Demographic growth and spatial organisation: a representation in model form of active processes in the Bolívar province of Ecuador

Croissance démographique et organisation de l'espace : essai de modélisation des processus actifs dans la province de Bolivar en Equateur

Crecimiento demográfico y organización del espacio: ensayo de modelización de los procesos activos en la Provincia de Bolívar, Ecuador

Michel Pouyllau, Yves Poinsot and Fabien Pouille

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Introduction

1 Since the increase in population which occurred in Ecuador between the end of the last century and the 1950s, we observe a series of spatial reorganisations, coupled with a considerable increase in the pressure on natural resources. Factors such as high local densities, migration towards the low-lying lands, the emergence of socio-economic models linked specifically with oil revenues, coupled with an anarchic management of newly emerging networks and the return of the indian communities into the more remote regions have all contributed to a transformation of the mountain areas, which very much calls into question the future of these environments and the societies which occupy them.

2 Since the the end of the 1960s, despite agrarian reforms begun in 1964, there has been a large increase in demographic pressure in some parts of the Ecuadorian Andes (mainly in the Interandean valley but also on some of the outer slopes). Intensified cropping systems and the opening up of new areas for colonisation have triggered or accelerated processes of erosion and/or the impoverishment of the soil's agronomic potential, which in the long term represents a serious rural crisis. In this evolving context there is a clear differentiation between the behaviour of the rural indian societies and their mestizo
counterparts. There is a very deep divide between the two groups, not only in the management methods used in relation to potential production (types of production, crop systems, land systems, etc.) but also in strategies for resource diversification, which are based on quite distinct migratory practices.

With a view to understanding the complexity of the mechanisms involved in this difficult situation, the research programme "Mountain slopes" (the combined responsibility of REGARDS CNRS-ORSTOM and the University Michel de Montaigne-Bordeaux 3), which has published this paper, determined to understand the effects of this demographic growth on management methods in these societies which were so different culturally. In order to do this, it was decided that the question be approached from two distinct directions. The first consisted of an analysis of social responses to demographic growth, based for the most part on the diversification of resource systems and in particular on migration strategies. The second, in contrast, was based on measuring the agro-ecological consequences of these transformations, through a detailed analysis of the use made of the "land" resource, not only in its physico-chemical dimension but also as an element of the production systems undergoing transformation, among both the mestizo and the indian populations. This paper deals mainly with the former approach.

As the aim of this study is a fairly detailed analysis of processes involved, we decided to focus on a limited area, where indian and mestizo societies coexist in similar hillside areas and where the processes under consideration have been manifest for some time: the Guaranda basin in the Bolívar province (Figure 1, general map). This region is situated on the first external slopes of the western Cordillera, close to the Chimborazo massif, midway between the Interandean valley and the pediment of the Costa. From a multi-scale perspective, it can be considered as representative of an intermediate level, midway between Ecuador as a whole and the basic community system unit.
The results presented here are incomplete (the study is still in progress) but we feel they are of interest when presented using chromatic cartography on three distinct scales. This also enables us to demonstrate how the principal migratory processes obey many determinants, present both in the "source" area and in the "goal" area; they are also directed (or guided) by geographical factors which are active on many levels, from the cities of the Andes or the coastal areas representing modernity, to the different ecological aspects of newly colonised land, the Costa (Pacific region) and the Oriente (Amazon region), and by factors at the level of a single hill slope, inherited from the "vertical archipelago" identified by J. Murra in pre-Colombian societies.

**Bolívar province in relation to Ecuador as a whole:**
**which territorial models and which scales should be used**

In order to identify the functional structures of the region contained in the Bolívar province, to explain them and forecast developments, a systems model needs to be produced, such as that defined by Brunet R. et alii (1992): "The structure of the system should enable us ... to identify elements, fluxes and retroactions". The ultimate stage of forecasting developments in the system is not undertaken in this paper.

