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Full Length Research Paper

Reforestation land use and social development in the Rio Grande do Sul State, Brazil

Letícia de Oliveira[1]* and Paulo Dabdab Waquil[2]

[1]Facultty of Administration, Accounting and Economics - FACE, Federal University of Grande Dourados - UFGD, Rodovia Dourados - Itahum, Km 12, Cidade Universitária, CEP 79.804-970, Dourados - MS – Brazil.
[2]Federal University of Rio Grande do Sul - UFRGS, Avenida João Pessoa, 31 - Centro - CEP 90040-000 -Porto Alegre - RS – Brazil.

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The aim of this paper is to analyze the impact of land use due to forestation, through social indicators that influence regional development. Specifically, it seeks to identify key social indicators that are influenced by the change of land use and to check the relation of land use with social indicators. Methodologically, the research was classified as exploratory and descriptive, with quantitative analysis. The researched groups were municipalities of Rio Grande do Sul State, but to simplify the analysis for possible comparisons between them, there had been formed five groups of municipalities. Also there have been selected 18 variables for study, grouped into six dimensions. The results highlight the group 3 as the one that presented a better performance in the averages. This is an intermediate group in the proportion of the municipal area in forestry. Thus, the observation of the different variables that showed a better performance demonstrates that forestry provides additional development of municipalities, but, as from the moment that the area of forestry increases, municipalities tend to have lower performance. Therefore, it is concluded that forestation results in better indicators to some extent, but as its proportion in the municipalities grows, the indicators worsen again.

Key words: Forestation, land use, regional development, social indicators.

INTRODUCTION

A new situation has been the focus of governments, organizations and scholars to prevent the shortage of resources and to provide economic growth of regions. To this end, discussions that include changes in land use and economic, social and environmental concerns are fundamental to strengthen regional development. To Briassoulis (2000), the impact of land use changes is the result of a complex network of interactions between environmental and socio-economic forces in space and time. Considering the economic activity of forestry sector, which shows great importance worldwide and that has been the subject of studies due to its great diversity of supply to various production chains, it is expected that it helps in the economic, social and environmental growth of the region, and to contribute to global sustainability.

According to data of Ministry of Environment, MMA (2007), in 2006, in Brazil, the area of planted forests (areas of reformed forests and new cultivations) were of 627 thousands of hectares, meaning an increase of 13% in the relation to 2005. The states with larger planted areas with production objectives are Minas Gerais (23.1%), São Paulo (15.6%) and Rio Grande do Sul (14.4%). For the Brazilian Association of Planted Forest Producers, ABRAF, the eucalyptus and pines forests represent 34 and 66%, respectively, of the total of new cultivated areas (ABRAF, 2007).

Besides the socio-economic importance of the forestry sector in Brazil for the value-addition, income generation, origination of taxes in the form of duties, contributions and fees, foreign exchange and jobs, the sector integrates with several production lines, with broad diversification, having a multiplier effect on the Brazilian economy.

The forest-based activities have comparative advantage for being developed in Southern Brazil, as it has excellent soil and climate conditions (Regional Development Bank of Southern-BRDE, 2003). The state

*Corresponding author. E-mail: leticiaoliveira@ufgd.edu.br. Tel: +5567 3410 2049. Fax: +5567 3410 2046.

of RS had an area of planted forests in the year 2007 of 404,623 ha, representing 7.3% of the total area in the country that has more than 404 thousand ha; being 182,378 ha occupied with pine and 222,245 ha with eucalyptus plantations. Furthermore, considering the planted area of forests with other species in Brazil in 2007, the State of RS represents 38% of this area, with plantations of black acacia.

According to Castro et al. (2008), the RS's potential for the forestry sector development have been stimulated by State's Governments actions and by social movements led by organizations, which encourage several changes in institutional environment, for the benefit of regional development, sustained by the forestry agribusiness.

To Elands and Wiersum (2001), in the past, the attention was focused on the primary production function of forests, as a way to contribute for the economic advancement of rural areas, generating income, jobs and raw materials. Nowadays, the forestation role is changing gradually, with greater emphasis being given to its function of maintaining and recreating ecological services and facilities as a means of contributing to the attractive environment of living and leisure areas for an urban population growth. By the other hand, the reforestation in any area, should not be dominant, as it can put in risk the identity of rural areas (Elands and Wiersum, 2001).

Even then, many actors disagree about the role of forestation. Various doubts and criticisms occur concerning the advantages and disadvantages of forestry sector when compared to efficiency of traditional agricultural activities. Daniel (2000) comments that the comparison between these systems is only valid if monitored over time.

