculation of areas occupied by the different categories of risk (environmental signature) showing that 45% of the whole area is situated in the categories of high and very high risk to rock fall. If we take in account also the areas of medium risk (41%), we arrive at the striking percentage of 86%, meaning that the area studied is highly prone to rock falls disasters. However, it is not a surprising result in the geological perspective, as it can be seen if you walk along the drainage system inside the park, where it is common to see blocks of rocks of several diameters deposited after falling from the steep slopes.

There isn't doubt that the areas more favorable to rock falls are situated inside the conservation park, specially along the east limit, as well as at the south part of the conservation unit.

The map also shows that the trails inside the park are dangerously plotted on areas of high and very high risk, especially at the east part of the park. This fact demands a new drawing of the trails as a way of prevention of disasters to the tourism activity.

Outside the park the most dangerous area to rock falls is situated southeast of the map. It is interesting to mention that the community of Mogol, with a population of no more than 1000 inhabitants, is located precisely at this rock fall risky area. It is dispensable to comment about the vulnerability of this small population to this kind of natural disaster, demanding actions of rock contention, redrawing of roads, environmental education and politics of sustainable management.

Figure 3. Rock fall risk map



BIBLIOGRAPHY

CORREA NETO, A. V. **Cavernas em quartzitos da Serra do Ibitipoca, sudeste de Minas Gerais**. In: Seminário de Pesquisa do Parque Estadual do Ibitpoca. Juiz de Fora. Núcleo de Pesquisa em Zoneamento Ambiental da UFJF.1997.

ROCHA, G.C. Vulnerabilidade **geológica em um Parque Florestal do sudeste do Brasil**. Revista ERID, Vol. 3. P. 26-29. San Jose, Costa Rica. 2001.

ROCHA, G.C.; ARAÚJO, F.S.; VALENTE, A. S.M. & SALIMENA, F.R.G. **Mapeamento da vegetação dos arredores do Parque Estadual do Ibitpoca, MG**. In: LIII Congresso Brasileiro de Botânica. Recife. Sociedade Botânica do Brasil. 2002.

ROCHA, G.C. ; LEÃO, E. & CRUZ, J. **Parque Estadual do Ibitipoca**. CD ROM. Juiz de Fora. Editora Multimeios. ISBN 858525685.2002.

ROCHA, G.C. & MACIEL, D.M.G. **Distribuição geográfica dos solos do Parque Estadual do Ibitpoca.** In: VII Seminário de Iniciação Científica da UFJF. Juiz de Fora. Editora da UFJF. 2000.

ROCHA, G.C.; RAGAZZI, E.J.& ZAIDAN, R.T. **Avaliação ambiental por geoprocessamento na definição de áreas de fragilidade geológica do Parque Estadual do Ibitipoca, MG**. Anais do VI Congresso Brasileiro de Defesa do Meio Ambiente. CD ROM. 2000.

ROCHA, G.C.; RAGAZZI, E.J.& GOES, M.H. **Zoneamento preliminar da fragilidade geológica do Parque Estadual do Ibitipoca, MG, e arredores.** Revista Principia, Vol. 5. Juiz de Fora, EDUFJF. 2000.

XAVIER DA SILVA, J. **Geoprocessamento para análise ambiental**. Rio de Janeiro. Editora do autor. 2001.

ZAIDAN, R.T**. Zoneamento de áreas com necessidade de proteção ambiental no Parque Estadual do Ibitipoca, MG.** Universidade Federal Rural do Rio de Janeiro. Instituto de Florestas. Dissertação de Mestrado. 2002.