The organisational model of bipolar Ecuador is not shown here: the reader is referred to Deler J.P., 1991 (Géographie Universelle, chapter on Ecuador, p. 269). Briefly, between the towns of the Interandean valley, such as Ambato, and those of the pediment, such as Santo Domingo de los Colorados, or even Babahoyo, the Guaranda basin, by virtue of its current marginalisation does not fit in anywhere. We do know, however, that throughout history, the Corregimiento of Chimbo and Guaranda have played an important role as staging posts, as the road running through them was the shortest route between Quito and Guayaquil. The only major changes that might be introduced since Deler's model in 1981 are the emergence of the main Quito-Santo Domingo de los Colorados-Guayaquil axis (in favour of the former Quito-Cuenca-Guayaquil axis); also a secondary axis from Lake Agrio (oil from the Oriente region) to Quito and Esmeraldas (refinery), and of course we add the Guaranda basin, torn between the Quito and Guayaquil areas of influence. Migrants from Bolívar province tend to strengthen the Guayaquil-Santo Domingo de los Colorados axis, as their migration dynamics take them the whole length of the Costa pediment. The model is based on five chorotypes to which we shall refer: Andes effect; highlands/lowlands relationship; movement towards the coastal areas and closure in the east; central nucleus and peripheries; bipolarity and polarisations (figure 2: land occupation in Ecuador in 1993 and the relationship between Bolívar province and the rest of the country).
The balance between overpopulation and migration: the Guaranda basin in Bolívar province

The terracing observed in the region is typical. In the páramos, even though the prevailing agro-climatic conditions restrict human settlement and vegetation considerably, some marginal crops (potatoes) can usually be found around the edges at lower altitudes (at about 3,600 to 3,800 metres), and these are gradually replaced by extensive livestock rearing. Recent volcanic deposits of ash, lava and lahar render the soil here virtually sterile. Rising above the páramo, the peaks of volcanoes crown the Cordillera; in the region studied lies the highest mountain in Ecuador, Chimborazo (6,310 m).

The inland basins on the outer mountain slopes, like the Guaranda, drain into the Pacific. They are more humid than those in the central Interandean valley. On the basin slopes between 3,200 and 3,600 m, sometimes as high as 4,000 m, are the mountain cropping systems: barley, beans, potatoes are rotated in a patchwork of regular plots, giving a landscape of open farm land. This is the area inhabited by the Indian peasant communities, scattered across many small hamlets of only a few houses at the edges of the large haciendas which concentrate on cattle or mechanised potato cultivation in the northern part of the Guaranda basin and in the extreme south.

Between about 2,300 and 3,200 m is the mid-level terracing of the basin floor, the area of the small landholdings (minifundios) with maize crops predominantly (dry maize, fresh maize, wheat, beans), which often represent more than 50%, or even as much as 70% of the area given over to annual crops. There has also been a degree of specialisation into other areas, as urban markets in the towns of the Interandean valley have developed. In a central position, among the basins or further upstream, high quality dairy farming is practised in modernised haciendas on artificially irrigated fields. Everywhere, the landscape is predominantly thickets with large hedges of eucalyptus or lecheros.
(Euphorbia laurifolia); there are large rural townships which provide a network of weekly markets, and an extraordinarily dense scattering of rural houses.

The last level is the most deeply entrenched part of the basin, or the area into which the valleys or the lowest parts of the external slopes cut most deeply, near where they drop away from the mountainous massif close to the Pacific: in the Bolívar province this is the drop towards the Babahoyo pediment, the Echeandia region, or the valley of the Chimbo river near the small town of Chillanes. The slopes have to a large extent been cleared by peasants from the Sierra (see the example of Llullundongo in: Pomeroy C., 1988), but it is only areas which slope gently or valley floors which are farmed; these warm areas have long been used for sugar cane, cultivated in the large haciendas, but now it is not unusual to see orchards of citrus fruit or avocados, or even market garden crops, made possible because of the large increase in population, which thus provides an abundant labour supply.

Demographic regulation and migration strategies

For a better understanding of land occupation in the Bolívar province, we shall first look at strategies established by the farmers. In order to do this, we shall demonstrate the existence of migration on a large-scale, both inter- and intra- province, seasonal and permanent, and this will clarify the strategies of the farmers which we will then describe.

Regulation of demographic pressure through migration

The first remarkable phenomenon to note is the very low population growth in the province over the last 40 years. There was a clear reduction in growth at the beginning of the 1970s and since then until the last census in 1990 the population has remained virtually static.

The hypothesis of a natural zero growth rate is to be rejected, given the fertility rates. In fact, Bolívar province is definitely behind the other provinces in its demographic transition, with an average of approximately 6.5 children per woman in the middle of the 1980s, whereas the average for all the Sierra provinces combined was less than 5 and for the Costa provinces only 4. The isolation of the Bolívar province and its slow development in relation to the rest of the country provide an explanation for these high rates: only in the Amazon regions are higher rates to be found. Given that the average life expectancy is more than 60 years, population increase, far from being a negative figure should in fact be fairly high.