The arguments presented lead to assume that the areas of forest plantations are growing to meet the demand of forest-based industry. But this increase has been causing negative social and environmental impacts, leading to conflicts and changes among the various interested parties, for example occupying areas previously designated for pasture or other crops.

Thus, the justification of this article relies on the need to understand how changes in land use arisen from forestry activities affect the social indicators of the municipalities of Rio Grande do Sul-RS. The aim is to understand the land use and its consequences on regional development of RS.

It should be noted that, in recent years, there has been a discussion about the positive and negative impacts of forestry development in the municipalities of RS, since there are financial incentives for their execution, but there is also a great concern about economic and sustainable development of the municipalities in relation to reforestation.

Besides contributing to the discussion of the topic, the question of how changes in land use arisen from forestry affect the social indicators of the municipalities of this state became very important. To answer that, the study pursued to test the hypothesis that changes in land use with the advancement of forestry can boost local economies, leading initially to improvement in some indicators (positive effect), but from a point of excessive advancement of the activity, it can lead to lack of diversification and thus the worsening of the indicators (negative effect).

That way, the main general objective is to analyze the impact of land use arisen from (re)forestation, through social indicators that influence regional development. Specifically, it aims to compare the social indicators in the study, identify the key social indicators that are influenced by the change of land use and verify the relationship of land use to the social indicators in regional development.

Land use and land use changes

To the FAO (1995), land use involves both the way the biophysical attributes of land are manipulated as the intent of this manipulation - the purpose for which land is used. Land use concerns the function or purpose for which the land is used by the local human population and can be defined as human activity directly related to land, making use of its resources or having an impact on them. It adds that land use changes the land cover in three ways: Converting to or changing it to a qualitatively different state, modifying it or changing its status quantitatively without complete conversion, and preserving it in its condition against natural agents of change.

According to Lambin et al. (2003), the land use is defined by the purposes to which humans exploit the land cover. There is a high variability in time and space in the biophysical environment, in socio-economic activities, and in the cultural contexts that are associated with the change of its use.

It should be noted that changes in land use are not simple processes. According to Lambin and Geist (2001), there are simultaneous complex patterns, which extends from changes in land cover to conversions. There is a functional complexity in the types of changes in land cover and structural complexity of these types, both in terms of system space as in temporal patterns of change.

To Lambin et al. (2003), the change in land use is a spatial property observed in the scale of a landscape. It is the sum of several small-scale local changes in the distribution of land that reinforce or cancel each other. These changes are the product of multiple decisions that result from interactions between different agents, that act according to specific conditions, anticipate future consequences of their actions and adapt their behavior to changes in external conditions (market) and internal conditions (their wishes). Change in land use is then a complex behavior of large-scale space that emerges from the aggregate interactions of less complex agents.

According to Briassoulis (2000), the impacts of change are different depending on the spatial level at which impacts are manifested in global, regional and local and can be classified as environmental and socio-economic.

Aspinall and Justice (2003) indicate that studies have shown clear evidence that changes in land use and land cover have a significant impact on the variety of environmental, ecological, economic and social conditions and processes. These consequences of change are both direct and indirect, and are also evident in a context of spatial and temporal scales. Thus, better understanding and knowledge of the consequences of the change of use and land cover is an important goal of the scientific strategy for study.

According to Lambin et al. (2003), there are direct and indirect causes of change. The direct ones are the human activities or actions originated in the planned use of land and which directly affect their coverage, evolving physical actions in the land cover. The indirect causes are essential forces that sustain the direct causes of changes in land cover, operating in a more diffused way, within a period, changing one or more direct causes. The indirect causes are formed by a complex set of social, political, economical, demographical, technological, cultural and biophysical variables, that are the initial conditions in human environment relations and that are structural (or systemic) in their nature.

For Briassoulis (2000), the socio-economic causes include demographic, social, economic, political and institutional processes and factors, such as: Population and population change, industrial structure and change, technology and technological change, family, market, several public and political sector entities, norms, values, community organization and norms, ownership regime.

