



Agenda 21; a form of joint environmental management in Manizales, Colombia

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SUMMARY: *This paper describes the development of Bioplan-Manizales, a local environmental action plan (LEAP) for the city of Manizales, and the different groups that contributed to its development; also, how this plan became integrated into the municipal development plan and the municipal budget. The measures taken to monitor and evaluate the social, economic and environmental effects of the environmental policy are also described and these include a series of urban environmental observatories. The paper also describes the broader national and international context for the innovations in Manizales – including the political, legislative and fiscal changes in Colombia that have encouraged local authorities to develop local environmental agendas. Manizales' own historical development is described including the environmental changes that this development brought and the environmental problems that it precipitated.*

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I. INTRODUCTION

COLOMBIA, A TROPICAL country rich in ecological and cultural diversity and facing multiple political and social conflicts, today faces the challenge of strengthening local environmental management in 1,134 municipalities, home to some 38 million people. In Colombia, following the UN Earth Summit in Rio in 1992, all the legal instruments needed to facilitate broad community participation in environmental decisions have been put in place. But the capacity for popular management that environmental decisions require has yet to be achieved. Responsibility for the environmental management of regions, municipalities and cities cannot rest solely with the state.

In Manizales, a plan for local environmental action (Bioplan), an interesting scheme of joint environmental management, is developing, linked to the principles of Agenda 21. A continuing commitment by local government and the state university to environmental research and to the sustainable development of the municipality and the region has succeeded in consolidating a programme of continuous environmental action which is addressing the social, economic and environmental problems of

this geographically complex area.

As a result of continuous leadership by the universities and the NGOs, and the ownership and commitment of the communities, the environmental policy is underpinned by a continuous investigation into the area's environmental problems and potential and broad popular participation. The public sector, the private sector and the communities have all come together in this constantly growing participative process. As a result, Bioplan's various programmes and projects are being implemented and Manizales has succeeded in improving the quality of life of its residents and in increasing the capacity for environmental management of the poorest communities.