Analysis of demographic data at the level of the parish, the smallest administrative unit, reveals several disparities within the Province. Many parishes have experienced a net loss of inhabitants. Over the period 1974/1990, in only 10 out of 26 parishes has the population increased. An initial group of parishes are at a high altitude in the valley of the river Chimbo, along the main road axis of the province which links the Sierra with the Costa. They have large administrative centres where local government and other bodies generate employment. A second group consists of parishes where all or virtually all of the population lives on the western pediment. We can thus suggest right away that the main road has a stabilising effect on the dynamics of the population, and that the difference in altitude also has a role to play. As the relief of the country does play an important part in Ecuador, it is vital to consider land use by the populations according to altitude. First of
all, the administrative division of the province is very revealing. Only 7 of the Province's 26 parishes are situated at an altitude lower than 2,000 m, in an area which is two thirds of the Province's total surface area. Between 2,000 and 3,000 m, at the level of the Interandean basin floor and enclosed by the lower slopes to the north and the east, there are 16 parishes in a sector where the vast majority of the population are mestizos. Above 3,000 m, there are 3 parishes where the population consists for the very large majority of indians. However, because of wide topographical variations, these populations may still own land in the lower zones, where maize and wheat cultivation predominate.

Moreover, the parishes situated below 2,000 m, those on the external slopes and on the pediment, do not cover the area uniformly and there was thus a gap on the upper and middle slopes, with no administrative centre located between 1,500 and 2,000 m in 1974 yet 5 administrative centres below 1,000 m. A study of the distribution of parish administrative centres according to altitude is interesting in that it mirrors the land occupation confirmed by census returns at parish level. In our study, we have assumed that the entire population of a parish lived in the administrative centre. Although there is a degree of uncertainty here, this distribution according to altitude does reflect a population distribution where inhabitants live for the most part in the administrative centre of their parish or very close by, and the scale of 1,000 m selected for our diagrams absorbs these inaccuracies. The numbers of inhabitants according to altitude between 1974 and 1990 indicate a decrease in the Interandean basin, yet a considerable increase on the pediment. On the middle and upper slopes, although these are still relatively sparsely populated, the rate of population increase is fairly high. The populations of the highest parishes in the Province, which consist mainly of indians, appear to have remained steadier than those on the lower level, which are occupied mainly by mestizos.

This general state of stagnation in population increase in the province as a whole and the decreases in population observed in many parishes would suggest that there is a high rate of migration, with different strategies according to the altitude and the ethnic composition of the populations. In order to confirm the existence of these migrations and to reveal these different strategies, we compared populations counted at the census with the numbers who should "logically" be present. This calculation was carried out as follows:

Logically present population = population as censed in 1974 + (birth(i) - death(i))

The difference between the population at the census and the population we calculated indicates population movement. If the difference is negative, this indicates emigration, if positive, then there is immigration.

In 1990, we noted considerable population "deficits" in most cases, with as few as 64 per 100 of the 1974 population present in the parish of Las Navas in the north-west of the Province. To this must be added the exception of Echeandia, on the pediment, with a net gain of 15 per 100. It is, in fact, in this part of the Province that we found the smallest population deficits, in the parishes of Calumna (0 per 100) and San José del Tambo (-3 per 100). These parishes were occupied only recently, as we shall see below, by inhabitants of parishes in the Sierra. Thus from these results, we observe a massive immigration of the populations of the Sierra both towards the exterior and also into the parishes in the warmer areas of the Province.
Migration strategies and their aims

However, although migration is widespread amongst the farmers of Bolívar province, it can take various forms, depending on the farmer's financial position and the land at his disposal, as well as his aim in taking this step. The aims behind migration can be divided into two main types: agricultural and non-agricultural.

The former represent a farmer's conscious decision to continue his activity, and pass on his capital and productive capacity to his children. This type of migration can be achieved by rural-rural migration (colonising new land, for instance) or by seasonal migration to salaried employment which enables him to boost his income and retain his land capital so that he can continue to live in a rural area, despite the low income he derives from his farm.

The latter represent a farmer's wish not only to change activity, but also often to move to a different location. This can be achieved by definitive rural-urban migration to one of the two major cities. In Bolívar province, this type of migration is mainly undertaken by the mestizo farmers. However, such farmers, who have small or medium-sized landholdings (minifundistas or mediofundistas), have difficulty in integrating into the major towns and into the employment available there, such as construction work, which is taken by seasonal workers, who are often indians. They therefore prefer to defer migration onto their children, by practising non-definitive, yet sufficiently well-paid migrations to pay for their children's schooling, thus enabling their children to find work in town at a later date. These are seasonal or temporary rural-rural migrations to the plantations of the Costa.

