SELECTING HYDROELETRIC POWER PLANT ALTERNATIVES USING REMOTE SENSING

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Analysis refering to the distribution of the population and rural employees in regions which are subject to inundation by hidroeletric power plant reservoirs, are interested in identifying the more favorable alternative.

The literature presents a serie of studies using remote sensing techniques to estimate urban population (Ogrosky, 1975, Hsu, 1971; Anderson and Anderson, 1973).

The objective of this study is to evaluate the application of LANDSAT imageries integrated to census datas to verify the distribution of the population and employees in rural areas. The area test is located on the high course of Araguaia's river, between the States of Mato Grosso and Goiás (Brazil), where feasibility studies of hidroeletric power plants have been conducted.

The methodology adopted is based on the relation between land use data, extracted by visual interpretation of LANDSAT TM imageries, and census datas refering to employees and population in rural area, to assist the development of demographic maps.

Also its purpose is to evaluate the visual analysis of LANDSAT-TM imageries to assist studies refering to the generated impacts on the roads network by the differents alternatives of hydroeletric power plants being studied, and to estimate the cust to reorganize this network.

Population Studies

The studies refering to the distribution of population and employees in rural areas, was conducted by first estimating the land use areas in different census sector by planimetring these areas, visually extracted from LANDSAT TM imageries,band 3, scale 1:100.000 (table 1).

Table 1

Land use area estimated from LANDSAT TM imageries and corresponding census data

Census Sector	Land use area (km^2)	Population (inhabitants)	Employees (individuals)
PB 8	122.1	589	325
PB 7	72.8	181	75
A3	53.4	212	107
PB 4	37.1	222	46
PB 5	36.1	285	45

Based on datas presented on table 1, it was calculated the correlation coefficients between land use area and the employees and rural population. Then, the data was adjusted to a linear function through regression analysis (Table 2).

Table 2

Correlation coefficients and regression equations to the land use area, population and employees

	Correlation coefficents	regression equations
Land use area X Population	0,81	Y = 52.2 + 3.8x(1)*
Land use area X Employee	0,94	Y =-81.2 + 3.1x(2)*

* x = land use area

The population estimation using eq.1 and 2 compared with censitary datas suggest that the methodology is favorable to be applied on population studies in the stage of selecting the more favorable alternative (table 3 and 4).

Table 3

Population Estimation

Census Sector	PB 8	A3	PB 4	PB 5	D5*
Estimated Population	517	255	193	192	591
Actual Population	589	212	222	285	956
Percent Error	-12.1%	+20.7%	-12.8%	-32.6%	-38.1%

* not considerated in regression analysis.

Table 4

Employees Estimation

Census Sector	PB 8	A3	PB 4	PB 5	D5*
Estimated Population	299	85	34	33	359
Actual Population	325	107	46	45	430
Percent Error	-7.9%	-20.1%	-25.2%	-26.3%	-16.5%

The results also suggest that the studies were more favorable to analysis refering to the distribution of employees. The maps illustrating the distribution of rural employees using census data alone and integrated with LANDSAT TM datas are present on figures 1A and 1B, respectively.

Roads Network Studies

The implantation of the different alternatives in the study area will interfere with the roads network at different levels. The most detailed topographic maps existing in this region (scale 1:50.000) were developed from aerial photographs taken between 1964 and 1966. After aproximately 20 years, the situation is different. Many roads had been constructed and others had been abandoned.

To evaluate the impact and to formulate proposals to reorganize the roads network, the LANDSAT TM, band 3 scale 1:100.000 was interpreted visually, aiming up-dating the network roads on the existing topographic maps, and to identify more precisely their interference with the proposed alternative reservoirs.

After that it was elaborated an integrated analysis refering to the land use and the roads network, directly over the same LANDSAT TM imageries, aiming to analyse the utilization and function of the roads network.

Finally, the LANDSAT TM imageries bands 3 and 4 were visually interpreted, aiming to identify physiographic zones appropriate to implant roads, with basis in the relief features and drainage network analysis.

The studies mencioned above were integrated to formulate proposes to reorganize the roads network which will be inundated and to calculate the cust to implant it, considering different alternative hydroeletric power plants. Figure 2 present the roads network planning, to one reservoir alternative in study. In this case, the studies indicated that from the 185 km of roads planned, only 110 km will be necessary to be constructed, because in some areas, the existing secondary roads can be utilized, after the improvement of their traffic conditions.