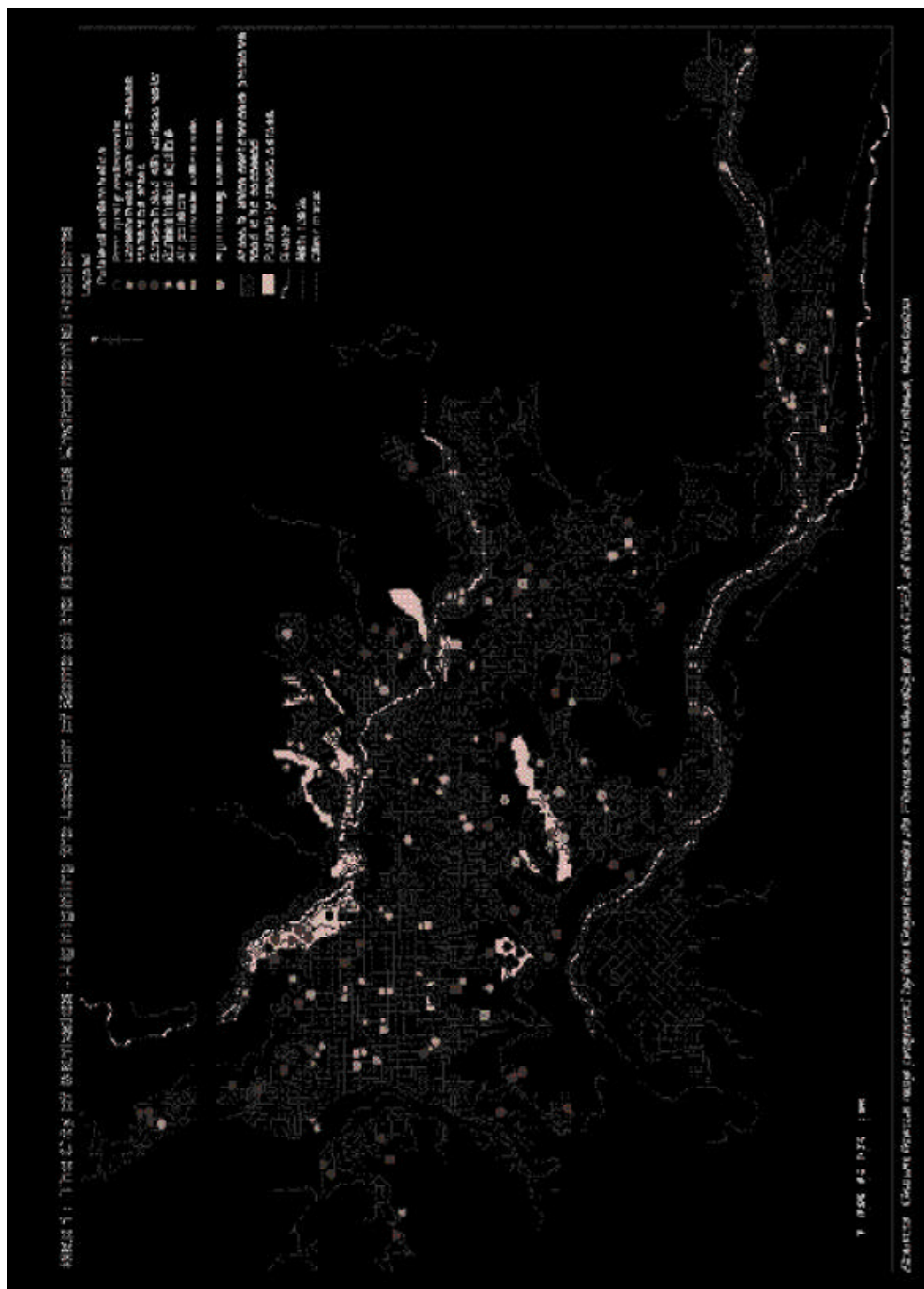
II. THE DEVELOPMENT OF THE CITY AND THE SHAPING OF ITS ENVIRONMENT

THE MUNICIPALITY OF Manizales lies in the tropical zone, to the west of the Andes, Colombia's central mountain range. Its physical geography, soil characteristics, rainfall and water resources are determined by the influence of the Cumanday massif. Among the active volcanoes of this massif, at a height of 5,400 metres above sea level, is the snow-capped volcano of the Ruiz, whose eruption (and resulting thawing of snow) in 1985 led to avalanches of stones and mud which destroyed the town of Armero and other small riverside communities where over 35,000 people lived. In Manizales and the surrounding area, this event generated a "culture of disaster prevention" which is now an integral part of the research and environmental planning programmes of the region.

By virtue of Manizales' geographical location, with marked variations in altitude, the territory of the municipality is characterized by great climatic and ecological diversity:

- moist tropical forest at 880 metres above sea level, with an average temperature of 30°C, occupying 19 per cent of the municipality's territory;
- very moist forest in the foothills at 1,500 metres above sea level, with an average temperature of 23°C, occupying 62 per cent of the municipality's territory;
- very moist forest in the mountains at 2,100 metres above sea level, with an average temperature of 18°C occupying 12 per cent of the municipality's territory; and
- very moist forest in the mountains at 3,800 metres above sea level, with an average temperature of 4°C, occupying 6 per cent of the municipality's territory.

At present, rural areas account for 397.1 square kilometres of the municipality's territory; in 1997, they had a population of 57,057 inhabitants concentrated in seven administrative entities known as *corregimientos*. The urban area covers 42.9 square kilometres, with a population in 1997 of 358,194 inhabitants concentrated in 11 administrative entities called *comunas*. The urban area of Manizales lies in the very moist forest of the moun-



tains and its topography of steep slopes, its high rainfall (2,200 mm per annum) and its 78 per cent humidity restrict urban expansion onto the hillsides. It could be said that Manizales has already surpassed the natural limits to its expansion and must seek alternative ways of managing growth – for instance, through increasing density in selected areas and through re-using existing buildings and lots. For this reason, proposals to define and allocate land use will be developed, linked to the restrictions of the hillsides.

According to data in the municipal environmental profile, the environmental problems of Manizales can be summarized as follows:

- inappropriate transformations in its ecosystems, including felling of trees to make way for permanent and temporary crops, the impact of agricultural expansion on the buffer zone of the snow-capped volcano of Ruiz and the transformation of green protection zones by urban expansion;
- pollution of rivers and water catchment areas by industrial, agricultural, mining and domestic pollutants; and
- high seismic and geological risks as a result of the steep slopes and high levels of soil humidity.

Impacts within the urban area arise from:

- a transport and road infrastructure system inappropriate to the city's topography;
- dwellings located in high risk areas due to the increase in urban poverty;
- industrial contamination of the city's rivers;
- degradation of the landscape including a loss of urban and architectural heritage;
- shortage of green spaces and public recreation areas; and
- problems arising from a lack of education and training in participative environmental management.

Manizales' environmental potential lies in the biodiversity of its ecosystem, the variety of climates within the municipality's territory, the quality and quantity of water in its catchment areas, the hydro-electric and geothermal potential of its water resources, the agricultural quality of its soil and in the scenic quality of the landscape. Also central to its potential are the credibility of its institutions (including local government), the efficient size of the city's urban area, the many community environmental action groups, and the NGOs and universities.

Manizales municipality has always had a moderate rate of population growth; in 1997, it was 2.1 per cent lower than the national average. Of the economically active population of 137,000, 28 per cent work in commerce, 17 per cent in industry, 11 per cent in education, 12 per cent in agriculture and 9 per cent in construction while a variety of service sector occupations account for the remaining 23 per cent. At present, due to the "coffee crisis", local investment has fallen and the current unemployment rate of 12.4 per cent is four points above the

national average. This is just one of the challenges that Manizales has faced in the course of its history and, in considering its settlement process, one must bear in mind two factors, popularly known as “the culture of coffee” and “the culture of prevention”.

The striking geographical location of Manizales' urban area amidst steep slopes is the result of the historical dynamic of settlement of a country which, as a result of the Spanish conquest in the sixteenth century, lost almost all of its indigenous population with only a few small local settlements in inaccessible mountain areas remaining. Manizales remained unchanged until the end of the nineteenth century when, as a result of the poverty prevailing in the state of Antioquia in the west of the country, a small group of inhabitants migrated in search of gold for use by craftsmen. They settled in a large part of the territory which today makes up the municipalities of Salamina, Neira and Manizales. This internal migration gave rise to what is known in Colombia as the “Antioquian settlement” which forms part of the identity of the local and regional culture. The new inhabitants transformed the ecosystem of the Andean cloud forests, constructing small settlements which served as temporary dwelling places, while dedicating themselves to mining and growing food crops. These settlements were strategically sited in the highest parts of the mountain range so as to dominate the territory visually and allow the defence of the mining activities. This explains how, later, towns became consolidated around roads that were relatively inaccessible, in areas with such steep slopes.

