ELEMENTS for PERIURBAN DYNAMICS

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ABSTRACT

Rapidly growing cities cause inadequate transformation in the use of land. Government policies tend to be obsolete shortly after implementation, supply of basic services becomes insufficient and expensive, and food prices tend to increase. All these factors are certainly the case in many developing countries where large amounts of population often migrate to settle down, sometimes in dangerous or unhealthy locations, but other times in areas suitable for agricultural purposes in the periphery of the city.

The land surrounding the metropolis enters a transitional stage. The territory becomes uneconomical for rural exploitation, but it requires to be supplied with basic services for urban housing. The System Dynamics approach is then appropriate to study and plan these unstable systems.

This paper presents a model to assess the growth of peripheral districts of the city. It is a useful aid for policy making in land use issues and a good tool for planning basic services such as health, schooling, transport and recreation.

A simulation is carried out for the Periurban District of El Corazon in Medellin, Colombia. A good approximation between historical data and model results can be appreciated. Some scenarios of future growth are explored and the consequence of land-use policies are confronted.

1. INTRODUCTION

Since the appearance of Urban Dynamics by Forrester (1969) an important amount of literature has been produced on the topic. Nevertheless, many aspects related to city life remain to be studied. In particular, the dynamics of the periphery is of major interest because of the transformation that takes place in the use of land, affecting population welfare.

Large cities in developing countries continue to grow fast, altering the environment, breaking the preexisting equilibrium, and transforming social conditions. Often the situation turns dramatic as population settles down on steep eroded hillsides, in the neighborhood of contaminated land, or in flooded areas, threatening human life. Planning the periphery is then of major importance for local governments as there is need to make adequate use of the territory, reserving land for transport, recreation, education and other vital services for the community.

In many countries some research has been done on the topic and legislation has been implemented, but not all that much has been accomplished. In Latin American cities this is partly due to inappropriate research techniques and lack of political will. Planning is frequently based on mental models because of difficulties arising in dealing with systems in transitional stages. Furthermore, it is not always easy to include in planning models changes in policies due to political pressures of a particular person or social group.

The areas surrounding the cities may be used for housing, community services, industry and/or commerce and often for only one of these purposes. This paper deals with some aspects of Periurban Dynamics involving housing and some services, while currently there is work being carried out considering commerce.

In what follows, apart from the peripheral territories of the city, which may be urban or rural, there are references to neighborhood areas (urban or rural) belonging to nearby cities.

2. The Model

The price of urban land determines occupancy patterns, but as less expensive territories become attractive their cost tend to increase.

Figure 1 shows the likely land market behavior, as illustrated by Palacios (1985), where the price function is high in central areas and decreases with distance, but in the border of the periphery of the city the slope of the function does not follow the previous tendency, as can be observed, because of surplus value expectations due to possible future uses. This theoretical scheme is partially supported by preliminary research with actual data, although in some cases more variables are needed to explain land price behavior.

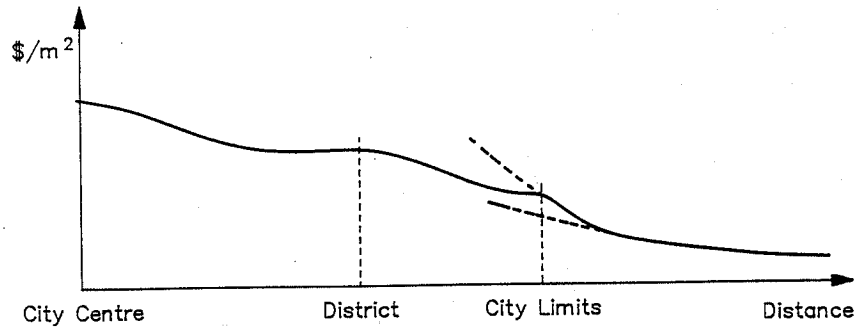

Figure 1. Likely land price as function of distance from the city centre.