Since the arrival of the Spanish, migration to the Costa has become important in Bolívar province, which until that time was populated only in the Sierra. Since the end of the 16th century, the Corregidores of the Spanish Crown have complained of the difficulty in collecting taxes because the Indians had so often left for the bodegas of Babahoyo, on the Costa. It was at the beginning of the 20th century, the time of the major cocoa boom in Ecuador, that the deforestation and colonisation of the external slopes and the pediment began, and this is confirmed by the emergence of a number of cases of death from malaria in the Sierran parishes (see figure xx). This information was gathered from the registers of deaths (libros de defunciones) in those parishes where the presumed cause of death was recorded. Using surnames and villages of origin, we were also able to note what a high proportion of the Indian population had spent time on the pediment. The number of women and children who died from this illness shows that the migrations were a family affair. We suppose that these groups of Indians were sent by the large land-owners to clear the land in the hot areas and set up a plantation. These two-way movements and colonisation had increased considerably by 1910, the time when frontier villages such as Echeandia were being established on the pediment. The development of antimalarial treatments and the decrease in malaria in these regions after deforestation reduced the number of cases in the Sierra at the beginning of the 1950s. The middle slope was also colonised for the production of sugar cane, used in the manufacture of aguardiente — illegal at the time— which men carried up to Guaranda on their backs. During the first period of colonial development, until the 1970s, settlers often retained their land in the Sierra, as even today its value can be five times higher than that of land on the pediment. This also enabled them to take advantage of the different ecological levels of the land. The majority of these settlers subsequently sold their land, wanting to make a clean break
from the Sierra. This archipelago-style of farming has developed more recently in the south of the Province. Those in a more precarious situation in the Sierra, that is those with less land, continued to migrate only seasonally to agricultural work offered on the large plantations which was better paid than in the Sierra (such differences in pay still exist today for the rice and soya crops).

26 The colonisation of new land took on different forms according to the socio-ethnic origin of the farmer. In the case of Indian communities, progression was along the surface, gradually pushing back the boundary of the communal land along the hillside. Settlements tended to be of an archipelago type for the mestizo populations and for natives who had become dissociated from their communities. Land purchase depended on their available funds.

27 Farming the land on the slopes and on the pediment may be considered as a motivating force for the Bolívar farmer. For those who had purchased land using profits from the sale of tropical produce, land speculation became normal practice. Migrations then tended to be southwards as new land was acquired along the pediment and the original plots were sold off. Many Bolívar farmers thus acquired land in the Santo Domingo de los Colorado's region, which had the advantage of opening up the Guayaquil and Quito markets.

28 In the middle of the 1960s, and on a much larger scale again in the middle of the 1970s (as a result of the oil industry), the opening up of new frontiers in the Amazon region was a particularly attractive proposition for these "mobile" farmers. The body responsible for allocating land (I.E.R.A.C.) offered 50 ha along the main communication axes (river or road) to whoever would clear them. As well as their willingness to be mobile, these farmers, who had already lived in the hot climate of the western pediment, were well able to determine whether the land was suitable for the production of cocoa-beans, coffee and bananas and knew the market for these crops. Thus many anticipated the measures to be taken by the I.E.R.A.C. and obtained land titles free, thus enabling them to sell land that they had not purchased. Farmers from this first wave of settlers who are still in Oriente now belong to the well-to-do population of the towns that have grown up along the eastern pediment (shops, wholesale buying and selling of agricultural produce, etc.). Nowadays, children's schooling is a priority and agricultural production has been neglected. Although initially, the aim of migration was agricultural, it is now turning towards integration into the urban world of the mestizo population. Some individuals, who still have their land in the Bolívar Sierra, leave a family member to farm it in their absence and return there in their old age. It should be noted that all the Bolívar inhabitants surveyed have possessed land on the slopes or the western pediment of Bolívar province at one time or another, which confirms the hypothesis of a movement being set in motion with the Sierra/slopes migration.

29 To sum up, definitive inter-province migration is the rule for the mestizo population, and this appears to regulate demographic pressure. Those who were most mobile, and who were in the most favorable situation to begin with, have been able to continue farming in the different settlement areas. For the others, seasonal migration to the Costa enabled them to give up farming, or at least ensure that their children would not have to become farmers. For the Indians, who are very much attached to the land and thus had the opposite aim, the apparent demographic stability suggests major changes in the land system in the upper part of the Bolívar province. One is the "indigenisation" of the Sierra, which has yet to be measured. The consequences of these agricultural strategies naturally
have repercussions on production systems and their impact on the environment. For example, as income from farming often represents less than 50% of a farmer’s total income, he will limit investment in the farm, which will lead in turn to low productivity and a deterioration in the soil.