In this context, a study focused and founded, followed by systematic comparative analysis of case studies of the dynamics of land use, have helped to improve the understanding of the causes of change in land use. According to Lambin et al. (2003), these syntheses have produced insights into the general causes of sectored changes in land use and in the way of interaction between various causes. Thus, some general insights into the sectored causes of changing in land use are considered by Lambin et al. (2003) and Lambin and Geist (2001) as:

a) Multiple causes: Caused by multiple interactive factors originated from different levels of organization of human-environment system. Variables can be time-consuming, with long-term turnaround, which determine the limits of sustainability and collectively govern the trajectory of land use or fast variables, with a short turnaround.
b) Natural variability: Change and variability in the natural environment interact with human causes. Natural and socio-economic changes can occur as synchronous events, but independently.
c) Economical and technological factors: In a timescale of few decades or less, changes in the land use result, at most of the times, from individual and social answers to changes in economy, mediated by institutional factors.
d) Demographical factors: In a long term timescale, both the growth and reduction of a given population always had and still have a major impact in land use.
e) Institutional factors: It is important to understand the institutions (political, legal, economical and traditional) and their interaction with individual decision making.
f) Cultural factors: Many cultural factors also affect the decision making process related to land use issues. Land managers have various motivations, memories and personal stories. Their attitudes, values, beliefs and individual perceptions influence their decisions.
g) Globalization: The globalization in itself is not responsible for changes in land use, but is a process of other factors discusses above. The globalization can accelerate or delay the impact of those responsible for land use.

Therefore, apart from great diversity of causes and situations that cause the change, there are some patterns in the change that result from recurrent interactions between the responsible factors, followed by specific events. In few words, the main causes for the changes in land use are: Shortness of resources, which leads to an increased pressure for productivity against these resources, changes in opportunities created by market, extern interventional policies, loss of adaptive capacity and increase in vulnerability; and changes in social organization, in the resources access and attitudes.

Economic and regional development

According to Schwartzman (1973), regional economies are open areas, and therefore subject to all consequences caused by a high mobility of production factors and goods outside their borders and back inside them.

Apart from that, another factor to be considered in regional theory is the fact that the distribution of natural resources and customers markets is not equal for all regions (Schwartzman, 1973). The economical development have been an unequal regional process because of the fact that some regions have good natural resources, but are far apart from consumer centers, others have market and materials access, and others lack of resources and access to markets.

Julien and Lachange (2001) show that common elements of the regional development dynamic can be resumed in three topics: The first of them is the existence of absolute advantages, at least for some time, such as mineral water source, large forests, or significant tax benefits. Absolute advantages also include significant government investments in new industries. The second topic refers to a significant reduction in economic uncertainty for investors, caused by the absolute advantages, as it generates benefits that competition have not, ensuring substantial profits for a given period of time. Together, these two factors explain the third: The massive influx of foreign investment in the region. Investors are attracted by the advantages and the low level of risk, and their investments generate higher incomes, which have impact on the region as a whole.

The regional differences lead to definitions about public policies, providing the preparation of action plans to obtain economic growth, social equity, territorial integration, and to minimize development inequalities between regions. Based on the relations between the social objectives and needs and the regional inequalities issues, regional public policies are understood as part of general economical policy (Verschoore Filho, 2000). It should be highlighted that regional public policies strategies emerge from the region own characteristics and potentialities, leading to a better approach to its development.

Within this context, the forestry sector activities are essential to the development of a region, as they attract investments and enterprises, providing employment and boosting local economy.

The understanding of the changes driven by the change in land use provide a broader knowledge of the context and a better understanding of the regional development dynamics. Breitbach (2001) comments that regional development approaches emphasize specialization – much more than diversification – as a favorable factor to the regions looking for a competitive insertion at national and even international markets. That way, the specialization allows lower the cost and improve competitiveness, but it should be stressed that what can be good for a business might not be the better choice for another region.

Breitbach (2001) adds that the students of "innovative means" do not share the idea that regional development must be based on specialization, as regions that are diversified are more able to respond to the characteristic of globalized economic as risks and uncertainties. The author states that diversification is an important stake or regional development, especially when considering the risk and uncertainty in the global economy. It should be noted that a diverse region is more adaptable and flexible to economic changes than a highly specialized area.

Paiva (2006) highlights the existence of a literature that demonstrates empirically that the developed regions are those who can rely on a broad and diversified production sector of basic and non-basic items, taking from there the conclusion that diversification, and not specialization, is the consistent and sustainable alternative for regional development.

It should be noted that the State of RS, the object of study, presents a regional inequality, where the production structures and processes of socio-economic development show different situations, well-known and noticeable. In this sense, the importance of this study should be underlined as a contribution to the analysis of inequalities in development indicators and in how these can be influenced by changes in land use, particularly for the advancement of forestry.