However, it was the cultivation of coffee at the beginning of the twentieth century that transformed the region socially, economically and environmentally. The optimal ecological conditions for coffee growing provided by the moist forests of the mountains, together with the internationalization of the coffee trade, generated significant economic surpluses. The area allocated to cultivating coffee grew steadily and it now accounts for 72 per cent of the municipality's total agricultural production. The temporary settlements remained and make up what today is known as the “coffee axis” where a network of medium sized towns and rural and urban communities are home to a population of 2.3 million inhabitants in what is considered one of the regions with the highest quality of life in Colombia. The “re-urbanization” of the municipality of Manizales, where countryside and city merge without any well-defined territorial boundaries, also derives from the coffee economy and the construction of a road network and of services for the transport and commercialization of the coffee bean. Research on aspects of the economic and environmental history of the settling of Manizales has been important for the environmental planning of its territory. This history can be summarized into the following periods.

a. The Coffee Boom; the New City Following the Fires

As a result of coffee exports and its commercialization in international markets, between 1920 and 1930 Manizales was Colombia's main supply centre for merchandise coming from

Europe and the United States. It became the country's second most economically and politically important city. In 1927 and 1928, two conflagrations destroyed almost the entire city, leaving only a few buildings standing on the periphery of the city centre. The prosperity of the majority of the population enabled work to go ahead on reconstruction. However, the new city changed from being a mountain city of the Antioquian settlement to being one whose architecture, parks and urban structures were designed by firms from Paris or London who had won international competitions. The construction of the new projects required substantial modification of the topography and the tropical Andean forest trees were replaced by species brought from Europe while the bamboo framework used in traditional building was replaced by cement and steel which had to be imported from Europe. Subsequently, using technology imported from Europe, a system of transport to and from Manizales using aerial cables for carrying cargo and passengers for up to 80 kilometres facilitated communication with the Magdalena river, from where coffee was sent to the embarkation port of Barranquilla on the Atlantic coast. During this period, Manizales succeeded in overcoming the physical isolation resulting from its mountainous topography and rebuilding a new city following the fires.

b. The Coffee Crisis and the Celebration of the Centenary

Towards the end of 1930, coffee prices fell on the international market and the former production boom declined. Communications within Colombia had been expanded and modernized, and Manizales was no longer the point of confluence of roads linking what became Colombia's three largest cities, Cali, Bogotá and Medellín. Manizales was now a terminal city on the crest of the mountain range and on the margin of the principal road and rail links. Nonetheless, it retained its political importance and, for this reason, on the occasion of the 1950 centenary of its foundation, the government provided significant funding for the construction of new infrastructure in the city. It also decided to establish two universities of national rank in Manizales and the city began to distinguish itself in the educational and cultural fields. From that moment on, the universities played an important role in the development of the region, including participation in its planning. Today, the city's eight universities have approximately 20,000 students and, together with the municipality, are managing the consolidation of Manizales as a university city.

c. The Second Coffee Boom and its Environmental Impact

In 1975, coffee prices went up on the international market, generating significant economic surpluses for the city and the region which lasted for five years. Coffee's high profitability led to increased cultivation of a new variety (Caturro coffee) which needs more sun for increased production. This led to serious damage to the moist mountain forest ecosystem as a result of

deforestation of large areas of secondary woodland which had provided shade for the existing variety (Arabic coffee). Thus began a rapid exhaustion of the soils and a decline in the productive diversity associated with other food crops and fruit trees. In addition, large areas of woodland with great biodiversity were lost. The increase in coffee production also raised the demand for water for growing and washing the beans to the point where demand exceeded possible supply from the region's catchment areas. For this reason, in 1979, the national coffee growers' federation began a programme of rural environmental education, environmental action, reforestation and research on clean, appropriate technologies for coffee production which would minimize the impact on the ecosystem and take account of integrated resource management. This programme had a positive outcome for the region and the country, and achieved its objectives.

However, the boom also had negative environmental effects on Manizales' urban area due to the rise in investment in construction. At the time, Miami, not London, was more influential, along with a drive to "modernize the city". This led to the destruction of much of the urban and architectural heritage which had been completed for the centenary in 1950. The city began to transform its roads, which had to fit into the steep slopes, and construct high speed avenues and increase the density of the central areas. The architecture also became more homogeneous. In this period of what was called "urban renovation", the expansion of the urban area coincided with the gradual deterioration of the natural and constructed landscape. In many cases, this surpassed the capacity of the surrounding environment and overstepped natural limits during "adaptation" of the hillsides for the large-scale erection of housing and urban structures. The technological and architectural solutions used within town planning were not the most appropriate ones, and the quality of the landscape and of Manizales' public and historic places suffered.

Manizales' history is full of events that illustrate the topographical conditions adverse to the city's urban construction: the construction of building lots by "terracing"; the diversion of river courses; and deforestation for the construction of buildings and roads. When, in 1979, a major earthquake destroyed a large proportion of the "modern structures" and the new "infrastructure works", intensive work was begun to investigate the links between seismic and geological risks and construction characteristics. At the time, the municipality developed a new building code which related the appropriateness of the terrain to the possibilities of earthquake resistant constructions, and a project on seismic micro-zoning was initiated to generate knowledge of the carrying-capacity of the city's different areas.

d. The Eruption of the Ruiz Volcano: Environmental Crisis and Economic Recovery

In November 1985, the volcano Arenas del Nevado del Ruiz erupted. One of the social consequences of this was that part of

Manizales' population moved to other cities because of the risk of a fresh eruption affecting Manizales and the surrounding region. Meanwhile, all new investment in the city came to a halt. This had drastic repercussions on the local economy and the national government declared an economic emergency in Manizales and the region affected by the eruption. The economic emergency decrees sought to stimulate investment by allowing the tax-free import of machinery and products associated with industrial production and by supporting employment generation. During the three years for which these provisions were valid, a total of 76 national and international businesses were set up in Manizales' industrial zone, of which 42 remain active. Although this was important for restarting Manizales' economy, it also brought negative environmental impacts in the form of increased environmental pollution in the Chinchiná river and the Manizales stream. In addition, the increased demand for water outstripped the installed capacity of the industrial zone's aqueduct. At present, work is being done under a business co-operation agreement, together with the National Industrialists' Association and the environmental authorities, to reduce the environmental impact by improving the technology.