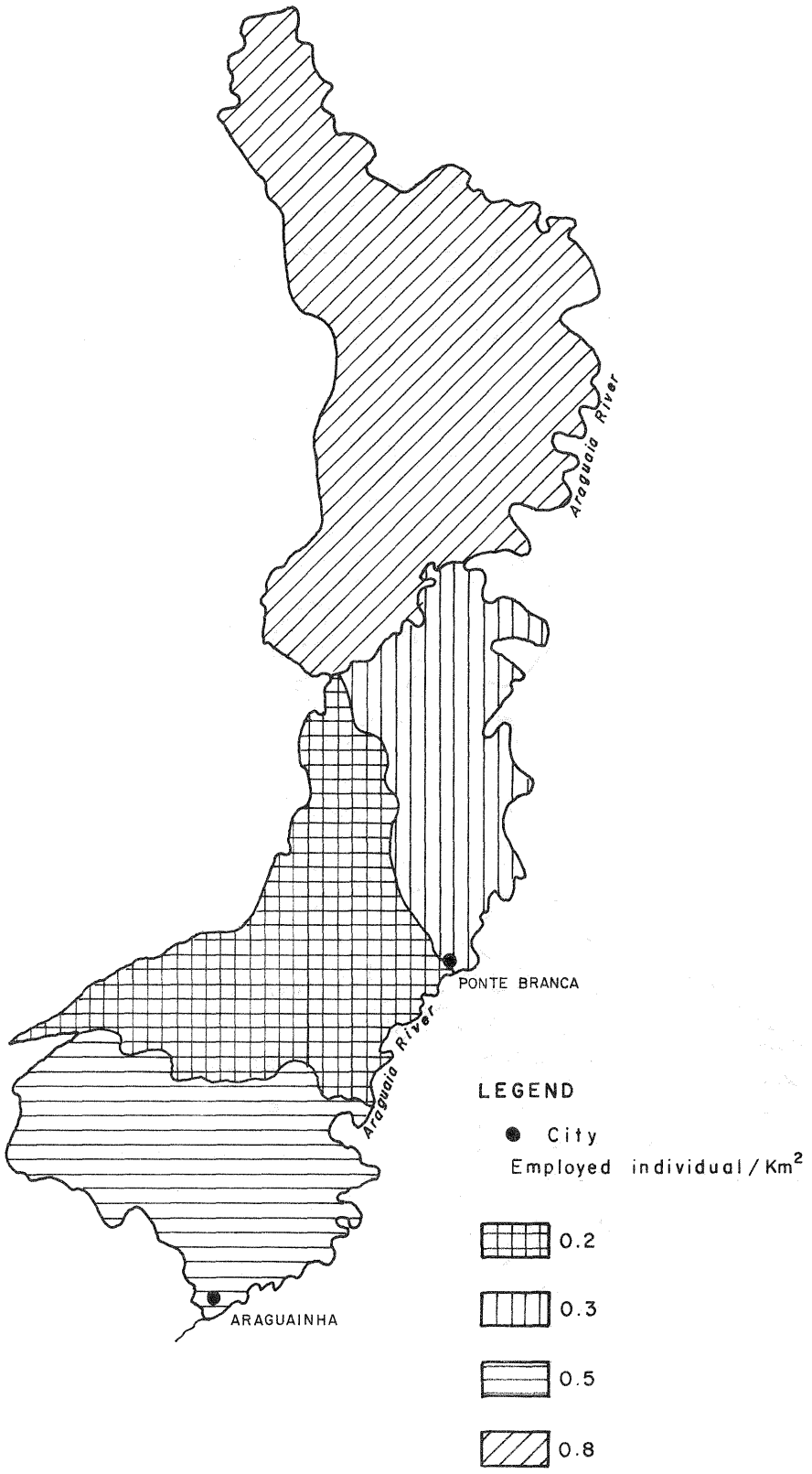

FIG. 1-A EMPLOYEE RURAL POPULATION DISTRIBUTION USING CENSUS DATA

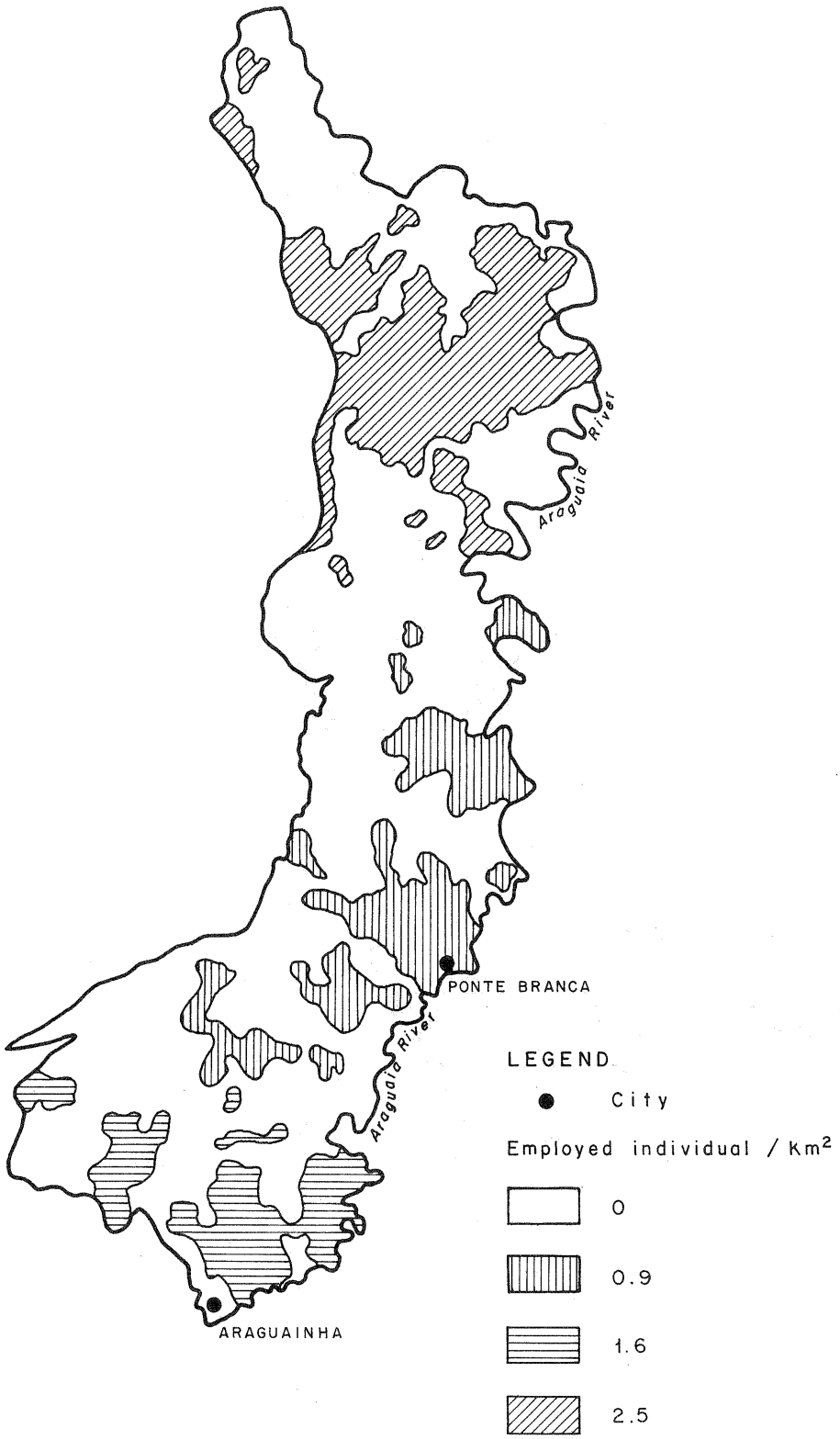

FIG. 1.B EMPLOYEE RURAL POPULATION DISTRIBUTION USING LANDSAT AND CENSUS DATAS

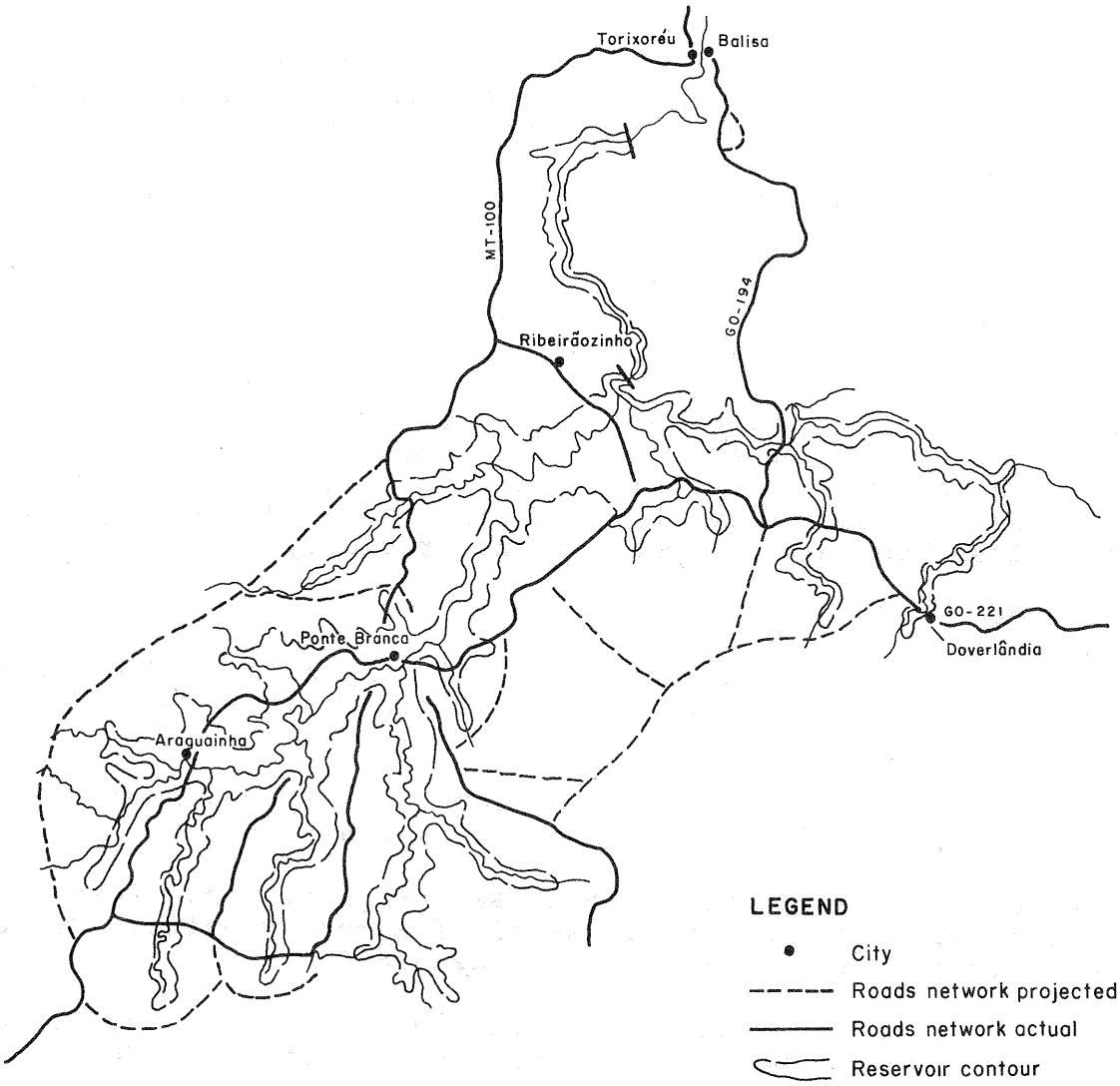

FIG. 2 ROADS NETWORK PROJECTED USING LANDSAT DATAS

Conclusion

The results suggest that the use of LANDSAT imageries integrated with census data allows the development of demographic maps in more detail than using census data alone, usefull to aid the selection of the more favorable alternative.

Otherwise, by the use of LANDSAT TM or SPOT digital data, it's possible to obtain more accurate land use maps with more land use categories. By integrating this data with census data, field samples and multiple regression analysis, it becomes possible to obtain more accurate demographic estimation which are usefull in socio economic analysis in more developed stages of the project.

The visual interpretation of LANDSAT TM imageries also suggested its usefullness to studies refering to the reorganization of the roads network which will be inundated by different alternative reservoirs, since they allow integrated analysis, rapidely, refering to the use and function of the roads,physiography and actual roads network. By the use of this imageries it was possible to formulate five proposals to reorganize the roads network which will be inundated by five alternatives hydroeletric power plant, rapidely.

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