RESEARCH METHODS

This research can be classified as an exploratory and descriptive study (Gil, 1995), with quantitative analysis (Freitas et al., 2000; Godoy, 1995). Exploratory, as it seeks to discover how changes in land use caused by forestation in the State of RS affect the dimensions to be studied, and descriptive, as it seeks to understand the relationships between the studied and changes in land use at Rio Grande do Sul State.

The research was developed in the forestation sector of Rio Grande do Sul State. The secondary data used were obtained through the *Fundação de Economia e Estatística Siegfried Emanuel Heuser* – FEE's website, for the timeframe of March to June 2008 period (FEEDADOS, 2008). Secondary data from bibliographical references and available information related to the issue, debated in various national and international scientific magazines and journals available in databases had been used.

The municipalities were grouped in relation to the land use and forestation, in other words, the relation of the reforested area (area cultivated with eucalyptus, pine and acacia) in relation to the total land used in each municipality (native forest, agriculture, exposed soil, field, dunes, water, swamp, urban and non-classified). The data used for grouping the municipalities with forestation were obtained from the *Inventário Florestal Contínuo* – IFC of Rio Grande do Sul, for the year 2001.

The objective of groups setting of municipalities was to make possible comparisons between them, characterized by different intensities of land use in forestry, and development indicators. Thus, there have been formed 5 groups of municipalities, according to land use in forestry: Those who have 0% of forest area; those with less than 1%; the ones with area larger than 1% and smaller than 5%; those with area with more than 5% and less than 10%; and those with an area greater than 10% of land use in forestry.

The study's object of this research was the municipalities of RS, being the research's population (496 municipalities). The Rio Grande do Sul State is situated in the Brazilian's South Region, bordering Santa Catarina State to the North, Argentina to the West, Uruguay to the South and the Atlantic Ocean to the East. The State represents 3.3% of Brazilian territory, occupying an area of 281,748.5 km^2, with a population of 10,582,840 inhabitants (IBGE, 2008).

Accordingly to the socioeconomic atlas of Rio Grande do Sul State, published by the Planning and Management State's Committee (*Secretaria de Planejamento e Gestão-SEPLAG*), the climate at Rio Grande do Sul state is typically of subtropical temperate type, with low temperatures, characterized as humid mesotermic. Its temperatures presents huge seasonal variations, with hot summers and rigorous cold winters, occurring frosts and eventually snow.

The average temperatures range from 15 to 18°C, with minimum of -10°C and maximum of 40°C. Regarding precipitations, RS State presents a well-balanced rain fall distribution along the year, due to ocean air masses that enters into the State. The average precipitation in the South part of the State ranges from 1,299 to 1,500 mm, and in the North part it ranges from 1,500 to 1,800 mm, being the northeast part of the State which receives greater intensity of rains, specially in the Plateau slope, the portion with higher amount of rain in the State (SEPLAG – Atlas, 2010).

It should also be highlighted that the State's relief presents altitudes up to 1,398 m and a diversified vegetal coverage, with areas presenting atlantic forest remnants and fields that characterize the Rio Grande do Sul's steppes (*Campanha Gaúcha*) and the highlands of Meridian Plateau (*Planalto Meridional)* (SEPLAG – ATLAS, 2010).