**Chorotype of Bolívar province**

The reference grid of the model of Bolívar province in relation to Ecuador as a whole, is based around three environments: the physical environment itself, which plays a major role in the structuring of bipolar Ecuador; social organisation, with the opposition between haciendas-mestizo-indian systems, and fluxes. The chorotype of Bolívar province is based on five choremes, representing five territorial models (see Figure 3: Chorotype of Bolívar province).

**Figure 3**

The altitude gradient represents the sole basis for the primary **aureolar model**. It shows the major divisions according to altitude: the páramos and the Chimborazo volcano, the upper part of the internal basins and the mid-level of the basin floors. The hydrographic openings, via deep gorges, do not play a vital role in inter-basin communication as exchanges tend rather to take place via the passes and flatlands of the páramos; these openings are not therefore included in the model.

**Differential land allocation follows a traditional centre-periphery model**, with a complex socio-cultural association of "mestizo and Creole" at the centre of the chorotype, and modes of production such as haciendas and/or agriculture on the basin floors which are predominantly mestizo. At the first part of the periphery, we noted progress in productivist-type agriculture (mainly mestizo) to the detriment of land which was
traditionally Indian. Around their community, the Indians subdivide their minifundios into extremely small plots. Conflicts may arise when rural mestizo villages are juxtaposed with Indian communities and haciendas, as in the Chillanes region (at the bottom of the chorotye). The páramo is in the process of being purchased, as a result of the pressure of Indian communities being pushed back to the uplands.

The distribution of the inhabited areas follows a partially assymetrical orbital model. The town of Guaranda, colonial in origin, which occupies the centre, and the second circle of Indian communities, follow regular orbital rules, but the first circle of rural mestizo villages (San Miguel, San José de Chimbo, San Simon, Chillanes, etc.) is somewhat asymmetrical, with an outcrop towards the south. This could correspond to environments downstream from the basin which are more favourable from an ecological point of view (warmer lands), but it could also be due to historical reasons: the pole of attraction for Corregimiento de Chimbo was nearer San José de Chimbo rather than Guaranda. The towns outside the basin, Riobamba, Babahoyo, and the cities of Quito and Guayaquil, are on an isotropic model.

The topography of the outer slopes plays a role, though not a vital one, in the upstream-downstream opposition. Socio-economic dynamics contribute to this model, by creating complementarities between these two geographical situations, thus contributing to the establishment of a model of dissymmetry. Altitude, which can be a very limiting agro-ecological factor, scarcely hinders the flux of exchanges, except a little in the north-east quadrant, where the Chimborazo massif is located. On either side of this barrier, there are easily crossed passes which promote contact with the north (Ambato and Quito) and the east (Riobamba). In the western half, there are many openings into the pediment and the Costa, which tend to obey the rules of posterior surface extension like the pioneer fronts (even though these were originally linear, along the roads), rather than truly linear extension. The south of the model, although it is a hydrographic outlet, contrasts with its downstream section due to the very steep slopes and the narrowness of the Río Chimbo gorge.

The contact model illustrates the role of the province in linking Quito and Guayaquil. Two exit-entry axes seem to emerge: one is of a linear type, towards the north, the agricultural markets and the cities of the Andes (Ambato, Quito); the other is a surface type, with the pioneering settlement area of the pediment and beyond this, the Costa and Guayaquil. The entire province can be divided into three bands: the highlands between Guaranda and the páramo to where the Indian communities have been pushed back; the intermediate high ground on the northern and southern edges of the basin, where haciendas, mestizo and Indian communities co-exist, and lastly the external slopes, towards the pediment, with contemporary settlement areas.

Using this regional context we have attempted to assess the effects of these socio-spatial dynamics on the functioning of Andean societies at local level. In order to do this, the functioning of a rural area of the parish of Chillanes was analysed in more detail. This enabled us to understand the effects of demographic changes on land control strategies in an area with specific topographic-climatic features and differenciated socio-culturally in the tripartite Andean fashion: hacienda-mestizos-indians.
The localised land model: Chillanes

Although this part of the study focused on three specific areas of the Bolívar province (Pucara, San Simon and Chillanes), the spatial organisation of one particular valley, that of the river "Guayabal", covering three rural districts of the parish of Chillanes, displays most clearly the whole range of processes involved. We attempted to produce a graphic model of this region which would highlight the structures and processes mentioned here in a historical perspective, according to the different phases which have produced the spatial organisation found today (Figure 4: Model of the rural area of Chillanes).