e. The Present Coffee Crisis and Regional Integration for Sustainable Development

From 1994 to the present, Manizales and its surrounding region have been undergoing one of the greatest coffee crises. The international pricing agreement between producer and consumer countries was ended and the way opened for the free market. A consequence of this has been a fall in coffee prices because of excess supply at the international level. The economic impact both on the region and on the country is significant. The signs of poverty in the cities and countryside of the "coffee axis" are obvious. In Manizales, because of its dependence on coffee-growing, the result has been a major fall in people's quality of life. Much of the city's commerce is linked to investments which were made possible by the profits and surpluses arising from the commercialization and sale of coffee. The proportion of Manizales' population that is below the poverty line has risen from 18 per cent in 1994 to 27 per cent in 1998. Since this phenomenon affects not only Manizales but the whole region, it is interesting to note that those in power have joined together to implement a regional agenda of sustainable development. Today, programmes and projects aiming at economic recovery, the construction of macro-projects of regional urban infrastructure, and the environmental recovery and territorial definition of the Cumanday massif bio-region are being supported at international level.

f. Municipal Environmental Autonomy and Environmental Territorial Conflicts

Municipal autonomy has been important for Manizales and the outcome of the process of decentralization which has been taking place in Colombia since the mid-1980s has been very

positive in making possible the integration of municipalities in decisions on economic and political issues and on regional and metropolitan action. But this autonomy has been less positive for the environment and, today, there are frequent conflicts between neighbouring municipalities, departments and regions throughout the national territory on issues of environmental administration. In Colombia, environmental regions do not coincide with politico-administrative regions. This is why it is so difficult for the environmental authorities to work within the territory's politico-administrative jurisdiction. Decentralization and local autonomy for environmental management give rise to problems because of the existence of economic and political interests at odds with the principles of environmental planning. In addition, environmental management has barely started to consolidate processes of community participation and environmental education. The municipalities are still not ready to administer their environmental territory sustainably.

In 1997, conflicts along these lines between Manizales and Villamaria, its neighbouring municipality, became sharper as a result of the application of measures to restrict land use with respect to shared areas and resources, both natural and urban. However, through the implementation of Villamaria's local environmental action plan (LEAP) linked to the goals of the Local Agenda 21 and developed by the urban environmental study groups of both municipalities, the National University of Colombia's Institute of Environmental Studies (IDEA) and the Ministry of the Environment, cooperation around joint environmental actions to manage water, tourism, transport and recreation was achieved. Similarly, projects were formed for municipal environmental integration and the establishment of an inter-municipal environmental committee to work towards solving "environmental conflicts".

III. ENVIRONMENTAL POLICY IN COLOMBIA AND IN MANIZALES

ENVIRONMENTAL POLICY IN Colombia has important antecedents with regard to popular participation and inter-institutional commitment to environmental management. The National Institute for Natural Resources (INDERENA) was founded in 1974 and initiated a diagnosis of the country's environmental situation which alerted the national government to problems which continue to receive priority on its environmental policy agenda. The regions' and municipalities' responsibility with respect to these problems was assessed and the Green Municipalities of Colombia programme was established to address them. This was an important milestone and support was given to the green councils, and broad popular participation in environmental management was generated. Subsequently, with the commitment to seek a sustainable form of national development, the development of environmental policy has been closely linked to the 1991 constitution and the 1992 UN Earth Summit whose

outputs included support for Local Agenda 21. Below, is a summary of some of the key components of Colombia's environmental management.

a. The Environmental Profile of Colombia (1990)

Colombia's environmental profile described the country's environmental situation and problems including those arising from unequal socio-economic development, the use of inappropriate technologies, the growing urbanization resulting from unemployment and violence in the countryside, natural processes that were transforming ecosystems such as earthquakes, volcanic eruptions and floods, and atmospheric changes. The profile also pointed to the difficulties for environmental management arising from a centralized administration in a country with such a complex and varied geography and with such a high percentage of autonomous municipalities and urban centres. For this reason, it put forward proposals of an institutional nature for participative environmental management and for consolidating a national system of environmental management. It also provided the basis for producing regional environmental profiles and urban environmental profiles.

b. The New Political Constitution of Colombia (1991)

The new constitution established the ecological function of property and indicated the environmental rights and duties falling to the state and to its citizens. It also decreed that the formulation of environmental policies was part of the national development plan and that sustainable development was a political goal for the country.

c. Creation of the Ministry of the Environment (1993)

In accordance with the constitutional mandate and following Colombia's participation in the UN Earth Summit in 1992, the conditions were in place for drawing up Law 99 of 1993 (the environmental law) and the Ministry of the Environment and the National Environmental System (SINA) were created. Thus, principles were established for an environmental policy with the institutional, technical and financial legislative bases to support local, regional and national environmental management.

d. The Urban Environmental Profile of Colombia and the Manizales Case Study (1993)

Colombia's environmental profile recommended the production of urban environmental profiles, emphasizing that 75 per cent of all Colombians live in urban areas and that the main environmental problems are concentrated there – due to pollution, lack of basic services and inadequate housing (in turn linked to unemployment and poverty). In Manizales, with national and local support and with the participation of universities, local government and the environmental authority, a municipal en-

vironmental profile was produced which served as a pilot research project for other cities in the country and as a basis for environmental planning for the municipality of Manizales and its region.

e. Bogotá's Local Environmental Agendas (1993)

The Institute of Environmental Studies (IDEA) and the Administrative Department of the Environment developed environmental agendas for Bogotá directly related to the Local Agenda 21. This was the first experience of its kind in the country and succeeded in consolidating a management process for environmental problems and possible solutions in Bogotá's various areas. These agendas have become an important instrument of local planning. They have also served as a methodological basis for developing environmental agendas in the rest of the country, including Manizales.