According to IFC-RS (2001) data (Figure 1), the RS State is

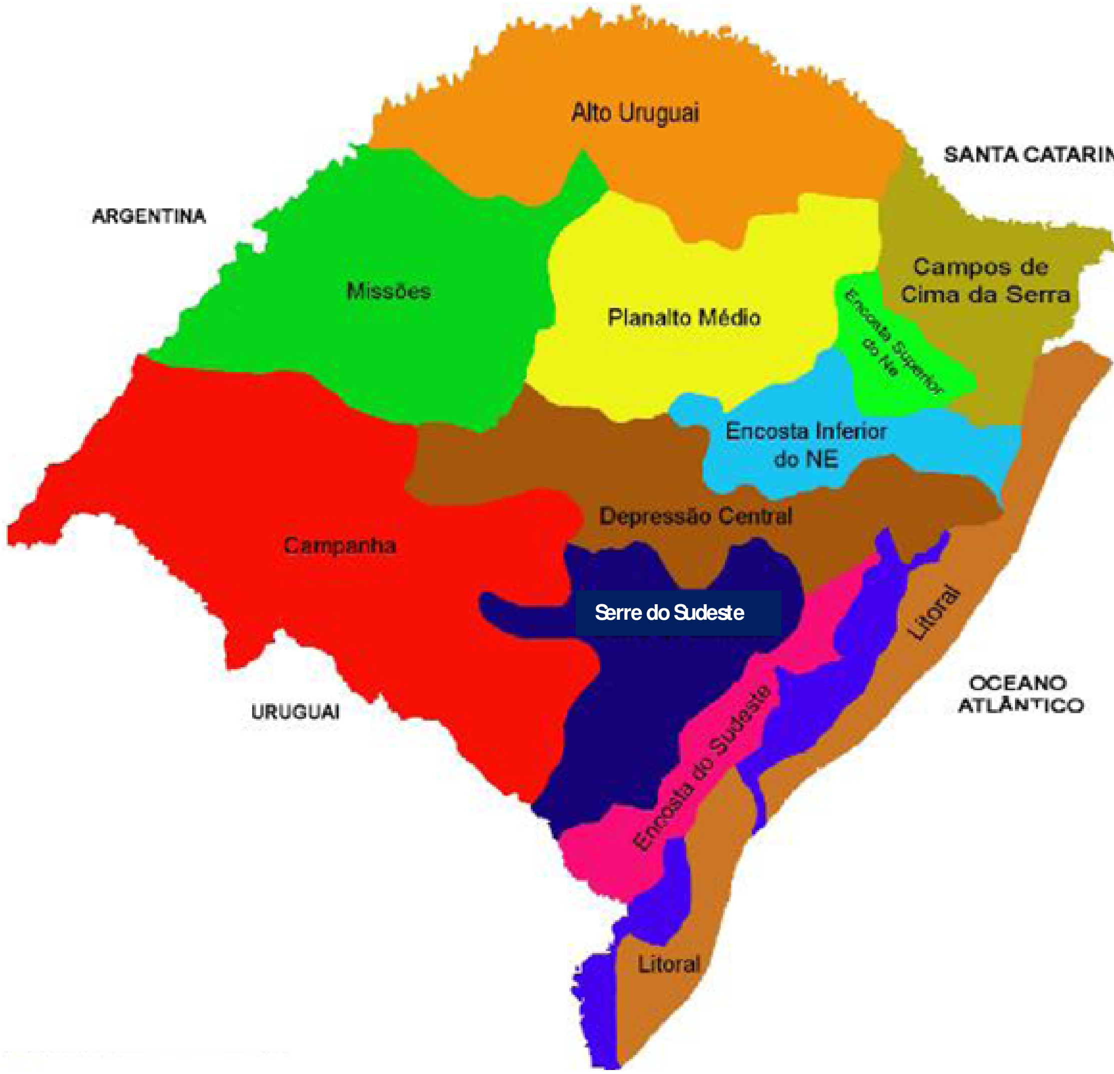

Figure 1. Rio Grande do Sul state Physiographic Regions (FORTES, 1956 modified). Source: Rio Grande do Sul state Continuous Forest's Inventory - *Inventário Florestal Contínuo do Rio Grande do Sul* (2001).

divides into 11 geographic regions: Litoral; Depressão Central; Encosta do Sudeste; Serra do Sudeste; Campanha; Missões; Alto Uruguai; Planalto Médio; Encosta Inferior do Nordeste; Encosta Superior do Nordeste e Campos de Cima da Serra (Coast, Central Depression, the Southeast Slope; Southeaster's Sierra Camps, Missions, Upper Uruguay; Medium Plateau; Lower Northeast Slope; Upper Northeast Slope and Upper Sierra Fields). The State can also be divided into 10 phytoecological regions, in regard to the vegetation: Floresta Ombrófila Densa (Floresta Atlântica); Floresta Ombrófila Mista (Floresta de Araucária); Floresta Estacional Semidecidual (Floresta Subcaducifólia); Floresta Estacional Decidual (Floresta Caducifólia); Savana (Cerrado e Campo); Estepe (Campanha Gaúcha); Áreas das Formações Pioneiras de Influência Marinha (Restingas e Dunas); Área de Tensão Ecológica (contatos) e Parque do Espinilho (Dense Fluvial Tropical Rain Forest Region (Atlantic Forest); Mix Fluvial Tropical Rain Forest (Araucária Forest Region); Seasoned Semideciduous forest region (Subcaduciofolia forest); Seasoned Deciduous forest region (Deciduous Forest) Savannah's Region (*Cerrado* and *Campo*), the Steppe's Region (*Campanha Gaucha*); Pioneer Formations Areas of Influence of the sea (*Restingas* and dunes); Ecological Disputed Area (contacts) and Park Espinilho).

According to the proposed aimed of the research, 10 variables were selected: From this selection, they had been grouped within four dimensions which can be checked at Table 1.