![Figure 4: Model of rural district in Chillanes](image)

Natural data can strongly influence the distribution of cultural units. The valley of the river "Guayabal" has a dissymmetry in its slope which is structural in origin, and this explains the very steep slopes on the right bank, while the inclines on the left bank are much less accentuated. Close to the valley axis, a model of convex slopes dominated by fairly extensive shoulders forms an area which, topographically, presents few constraints.

Onto this topographical differentiation are superimposed the effects of the night frost. This occurs regularly during the dry season (June to September) and returns in December-January if there is a veranillo (short dry season which occurs some years in December-January when the southwards descent of the ICT is particularly pronounced). If there is a night frost, it has a devastating effect on the developing crops planted in October-November for harvesting in June-July. It affects land above 2,700 m on the slopes, but in the flat areas on the valley floors it can begin at 2,300-2,400 m because of the cold breezes which blow into the still and stratified air present in the dry season. Although the livestock are not troubled by this night frost (and are therefore in area 3 of the hacienda), the crops are extremely sensitive and the best position for them is on the slopes around...
the valley floor, sometimes at high altitude (2,800 m and more), where the papa (potato) is added to the crop cycles more often.

40 **The hacienda and the modernisation** it has undergone have very much affected spatial organisation in the valley. With an area of several thousand hectares (more than 50% of the entire parish!) until the agrarian reforms, the hacienda disposed of a large proportion of its landholdings in the 1960s, keeping the land on the right bank of the river and little more. The use made of this land is shown in diagram form, with a division into four unequal and overlapping areas. The orchard and the plots farmed by the employees (about ten in all) are next to the buildings (1 on the model). Land cultivated by tractor covers the gentle slopes not directly adjacent to the river, and thus out of reach of the frost (2 on the model); rotations of traditional cereals are carried out here (wheat-maize-barley) and legumes for cash crops, a sector which is developing rapidly at the moment (lentils-peas). In the modernised pastures, farmed fairly intensively, are "Holstein" dairy cows, mostly on the flat areas exposed to the frost but which are easily accessible and very fertile on the lower parts of the slopes as this soil is volcanic in origin (3 in the model). The slopes traditionally used for cereals (4 on the model) where maize and wheat are rotated, extend towards the uplands. These are farmed using jornaleros, mainly *mestizo* workers from minifundios in the vicinity, who are taken on in groups of ten for work such as ploughing and harvesting. They are paid about a dollar a day, and this exploitation means that the costs of cereal production on these upper slopes can be kept competitive in comparison with the crops from the mechanised plots at the foot of the slopes. These crops, from two completely different modes of production are destined mainly for the markets of Guaranda, but they are also sent to Quito or Guayaquil.

41 **The network of plots and their ecological variations and size differences** were fundamentally changed when the hacienda decided to sell off so much of its land in the 1960s. The mosaic of plots seen in these landscapes typifies fairly well the diversity of situations found in the Bolívar province. Whereas the hacienda (A on the model) generally has vast four-sided plots organised in a circular fashion, as described above, the mid-slopes around the larger landholdings (latifundios) (B on the model) are owned by *mestizos* who nowadays form a class of *mediofundistas*, as some have a car or a small truck. They own farms of between 5 and 10 ha, which are tended by the family, with *jornaleros* from the *mestizo* minifundios hired for major work. There is crop rotation of maize and wheat, and peas and lentils are grown as cash crops, but this represents only the visible part of their property and resource system, which is in fact fairly diversified. This land on the mid-slopes is the family's main landholding, but they often own other plots up in the steep part of the uplands closer to 2,800 m where the crop rotation is "potatoes-maize-barley" and the work is carried out by salaried workers. Yields are often poor, but the advantage is that these crops do not require much investment (labour costs less than chemical fertilizers) and the grain that is harvested is less likely to be contaminated by the *plagas* which are present lower down. The seed used in this "warm" soil therefore comes from the "cold" land, only recently cleared and thus infested with few parasites. As well as farming on the high land, many *mediofundio* farmers supplement their income by farming neighbouring subtropico land, which is often cultivated in partnership.

42 The *minifundio* *mestizos* on the right bank (C on the model) were not able to increase their landholding during the transactions of the 1960s (through lack of capital, or a form of voluntary segregation during the land sales?). Hemmed in as they are on land which is too small in area, they supplement their income by taking temporary jobs on the hacienda.
or with the mediosfundistas, or best of all, they take seasonal work down at the haciendas on the coast, where they are paid two to three times more than on the Sierra. Their children attend school in Chillanes regularly. As their plots of 0.5 to 1 ha are too small to be subdivided, the descendants of these agricultural "proletarians" will have no choice but to leave for the towns in search of work.