f. The Environmental Policy of the National Development Plan (1994-1998) – the “Social Leap”

The environmental policy of the National Development Plan (1994-1998) – entitled the “Social Leap” (*Salto social*) – engendered the organization of the National Environmental System (SINA) and set it in motion. It also ensured the inclusion of the environment as a factor of development in the policies and programmes to be promoted by the state. Priorities were defined for a national environmental agenda to halt the accelerated environmental decline and the loss of the country's natural resources. The agenda's priority themes included:

- reducing the rates of extraction of natural resources;
- implementing mechanisms to reduce the environmental impact of industry;
- improving the quality of life in cities and towns;
- reducing poverty in urban and rural areas;
- preventing disasters caused by the inappropriate management of natural resources;
- reducing wasteful consumption patterns;
- increasing research on renewable natural resources;
- implementing environmental information and monitoring systems; and
- training public officials to improve environmental administration.

g. Colombia's Urban Environmental Policy (1995-1996)

The Colombian government's commitment to improving urban environmental quality finds clear expression in the environmental policy principles of the national development plan: better cities and towns. These principles provided a basis on which the Ministry of the Environment and IDEA could design the urban environmental policy which is being driven by the SINA in the country's 1,134 municipalities. Local Agenda 21

and its methodological and practical applications to the Manizales Bioplan and to the environmental agendas of Bogotá were very important in defining the policy's participatory character and in prioritizing action. The priorities of urban environmental policy were centred on:

- the promotion of urban environmental research;
- better management of energy consumption in the cities;
- an increase in public and a reduction in private transport;
- waste recycling and improved environmental sanitation;
- industrial production with minimal environmental impact and wastes;
- functional and self-managed growth of the cities with improvements in the quality of the surroundings in marginal communities, the regeneration of city centres and urban public spaces, and increased provision for recreation in urban areas; and
- popular environmental education for participation and support for the implementation in all of Colombia's cities and towns of the local environmental action plans linked to Local Agenda 21.

h. The Local Environmental Action Plans (LEAPs) – Local Agenda 21 (1997-1998)

Colombia's urban environmental policy proposed developing local environmental action plans (LEAPs) as the main means of implementing Local Agenda 21. It is hoped that all of Colombia's municipalities will implement the plans, with the aid of a methodological guide to be supplied by SINA. The guide will be developed by the Ministry of the Environment and IDEA, after evaluating Manizales' Bioplan and Bogotá's environmental agendas and constructing four pilot plans in different areas of the country:

- Villamaría (within the coffee zone and with its urban area contiguous to Manizales);
- Buenaventura (port city on the Pacific Ocean);
- Yumbo (a major industrial conurbation that is within the Cali metropolitan area); and
- Yopal (a petroleum-producing area).

These towns, each with different environmental problems, are considered a priority for the development of LEAPs. These pilot projects have already had multiplier effects. For instance, the government of the department of Caldas (of which Manizales is the capital) has committed itself to providing financial and technical support to the implementation of LEAPs in the 24 municipalities under its jurisdiction. The most important aspects of this process have been the active participation of citizens and NGOs in the phases of socialization and of commitment to the programmes, and the coordinated financial support for its implementation from the various governmental and environmental authorities.

IV. AGENDA 21 IN MANIZALES: JOINT ENVIRONMENTAL MANAGEMENT

THE CONSOLIDATION OF environmental management in Manizales is just as recent as in the rest of Colombia. Its development has been closely linked to national and international environmental policy. In 1992, as a result of the political decisions emerging from the UN Earth Summit, the National University persuaded the municipal government to take up the theme of the environment and integrate it as policy in the municipal development plan. It took concrete form in 1993 in the first municipal environmental agenda. This first, rather general, agenda was gradually integrated into local management. From this moment, inter-institutional actions were being consolidated among the universities, local government, the regional environmental authority, NGOs and residents' associations in order to develop programmes and projects on environmental education and the recovery of marginal areas.

Today, this shared commitment to the sustainable development of Manizales is receiving recognition at national level. Similarly, the positive results coming from programmes and projects to resolve the concrete environmental problems of the poorest communities make these a model for environmental management throughout the country. This joint action between the municipality and the university has gradually strengthened the link between research and management. A detailed knowledge of Manizales' social, economic and environmental reality was essential to the formulation of the LEAPs linked to Agenda 21.

To better understand how environmental planning developed in Manizales, the next section has a summary of the last three periods of government and includes an assessment of the most important factors for developing a form of environmental management that meets the priorities of municipal development.

a. 1990-1992: Social Welfare and Disaster Prevention as the Environmental Priorities

Although projects were being developed in Manizales for the recovery and improvement of the environment, the hillsides posed serious problems of degradation and a high risk of landslides. In these areas, the building of illegal settlements by invaders had increased and the number of families belonging to the marginal sectors had risen considerably. A total of 4,239 dwellings, housing 7 per cent of the urban population, were located in sub-standard areas as a result of critical overcrowding and a lack of urban infrastructure. The problems had become even more severe due to the rising population in risk areas and the increased need for civil works to protect the slopes. For this reason, the central goal of the municipality's environmental planning during this period was to improve the welfare and safety of the poorest population whose dwellings were located on hillside areas with a high risk of landslides.

Work was done on disaster prevention and disaster readiness, drawing on studies on the municipality's physical vulnerability.

From this moment on, environmental management emphasized the development of integrated programmes and projects on habitat. The first environmental agenda was formulated with the aim of improving dwellings and providing security to the inhabitants while also considering the physical risks of the terrain. These projects were implemented in association with the local university. During this period, 2,320 dwelling units were built for people from among the lowest-income groups. At the completion of the government programme, the number of dwellings located in high risk zones had been reduced by 63 per cent and a total of 360 hectares had been reforested as protected green areas.