It is worth to stress that, as each of the RS municipalities have different population, in each year, it was necessary to divide each variable by the population's count each year, representing, that way, its value 'per capita', except for the urbanization rate and infant's mortality rate variables, that have been collected representing its value 'per capita'. These data were collected for the years 1996, 2001 and 2006, as it has been chosen to work with 5-year periods. It is important to emphasize that this timeframe was chosen because of the land use data provided by IFC of RS, and these were conceived to be repeated every 5 years. Then, having as central data the ones referent of year 2001 in which IFC was realized, it was chosen to work with some period before and after this time. In this timeframe, data was available for most of RS's municipalities and also covering all the variables proposed to the study, except for a few municipalities in the 1996's year, as they

Table 1. Dimensions and variables in study.

Years	Dimensions	Variables	Measurement unit	Source
1996 2001 2006	Infrastructure	Telephone lines in service	Telephone lines per habitant	CRT Brasil Telecom. CTMR Brasil Telecom (Capão do Leão, Morro Redondo, Pelotas e Turuçu).
		Electricity consumption	Electricity consumption in MWh per habitant	Electrical energy distributors of Rio Grande do Sul
		Registered vehicles	Number of vehicles per habitant	Secretaria da Justiça e da Segurança - Departamento Estadual de Trânsito.
1996 2001 2006	Demographic	Number of infants born alive	Number of infants born alive per habitant	Secretaria da Saúde/Coordenadoria de Informações em Saúde - CIS/SES-RS
		Urbanization rate	%	IBGE FEE/Núcleo de Indicadores Sociais
1996 2001 2006	Health	Infant's death coefficient	By a thousand born alive	Secretaria da Saúde/Coordenadoria de Informações em Saúde - CIS/SES-RS.
		Hospital beds – hospital in agreement with Public Health Service (SUS)	Number of hospital beds by habitant	DATASUS
1996 2001 2006	Education	Higher education enrollment	Enrollment by habitants	Instituto Nacional de Estudos e Pesquisas Educacionais
		Elementary education enrollment	Enrollment by habitants	Secretaria de Educação Instituto Nacional de Estudos e Pesquisas Educacionais
		Secondary school enrollment	Enrollment by habitants	Secretaria de Educação Instituto Nacional de Estudos e Pesquisas Educacionais

Source: Elaborated by the author (2008).

were emancipated after that year. It should be underlined that FEE collects and organize the data, that are publicize in public media.

With the support of a statistical program called Statistical Package for Social Sciences / SPSS, it was possible to work the statistical analysis. The statistical techniques used in this research are: Frequency analysis, descriptive analysis, mean, mean between groups, analysis of variance and mean comparison by testing the least significant difference - LSD (least significant difference). This study aimed to compare the groups based on land use in relation with the total area of the municipalities of RS.

In this study, a significance level of 5% was adopted in the test of comparison of means. Furthermore, the null hypothesis, H_0, the population average are equal and that the alternative hypothesis, H_1, not all population means are equal.

RESULTS AND DISCUSSION

The infrastructural dimension consists of the variables: Phone lines in service, energy consumption and registered vehicles per capita in the municipality. The number of vehicles represents the total passenger cars, freight and other, and electricity consumption represents the commercial, industrial, residential, rural, public sector and others consumption in MWh. It was found that from 1996 to 2006, there was an increase of 144.3% for the number of phone lines in service and 25.3% for electricity consumption. It should be noted that the number of municipalities existing in 1996 was 386 for the variable number of phone lines in service and in 2006 it has 496 municipalities. For the number of registered vehicles, there was an increase of 21.9% from 2001 to 2006. For energy consumption in these years, there has been an increase of 4.7 and 2.5% for the number of phone lines in service.

Demographical dimension is formed by the variables: Number of live births and rate of urbanization. From 2001 to 2006, there has been an increase of 9.0% in the rate of urbanization and a decrease of 16.0% in the number of live births. For the relation of the years 1996 to 2001, the number of live births decreased by 19.6%.

To study the health dimension, it was chosen to work with the infant mortality rate (per thousand live births) and the number of hospital beds in the municipalities. It was found an increase of 9.2% from 1996 to 2001 and a decrease of 4.5% from 2001 to 2006 for the infant mortality rate. Regarding the number of hospital beds, there has been an increase of 4.1% from 1996 to 2001.

