Pasture mapping by classification of Landsat TM images. Analysis of the spectral behaviour of the pasture class in a real medium scale environment: The Case of the Piracicaba Catchment (12.400 km2 , Brazil).

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Abstract

The environmental consequences due to rapid land use changes show the importance to characterize the soil occupation in the landscapes. The analysis of satellite images is a fundamental method to assess land use mapping (e.g. Lilesand and Kiefer, 1987; Roughgarden *et al.*, 1991; Quattrochi and Pelletier, 1991). Attempts to map vegetation types, especially pastures, from satellite data in tropical and sub-tropical regions have very often limited success despite widespread development and use of numerous statistical procedures (Price *et al.*, 1992; Hernandez *et al.*, 1998). Especially in inter-tropical regions, some soil occupations such as pasture, forest and sugarcane could be characterized by similar spectral responses (Adams *et al.*, 1995; Hernandez *et al.*, 1998). In addition, accuracy in vegetation mapping is constrained by statistical approaches used to process remotely sensed data. Indeed, these approaches assume that ground data have linear or geometric relationships between class membership and predictor variables. The problem becomes more critical for large regions because of the greater variability in both spectral and ground data (Mathieu *et al.*, 1998).

In this paper, we analyze the accuracy of two classifications of Landsat Thematic Mapper, aiming at distinguish three main types of pastures (pasture s.s: p, good pasture, which mean well managed pasture: pb, and woody pasture: p+f) from other vegetation classes in a meso-scale basin (12.400 km2, Piracicaba basin, Brazil). The initial classification (CLASSIF 1) is based on non supervised clustering of the images. The delimited classes are interpreted and merged by comparison with standard spectra from NASA. The second classification (CLASSIF 2) is a parallelepiped partition based on the merged clusters issued from the first one. The validation is based on data from an agricultural survey at the catchment scale, and on 287 field observations randomly distributed within the whole catchment. The results are discussed regarding soil types and topography, and analyzing the spectral behavior variability of the pasture classes.

The two classifications performed well the total pasture proportion of the whole catchment, with prediction errors lower than 10 %. But the proportion of well located pastures (P) varied from 54 % for CLASSIF 1 to 73 % for CLASSIF 2. An error analysis of the prediction quality for the best classification, i.e. CLASSIF 2 exhibited the predominant effect of the soil type. Indeed, P values for CLASSIF 1 were higher for Podzolicos than for Latossolos: 44 and 84 %, respectively (Table 1).

Tab 1: Proportion of well predicted pastures for CLASSIF 2 as function of the soil types and the altitude classes.

	Soil types		**Altitude classes**			
	Podzolicos	Latossolos	<600	[600-800]	[800-1000]	>1000
Proportion of well predicted pastures	***84***	44	51	57	58	65

Finally, the validation results are varying with the type of pasture as shown in table 2. The joined classes "pasture" and "pasture+orchard" are representing quite well the group of good pastures. Almost all the classes are participating to the group of woody pasture.

Tab 2: Validation results for CLASSIF 2 as function of the type of pasture ("pasture", "good pasture" and "woody pasture").

	Pasture%	**Good pasture**%	**Woody pasture**%
% of total pasture	68.2	6.8	23.5
class 1 - water	2.5	0.8	3.3
class 6 - sugarcane	7.5	0.8	0.8
class 9 - wetsoil	3.3	0	0.8
class 16 - forest	6.7	0.8	4.2
class 17 – bare soil	10.8	0	3.3
class 18 - pasture	12.5	2.5	5
class 19 – past+orchard	26.7	2.5	3.3

In this study we pointed out the interest of non supervised classifications to map pastures types from satellite data in sub-tropical regions. The classification results are improved if the different steps are applied separately to the regions which are varying by their environmental factors as the soil type, and then merged.

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