The dynamics of urban land use may be typified by the findings in the city of Medellin, Colombia, where as may be observed in Figure 2 the proportion of land occupied in the city centre grows exponentially up to a point near saturation, then migration levels tend to decrease and in consequence the territory is occupied less rapidly, according to an asymptotic behavior. Also, as the centre becomes crowded, the demand for land is transferred to other areas located farther away. In this manner new centres are created with similar behavior as the previous ones.

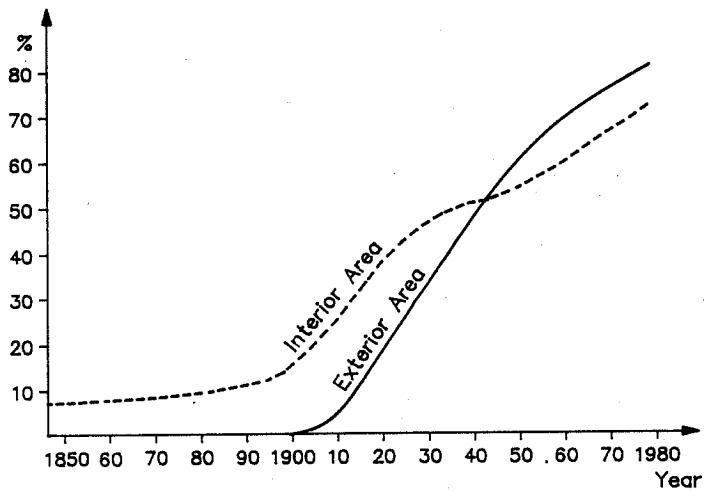

Figure 2. The function Interior Area represents the urban land portion of the total land available, within an area surrounding the city centre (Medellin, Colombia), in a particular year. The function Exterior Area represents the urban land portion, being used outside the city centre, of the total urban land in a particular year. (From Dyner (1987)).

The model described in this section is appropriate when the periurban areas being studied use the territory for housing and some community services such as schooling, health, recreation and transport. Also in the rural areas, there is consideration for land used for farming purposes.

The model is a further development of the one presented in Dyner (1987). Population needed to be desaggregated in order to take into account detailed uses of land and to incorporate variables subject to control in the planning exercise.

Figure 3 shows the cause-effect structure of aggregate variables. The three major areas involved (urban, rural and neighborhood) are being affected by the human requirements for urban and rural living. As land is saturated, territories are incorporated with consequences in migration levels.

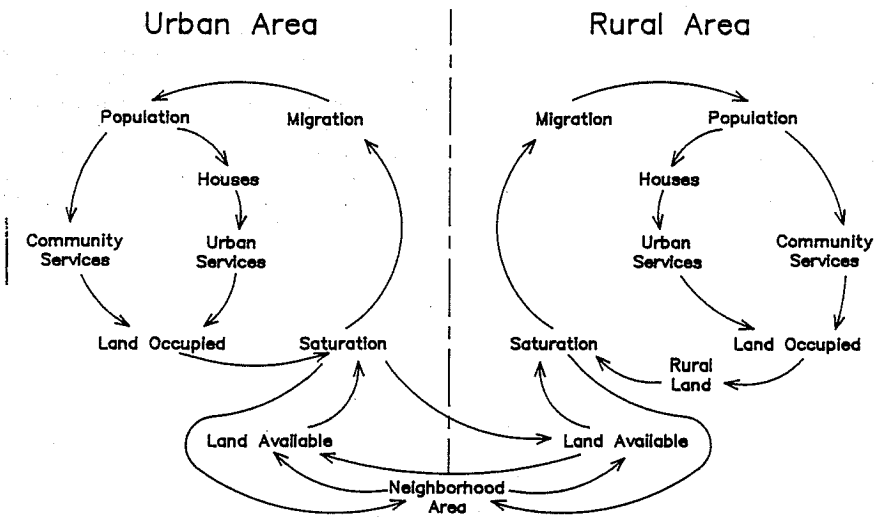

Figure 3. Cause-effect model.