The indians minifundistas are in a similar situation with regard to the land. They are for the most part to be found in the steepest part of the cultivated areas (D on the model). Having arrived from Chimborazo province in the 1960s, they bought from the hacienda owner (who had often employed them as labourers) the most marginal land, in lots rarely bigger than one cuadra (0.7 ha). An indian community was thus re-formed, which forbade its members to resell land to the non-indian population, thus creating an area from which the mestizos were totally cut off. These indian minifundistas are thus marginalised not only in their spatial organisation, but in other ways too: they are restricted to the very steepest slopes (30 to 40°), they grow food crops (maize-beans-wheat) without leaving the land fallow and virtually without manure, their plots are particularly susceptible to erosion, which occurs much more frequently in this area than elsewhere. As their land capital is insufficient, supplementary income is essential. Work on the hacienda or for the mestizos would seem to be excluded, as the two cultural communities appear to ignore one another completely. They therefore resort to seasonal migration into the towns, where they are taken on as construction workers, in order that the family's resources can be diversified. There are also frequent exchanges with the Indians from Chimborazo, where these families originated. Ties of compadrazgo appear to ensure that these exchanges will continue.

We therefore observe that the spatial organisation of this rural part of Chillanes has resulted from a variety of social groups, recent history and still active dynamics. If, as we have seen to be the case, temporary migrations play a vital role in the economic survival of many families, the farms which occupy this space are actors in a spatial system which can be explained only by many different factors and logics, with no single, simple model able to account for all aspects:

- the topo-climatic diversity determines a very significant spatial pre-differenciation: the flat areas in the valley floors are not cultivated extensively, due to night frosts, whereas the slopes, although steep and at a higher altitude, are less exposed to this problem. From this difference in bio-climate, due to altitude, derives a value-based model of ecological diversity, and this is especially the case with the mestizo mediosfundio farmers.

- the spatial transformations in the hacienda over the last three decades are the result of a liberal logic taking the place of the pre-capitalist hacienda which prevailed until that time. The reduction in the area of land farmed in fact indicates a desire to intensify production processes and gain access to a national market or even export. The result has been that settlers are no longer used, and have been replaced by casual salaried workers. There is now a high degree of specialisation, especially in dairy farming (on the flat pasture land), coupled with the development of mechanisation in the production of lentils, peas and green beans, which are sent to the towns.

- the fact that farming in the mountain areas is still maintained, characterised by the fields in zone 4 of the hacienda and the high altitude plots of the mediosfundio farmers, can be explained only through an analysis borrowed from a Marxist frame of reference. Land, which is the productive capital of this rural society, is concentrated in the hands of the few, whereas the majority of the workers, minifundistas trying to cope with a large population...
increase, find that their labour cannot be used on farms which are too small. They therefore sell their labour to those who have a large land capital, but where mechanisation is impractical as the land is too steep. These employers will only give very low rates of pay, so that their cost price remains competitive in relation to the prices charged for mechanised crops. The system of under-payment inherent in this situation exists only because of the wide imbalance in the labour market between supply and demand, the result of a large population increase in a region where land availability is fixed.

• the contradictory dynamics which differentiate the mestizo minifundistas from the indians derive from a major socio-cultural contrast which splits the Ecuadorian Sierra into two opposing "ethnic groups", divided by a variety of behavioural patterns. For the mestizos, the fact that they have no land, nor any capital with which to mechanise, makes it impossible for them to see any future in farming. Using income deriving from salaried work, survival is possible but short-lived, with the only solution for the future being migration into the towns, at least for the children who have been schooled by an education system which, more than ever, is the best route to upward mobility.

45 The native indians, on the other hand, already forced out of Chimborazo by demographic pressures, aspire to recreating a rural society, if possible one which is exclusively agricultural, in new surroundings. The reason for this attachment to the land, which, it is to be feared cannot last indefinitely, can be seen in religious references which are still frequent (pachamama), but is probably also due to the fact that access to the status of "Indian citizen" is impossible in an urban society run by the Creoles.