Box 1: The Eco-parks

The Eco-parks are protected green areas located within the municipality's urban area. Most are owned by the municipality or have been acquired through donations from individuals. Only buildings for recreation and education and the infrastructure required for its ecological conservation are allowed in the Eco-parks. The Eco-parks set natural limits on the expansion of the built-up areas and prevent construction on areas at high risk from landslides.

The environmental education programme developed in the Eco-parks is managed by different institutions including non-government organizations and the National University. For example, in Eco-park Alcazares Arenillo, the university is developing environmental educational programmes. The Recycler's Association manages this Eco-park through an annual contract with the municipality.

Some examples of the different Eco-parks:

- Eco-park Alcazares Arenillo (78 hectares) has a focus on conserving biodiversity. It is used for scientific research linked to environmental education.**
- Eco-park Montele-Yarumales (36 hectares) is an ecological reservation for scientific and technological investigation and citizen environmental education.**
- Eco-park Sancancio is a symbolic hill with the city. The park area includes an archaeological site of regional importance.**
- Eco-park Rioblanco is a strategic ecosystem providing water to the municipality.**
- Eco-park Bosque Popular (53 hectares) is the most important place for popular recreation and sport.**

There were some problems in defining the boundaries of these "protected green areas" and in determining the use of the soil – they were subsequently converted into eco-parks for environmental education and research. Eco-parks combine provision for recreation, environmental education and conservation while also keeping buildings off sites that are prone to land-slides or hazards – see Box 1. During this period, 168 hectares of protected green areas were incorporated into the municipality, corresponding to 9 per cent of its total area. In addition, the municipality established a new city boundary which incorporated environmental conservation as an alternative means of disaster prevention and provided tax incentives for the owners of these areas. For the owners of dwellings in high risk areas, there were land-exchange schemes so that they could resettle on safer sites, with the high risk areas recovered for use as forest. Also during this period, the Office for Preventing and Dealing with Disasters was created within the municipality and corresponding policy was formulated integrating the themes of the city's physical vulnerability and its physical suitability for urban expansion.

During this period, the municipality invested 17 per cent of its budget in the environment and disaster prevention area. The National University supplied 83 per cent of the budget for the joint extension programme and the regional corporation invested 23 per cent of its budget in infrastructure works to reduce the risk of landslides on the hillsides. The municipality also received significant national contributions towards the implementation of its plan for preventing and dealing with disasters. The affected communities were linked to this mix of technical and financial support and the first local disaster prevention committees were set up.

b. 1993-1995: Priority: Economic Growth without Environmental Deterioration. Public-private Environmental Cooperation

The years 1993-1995 were a significant period in Manizales' economic growth, as reflected in the municipality's fiscal performance and the growth of its revenues in real terms. Current revenues increased by some 64 per cent by the end of 1995, with capital investment up by 139 per cent and municipal incomes up by 56 per cent. At the end of the period, public finances were in surplus. For 1995, investment accounted for 59.9 per cent of the municipal budget, while municipal spending on administration fell to 23.5 per cent of the budget.

The process of administrative and fiscal decentralization within Colombia obliged the municipalities to transform public enterprises into mixed ownership entities which took over the administration of parks and green areas (Regreening Manizales), the management of the water supply (Waters of Manizales – Pure Water), the management of solid wastes (Green City) and the sanitation services (Sanitation Enterprise of Manizales). It is important to emphasize the efficiency of these businesses and the importance of the public-private association as well as the participation of community associations as members of the enterprises.

This was an important period in the consolidation of environmental management in Manizales because of the municipality's support for the university's initiative to develop the urban environmental profile of Manizales as a pilot case in Colombia. The profile provided the technical basis for management and it proved possible to assemble an inter-institutional work team to carry out the research. Programmes and projects of importance to community environmental education were formulated and the first community environmental committees were set up. The first community environmental agenda was developed and environmental priorities for Manizales were established.

The first phase of the large-scale transport plan was developed and got underway. This included the renovation of roads, the installation of traffic lights and the development of connections between the city's main road corridors. There was also a programme of environmental education for drivers and pedestrians which sought to discourage the use of private transport. The use of private vehicles had grown considerably due to low prices and incentives for the free import of vehicles resulting from the opening up of the country's markets. Other transport alternatives were sought and the first aerial cable project for public transport was developed. With the new scope for municipal autonomy, the local government approved a tax surcharge on petrol with the proceeds going to the large-scale transport project.

For the first time, Manizales had a budget explicitly allocated to environmental policy into which a large part of the municipality's financial surplus was invested. The budget equalled 21 per cent of the total municipal investment budget, of which 15 per cent went to environmental education programmes, community training and tax incentives for those protecting areas of ecological importance to the city, while the remaining 6 per cent was used to purchase land for use in environmental protection and conservation. However, unusually heavy rain resulted in landslides in areas which had not been considered high-risk areas. Two hundred and twenty-six families lost their houses, and lives were lost. As a result, the municipality had to spend much of the budget it had set aside for environmental policy on dealing with this emergency, on constructing new infrastructure works and on preparing land on which the displaced population was to be resettled.

c. 1996-1998: Community Environmental Training and International Management of the Bioplan

During this period, significant advances were made in developing participative methodologies for strengthening local entities' and communities' capacity to manage environmental issues and disaster prevention. The Municipal Training Institute (ICAM) and the Secretariat of Community Development developed programmes and supported the community environmental committees in the implementation of projects. The municipality also contracted several community associations to manage and administer two eco-parks, two community plant nurs-

eries and 15 neighbourhood parks. Community participation was established in three mixed economy enterprises (with public and private members), running rubbish dumps, the recycling plant and the centre for supplies. The integration of policies for economic growth, social welfare and environmental improvement, and the design of a system to monitor and evaluate sustainable development in Manizales were significant contributions of this period. The first stage of this system will be implemented in 1998 and it will put into operation the urban environmental observatories for the 11 *comunas* and seven *corregimientos* of the municipality's urban and rural area.