Local government policies are accounted for in the model in terms of rules of land use for housing, recreation, transport, health, education, reforestation, and farming.

National and regional government policies are also included in the model, as is the case with birth control incentives.

3. RESULTS

Table 1 shows a good approximation between the results supplied by the model and historical data. Although the series are short, there is evidence that the model takes into account the dynamic elements of the variables, even with such limited population.

YEAR	POPULATION			HOUSES		
	MODEL	HISTORY	DIFF.(%)	MODEL	HISTORY	DIFF.(%)
1982	3354	3354	0.00	506	506	0.00
1983	3406	3368	0.01	561	506	0.10
1984	3460	3344	0.03	596	612	0.03
1985	3509	3597	0.00	622	630	-0.01
1986	3569	3758	-0.05	645	688	0.06
1987	3625	3810	-0.05	680	689	0.01

Table 1. Model results, historical data and percentage differences.

Figure 4 exhibits two scenarios of land use. The non-decreasing functions represent the evolution of land use for urban purposes, while the decaying functions show the use of land for rural purposes. The higher scenario is based on actual tendencies, and the lower one assumes success in birth control policies and a further reduction of living spaces. It can be observed that saturation (given by the inflexion in the functions) begins to take place about the year two thousand in the base case, while in the other scenario this effect can be delayed for about five years.

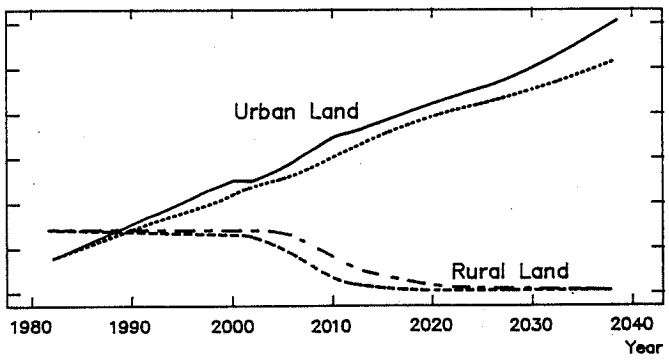

Figure 4. Scenarios of urban and rural land used.

Figure 5 shows the evolution of urban and rural areas for housing, recreation, schooling and farming. As population grow steadily new spaces are needed for housing and recreation, nevertheless the areas required for education increase less rapidly than for housing due to a fairly low birth rate. On the other hand, while necessities for recreation only increase marginally, the rural areas decrease constantly up to a point of elimination.

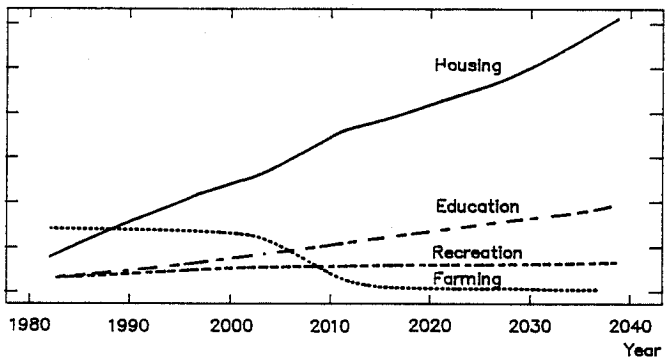

Figure 5. Possible scenario of land needed for Housing, Education, Recreation and Farming.

4. CONCLUSIONS

The method exhibited in this paper allows to quantify the effects of government policies through the design of scenarios and establishing their effects in land use for periurban areas.

Also, it is a good instrument for planning basic community services, as comparisons can be made between resources and requirements.

The model may be useful to dimension a district in terms of population policies, educational coverage, and facilities for health, recreation, transport and other services.

5. REFERENCES

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