46 Confined as they are to the most inhospitable pieces of land, deprived of any communal land in the valley, which is in the hands of the mestizos, the indians survive by working microplots of land, sometimes with little to show for it, on steep slopes exposed to surface drainage and thus to the rapid erosion of the soil, the basis of their productive capital. It is only as a result of strict social rules relating to land (forbidding the sale of a plot in the communal area to a non-indian) and probably also thanks to the financial resources that seasonal migration has brought in, coupled with strong social solidarity, that their plots (represented by arrows on the model) have gradually been extended, as land unsuitable for mechanisation has been abandoned by mestizos who have moved into the towns.

47 Although in this valley the toehold maintained by the indians remains marginal, it nevertheless reveals the depth of their cultural roots and the strength of the social ties that exist in some areas. When this is coupled with a sustained increase in population, it is easy to understand the fears of some citizens of Guaranda, who are afraid of a growing indian population throughout the country areas of Bolívar province, which has political support from various centres of power.

Conclusions

48 The province of Bolívar provides a good illustration of the migration phenomena which are affecting a large part of the Ecuadorian Sierra. The natural and sustained increase in migration dates back a long time (to the beginning of the century and it is still continuing apace), but it no longer generates any increase in population, which is now counterbalanced by a well-established and varied pattern of emigration.

49 The province falls within a specific geographical context, whose main features are:

• fairly distant from the major centres of Quito and Guayaquil,
• contact between the Sierra and the Costa, which allows many exchanges to occur (labour, produce, etc.),
• ecological diversity which generates intra-province complementarity (from the páramo to the subtropico, some individuals will always aim to gain control of several ecological levels),
• disparity in population densities which current migration is tending to make up for,
• a very marked socio-cultural duality which is revealed in contrasting strategies in relation to migration and access to resources. They are apparently leading to a gradual deterioration in the mestizo numbers in the rural areas of Bolívar province, to be replaced by a strengthening of the indian population. Some are already talking of an "indigenisation" of the Sierra, which is partly borne out by the spirited support given in 1992 to celebrations of 500 años de resistencia indígena and the series of demonstrations throughout the Sierra which followed.

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**ABSTRACTS**

The rural dynamics of the Ecuadorian Sierra are the result of the three-fold influence of demographic pressure, modes of land occupation and migration. The Bólivar province, situated on the outer slopes of the western Cordillera is of particular importance as it is a key territory in regional migration. Demographic growth, which is in fact fairly high, gives rise to a fairly low rate of population increase locally but a very high level of emigration towards the lowlands of the pediment, towards the country's major cities, Quito and Guayaquil, and also into Amazonia. When we add to this the two models of spatial organisation among the mestizos and the campesinos, we can clearly see the source of the conflict that is shaking the Sierra, namely, who should cultivate and who should control.

The study is based on three levels of analysis. First, we look at the relationship between the Bólivar province and the rest of the country. Secondly, we analyse things at a regional level and using different chorotypes. Lastly, we focus on a small valley, examining the unequal distribution of land and the diversity of resources which give rise to three distinct socio-spatial systems: hacienda, mestizos and campesinos which are represented in a hillside model.

Las dinámicas rurales de la Sierra ecuatoriana resultan de la triple influencia de la presión demográfica, de los modos de ocupación de la tierra y de los fenómenos migratorios. El caso de la Provincia de Bólivar, ubicada en los flancos exteriores de la Cordillera occidental, presenta además la originalidad de ser un territorio "clave" en las migraciones regionales. El crecimiento demográfico, bastante fuerte, se traduce a la vez por un débil crecimiento in situ pero sobretodo por una fuerte emigración hacia las tierras bajas del piedemonte, hacia las ciudades principales del país, Quito y Guayaquil, y para algunos, hacia las tierras del Oriente amazónico. Si agregamos los dos modelos de organización espacial producidos por los grupos mestizos y indígenas en la zona, tenemos reunidos las raíces del conflicto que sacude a la Sierra: el de quien cultiva y quien controla la tierra. Tres niveles de análisis son privilegiados. Primero las relaciones de la Provincia
de Bolívar con referencia al resto del país. Después al nivel regional y con diferentes corótipos. Por fin, al nivel de un pequeño valle, se hace énfasis a la desigual repartición de la tierra y la variabilidad de los recursos generando tres sistemas socio-espaciales distintos: hacienda, mestiz e indígena, los cuales son representados en un modelo de vertiente.

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AUTHORS

**MICHEL POUYLLAU**

Université de La Rochelle et UMR REGARDS CNRS-ORSTOM
pouyllau@regards.cnrs.fr, France

**YVES POINSOT**

Université de Pau et des Pays de l'Adour
poinsot@messv1.univ-pau.fr, France

**FABIEN POUILLE**

UMR REGARDS CNRS-ORSTOM, France
fabienpouille@csi.com