Manizales' participation in the UN Habitat II Conference in 1996 with the Bio-Manizales project as an example of successful practice was important because its environmental policy became known nationally and internationally. This led to cooperative actions to support sustainable development in Manizales. Following Habitat II, the municipal administration and IDEA signed six cooperation agreements with Latin American and European cities on technical exchanges and support for urban environmental management, community environmental education, environmental sanitation and environmental monitoring. These agreements have strengthened cooperation between cities and have had a definitive role in providing continuity to the LEAP:Bioplan.

During this period, municipal investment in environmental work continued to grow with the municipality allocating 23 per cent of its investment budget to environmental policy and disaster prevention. Furthermore, international support made possible investments equivalent to 4 per cent of the municipal environmental budget. The local universities contributed technical and infrastructure resources equivalent to 60 per cent of the budget allocated to activities in support of the community, and international and national support enabled the NGOs to establish projects equivalent to 6.3 per cent of the municipal environmental budget. The municipality and IDEA received technical and financial support from the United Nations Environment Programme, the Organization of American States, the Inter-American Development Bank, the UN Economic Council for Latin America and the Italian, Spanish and Brazilian governments.

During this period, the municipal environmental budget was increased through a 1.2 per cent extra charge on urban and rural properties, representing an environmental surcharge. Colombian national law requires municipal governments to invest this tax in addressing the main local environmental problems. In Manizales, this tax expanded the municipality's financial capacity to implement the Bioplan's programmes and projects. The extra funds went towards the construction of infrastructure to protect the hillsides, towards reforestation programmes, the purchase and preparation of geologically high-risk land for conversion into eco-parks, and the programme for popular environmental education and the creation of a university of the environment.

V. THE LOCAL ENVIRONMENTAL ACTION PLAN FOR MANIZALES

a. The Bioplan

FROM 1994 ONWARDS, the municipal development plan has had the sustainable development of the municipality and the region as its fundamental aim. For this reason, the Bio-Manizales project was approved as its environmental policy goal in the medium and long term in order to:

- stimulate knowledge of the local and regional ecosystem;
- conserve the municipality's natural and cultural resources;
- increase energy efficiency in the running of the city;
- improve urban living conditions for the whole population with attention to environmental sanitation, integrated waste management and recycling, and improved security for citizens in public spaces;
- facilitate the application of appropriate technologies in industrial production;
- create an efficient supply of public services and transport; and
- provide environmental education for popular participation.

In addition, the projects and infrastructure works that were needed to environmentally reclaim, revitalize and reconstruct the municipality were designed: eco-parks, water parks, bio-cycles, urban lifts, urban outlook points, urban washing parks, bio-markets, community plant nurseries, green corridors, bio-communities, the university of the environment and bio-tourist routes. A plan has also been drawn up to develop the historic cable car system that functioned in Manizales until 1958. The plan is for a network of cable car lines using small wagons each seating up to 20 persons. The central station of this system would be situated close to the viaduct of the Autonomous University with four routes covering the most important urban and inter-municipal flows: Manizales-Villamaria, Centre-North, Centre-South and North-West. These different projects were presented by the municipality to the industrial and construction guilds as a way of revitalizing the municipality and region's economy.

However, in 1996, when the development plan was carried out and no modifications were made in the commitment to implementing the municipal environmental policy, with Bio-Manizales once again remaining a long-term goal, there were swift reactions from the universities, residents' associations, ecological groups and environmental NGOs. The environmental sector's representative to the territorial planning council publicly called a citizens' forum which, after several days of discussion with the municipal council, was able to formalize an agreement for the implementation of the LEAP:Bioplan 1997-2000. Thus, the political commitment to improving the environmental quality of the municipality of Manizales passed from the realm of theory to that of action and the investment budget for envi-

1. The October 1999 issue of *Environment and Urbanization* will form the second volume on "Sustainable Cities Revisited" and will include a paper on the development of a local environmental action plan (LEAP) in Olivares, one of the 11 *comunas* into which the urban area of Manizales is divided. Olivares is one of the poorest and most environmentally deteriorated areas of the city and the plan developed there serves as a model for encouraging similar local action plans with strong commitments to participation and to combining social, economic and environmental goals.

ronmental policy was increased to carry out the programmes and projects.

For this reason, it is very important that the LEAP be converted into the principal driving force of the environmental policy linked to Agenda 21. Problems that require priority need to be selected; there is also the need to encourage the institutions and communities to support the development and implementation of the Bioplan. Following an extensive process of meetings and coordination led by the Institute of Environmental Education and the territorial planning council, the following were defined as LEAP programmes: bio-tourism, bio-transport, popular environmental education, integrated waste management and the action plan of Olivares Bio-comuna.⁽¹⁾

b. Community Environmental Action Plans

As part of the Bioplan, plans were designed for the 11 *comunas* into which Manizales is divided. These plans have already been implemented and evaluated. Most show shortcomings in terms of commitment to participation on the part of institutions and residents so that, in future, the communities need to prepare better for the coordination and decision-making phases. Some environmental conflicts also arose which usually revolved around problems of land use, individual economic interests or political group interests. Recently, this has posed difficulties for project implementation and has limited the participation of many community leaders.