The educational dimension was formed by the variables: Number of enrollment in higher education, elementary and secondary education. The number of enrollments in higher education refers to a center of technical education, university center, integrated colleges, colleges and universities. The number of enrollments in elementary and secondary school refers to federal, state, municipal and private schools. It was noted that enrollment in primary education decreased 14.4% from 1996 to 2006; and enrollment in secondary education increased by 36.9% in those years. It is noteworthy that within the years 1996 to 2001 there has been an increase of 42.6% in secondary school enrollment and a decrease of 5.1% in elementary school. Note that, in general, the variable number of enrollments in basic education is reduced, causing a decrease of 14.4% from 1996 to 2006.

The focus groups were formed according to the forestation area in relation to the total area of the municipalities. Thus, group 1 consisted of 93 municipalities that have no forest area. Group 2 has 219 municipalities with areas smaller than 1% compared to the total area of the municipality, group 3 has 85 municipalities with an area bigger than 1% and smaller than 5% of forestation, group 4 has 21 municipalities with areas larger than 5% and smaller than 10% of forestation and group 5 has 9 municipalities with an area greater than 10% of forestation in relation to the total area. It should be noted that 69 municipalities did not obtain data on its total area and even areas of forestry.

It was verified that the mean of groups 1 and 3 were significantly different at 5%. Group 1 consists of municipalities that have no area of forestry, and group 3 are those that have an area greater than 1% and smaller than 5%. It was observed that in the municipalities of group 3, the mean is higher, showing that they have a high number of phone lines per inhabitant. The same occurs between group 2 and 3, while group 2 has an area of forestation smaller than 1% and an average of telephone terminals below the group 3. There has been also a significantly difference between group 3 and groups 4 and 5. The municipalities of groups 4 and 5 have a larger area of forests, but a lower average number of telephone terminals, especially group 5. Those are the municipallities with an area greater than 10% of forestation and with the lower phone lines per inhabitant mean.

Thus, it was observed that from an increase in the total planted forest area of the municipality, this tends to reduce the amount of phone lines available to the public. According to such findings, it can be said that an increase in planted forest area above certain level is not beneficial to the municipalities. In this case, only one variable was observed, however there are numerous other factors that may interfere with the economic development of these municipalities, as verified in theory.

It was observed that group 3 was significantly different from groups 1 and 2 for the years 1996 and 2001 and differs in the year 2006, from the group 2. Group 3 has the highest average consumption of electricity, as there has been an increase of the forestation area, but from the moment that this becomes more than 5% of the municipal area, it occurs a lower mean between groups. Thus, it appears that forestation benefits the development of municipalities, but not when it represents an excessive activity.

According to the evolution of the group means related to the variable energy consumption for the years 1996, 2001 and 2006, there is a growing trend up to group 3 for the years 1996 and 2001 and then a decrease up to the group 5. In the year 2006 there is an increase in the mean up to group 4 and a reduction in group 5, the one which presents a higher percentage of forestry.

There was a significant difference in the means of registered vehicles variable, in 2001 and 2006, in groups 3 and 5. In 2006, there was a difference between group 1 and groups 4 and 5. The distinction between these groups refers to the fact that group 1 has a higher mean and no forestry activity in the municipality and that group 5 has a lower mean, with the highest rate of forestation in relation to the total area of the municipality.

According to the average number of registered vehicles, it noticed a relation between the decrease in the mean between groups and an increase in forestry activity in the municipalities studied. This fact explains that to a certain point, the forestry activity brings improvements to the development of the municipality but, as soon as this activity tends to occupy a larger area for the city's total area, it offers a reduction of this variable.

According to the variable live births, the mean between the groups did not differ significantly. However, it was found that in 2001, as the area in forestry increases, the average number of live births in the municipality increases also. In the years 1996 and 2006, this fact did not occurred, and specifically in 2006 there was an oscillation between the groups, causing a reduction and elevation between one group and the group, but it should be noted that, as forestation increased, there is increased also in the average of live births in the municipality.

Compared with the results of the rate of urbanization variable, the study highlights a significant difference between groups 1 and 3 for the year 2001 and a difference in Group 2 and Group 3 for the years 2001 and 2006. Group 3 has a higher mean compared to other groups, with smaller or larger area in forestry.

It is worth noting that as the forestation area increases, there is a reduction in the rate of urbanization mean of the municipalities studied. Thus, forestation provides better indicators of urbanization, unless it is at high levels of activity.

Considering the infant death variable, it has been found that there is not a significant level among the group of study. Group 4, which has a forestry area bigger than 5% and smaller than 10% of its territory, shows the lower mean amongst the groups. In this case, the forestry activity brought benefits to the municipality, as there is a low rate of infants death.

It noted a discrepancy between the studied years and the infant's death rate had been variable. In 1996, group 5 was the one with the largest area with forestation and with the highest rates of infant's death. But in 2001, this group shows the lowest rate of infant's death. It should be noted that in 2001, as the forestation area gets larger in the municipality, there is a decrease in the mean between groups, the group with the larger area with forestation has the lower rate of infant's death. In 2006, an increase in the forestation area and a decrease in the infant's death coefficient mean up to a certain point occurred, which is characterized as group 4 and after that an increase.

The means related to the number of hospital beds within the groups studied did not differ significantly in the years 1996 and 2001. Although there has been noted a lower mean for the groups with smaller forestation areas, this activity at the municipalities studied did not provide an improvement in the hospital beds indicator; there is a reduced number of beds per habitant in the municipalities that have larger forestation areas.

The group with smaller area of forestation shows the highest mean of hospital beds. So, group 1, with 0% of forestation area shows a mean of 0.005336 per habitant and group 5, with an area of forestation larger than 10%, shows a mean per habitant of 0.003190 for the year 1996. Besides that, in the year 2001, the same fact occurred: The group with smaller area of forestation shows a higher mean of hospital beds per habitant, and the group with larger area of forestation has the lowest mean.

Based on the results, it is noticed that group 5 differs significantly from group 1, group 2 and group 3 in the year 1996. Also, it was noticed that there was not significant variations for the other studied years. It should be stressed that group 5 is the one with larger forestation area and lowest mean in the number of enrollments in elementary school per habitant.

As verified about the number of enrollments in elementary school, there was a crescent increase in the groups mean. This way, as the forestation area gets larger, the enrollments in elementary school also increases. It represents, in municipalities with forestry activity, an increase in the scholarly level of population.

However, there has been noticed that in the years 2001 and 2006, group 3 showed a decreased in the mean. This Group is formed by the municipalities with area larger than 1% and smaller than 5% in forestation.

For the variable enrollment in secondary school, there has been noticed a significant difference between groups 1 and 4 for the years studied and also a significant difference in the year 2006 between groups 1 and 2, and between groups 2 and 4. This difference shows that the group with higher mean of enrollments is the one with 0% of forestry activity and that the group with forestation area larger than 5% and smaller than 10% of forestry activities have a lower mean for enrollment in secondary school, amongst the groups studied.

In an opposite situation to the one presented regarding the enrollments in elementary school, there has been verified that for the number of enrollments in secondary school, there is a decrease in the means for the groups 1, 2, 3 and 4, respectively. As the area of forestation increases in the municipality, the number of enrollments in secondary school decreases, indicating that in the municipalities with forestry activity, there is a reduction of scholarly level of the population.

However, the group 5, which is formed by municipallities with more than 10% of their territory occupied by forestry activities, shows an increase in the mean, in other words, the population has a higher scholarly level than those of municipalities with small or not any areas of forestry activities.

According to the results presented, forestry activity provides benefits to the socio-economic indicators up to a certain level of land use of the municipality for forestation activities.

Conclusion

This article was intended to understand how changes in land use, derived from forestation influence some of the social indicators in the municipalities of RS.

Based on the results presented, group 3 was the one which presented the better performance in means. This is an intermediary group in the sample with relation to the proportion of the municipalities' area with forestry activity. Thus, the observation of different variables that showed a better performance, indicate that forestry provides a higher development for the municipalities, but from a moment that the forestation area increase, municipalities tend to have lower performance.

Among the variables that showed better performance in a larger area of forestation in the municipality are: The number of live births and the number of enrollments in elementary school.

The variables that perform best in municipalities that have no forestry activities are the infant mortality rate, the number of hospital beds and the number of enrollment in secondary school.

Finally, it appears that forestry activities can stimulate local economies, helping to diversify production, adding income and improving social indicators, but only to some extent. After a certain forestation level, the indicators start to deteriorate because of the greater activity concentration. It has been noticed that, in general, the indicators improve from group 1 to 3, and then start to worsen until the group 5. Therefore, the activity must be regulated with well-defined limits, according to the ability of areas to avoid excessive change in land use and thus the worsening of the indicators.

Therefore, it is concluded that forestry can result in better socio-economic indicators to some extent, but as it grows a lot to share in the municipal forestry indicators worsen again. The main limitation of the research refers to the lack of some data, not available in the database, since not all municipalities had them, as many were emancipated after the year, 1996. Thus, there was a change in the size of the research sample.

It is recommended the use of other indicators to better analyze the impacts caused by land use and analyze all Brazilian states so the results from the municipalities could be compared from one state to another.

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