VI. EVALUATION AND MONITORING OF THE ENVIRONMENTAL POLICY

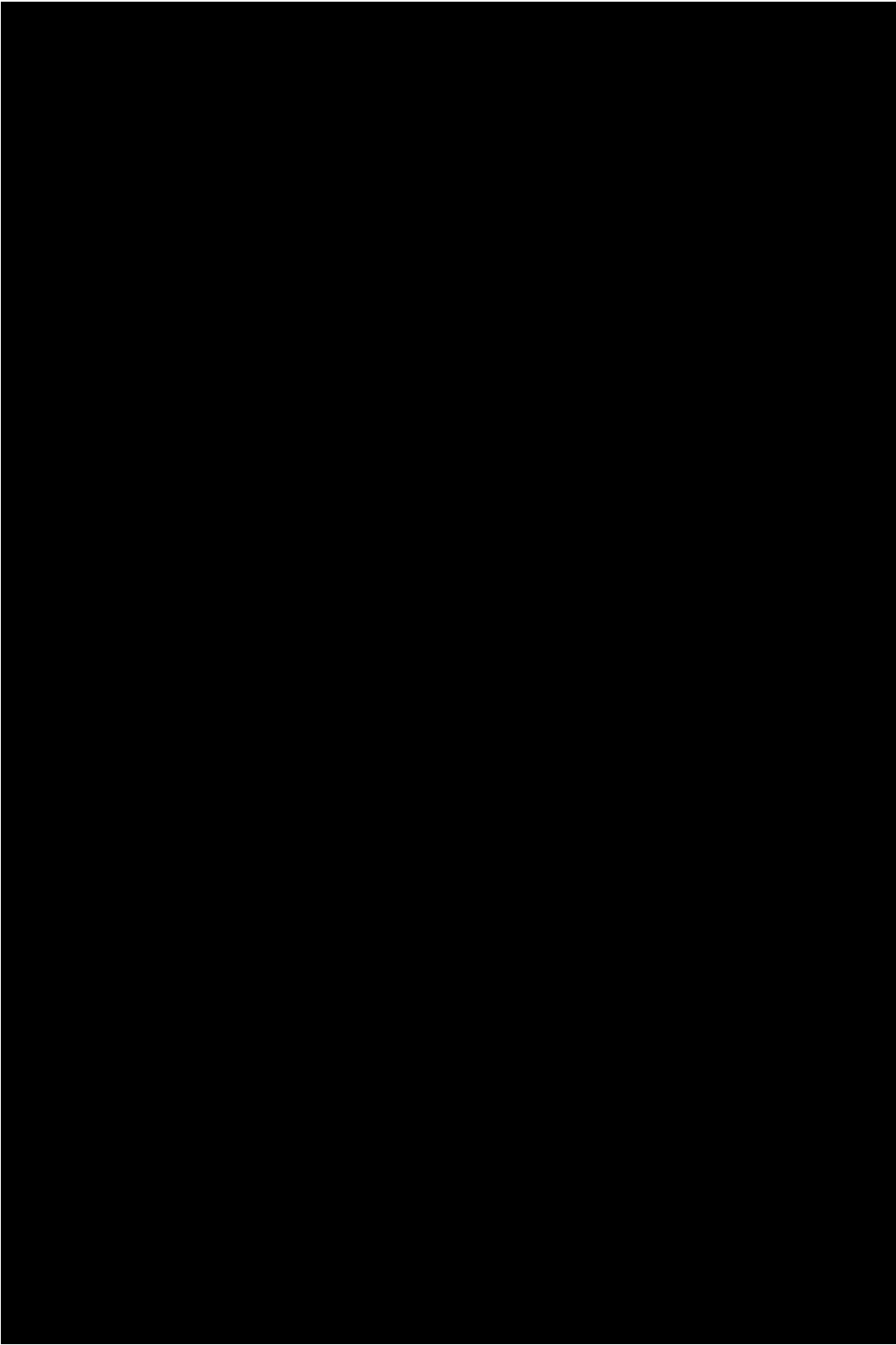
a. The Need for Monitoring and Evaluation

AN EFFECTIVE LOCAL environmental action plan in Manizales needs careful and detailed monitoring of conditions and trends. It is also important to monitor programme and project progress and the extent of citizen involvement in all aspects of the plan. The monitoring must also allow a constant evaluation of progress and of difficulties in the application of the policies, investments, programmes and projects in accordance with the plan's declared objectives of social equity, economic efficiency, effective research and protection or restoration of the environment. But it must also produce indicators that are useful for, and easily understood by, the population.

b. The Environmental Quality Traffic Lights

As will be described in more detail later in this section, a great range of data are collected on social conditions, the economy and the environment, and these form the basis for monitoring conditions and trends. Most are available for each of the territorial units for the city (the 11 *comunas*) and for the wider municipality (*corregimientos*) at least annually. Many are available each

Table 1: The Environmental Traffic Lights; how each Comuna scored for Composite Indicator of Environmental Quality



month or every three months. Based on this data, ten composite indicators have been developed reflecting overall environmental quality – see Table 1. For each of these, scores have been derived which fall into one of three categories:

- red which indicates problems;
- yellow which gives a warning of possible problems;
- green which indicates good quality.

As Table 1 shows, this allows a visual representation of where environmental problems are concentrated in terms of sector and in terms of area within the city. Table 1 shows the scores for the 11 *comunas* into which the urban area of Manizales is divided.

Since the completion of the Manizales municipal environmental profile in 1994, environmental quality traffic lights scoring has been applied as a manually operated monitoring system. Its methodological advantages have proved themselves over the course of four years as it has proved possible to monitor the ten environmental quality indicators listed in Table 1.

Many communities have helped to gather the data needed for this monitoring with help from the university. The simple methodology has also allowed communities to apply and interpret the system directly and to use the system to help define their community environmental agendas.

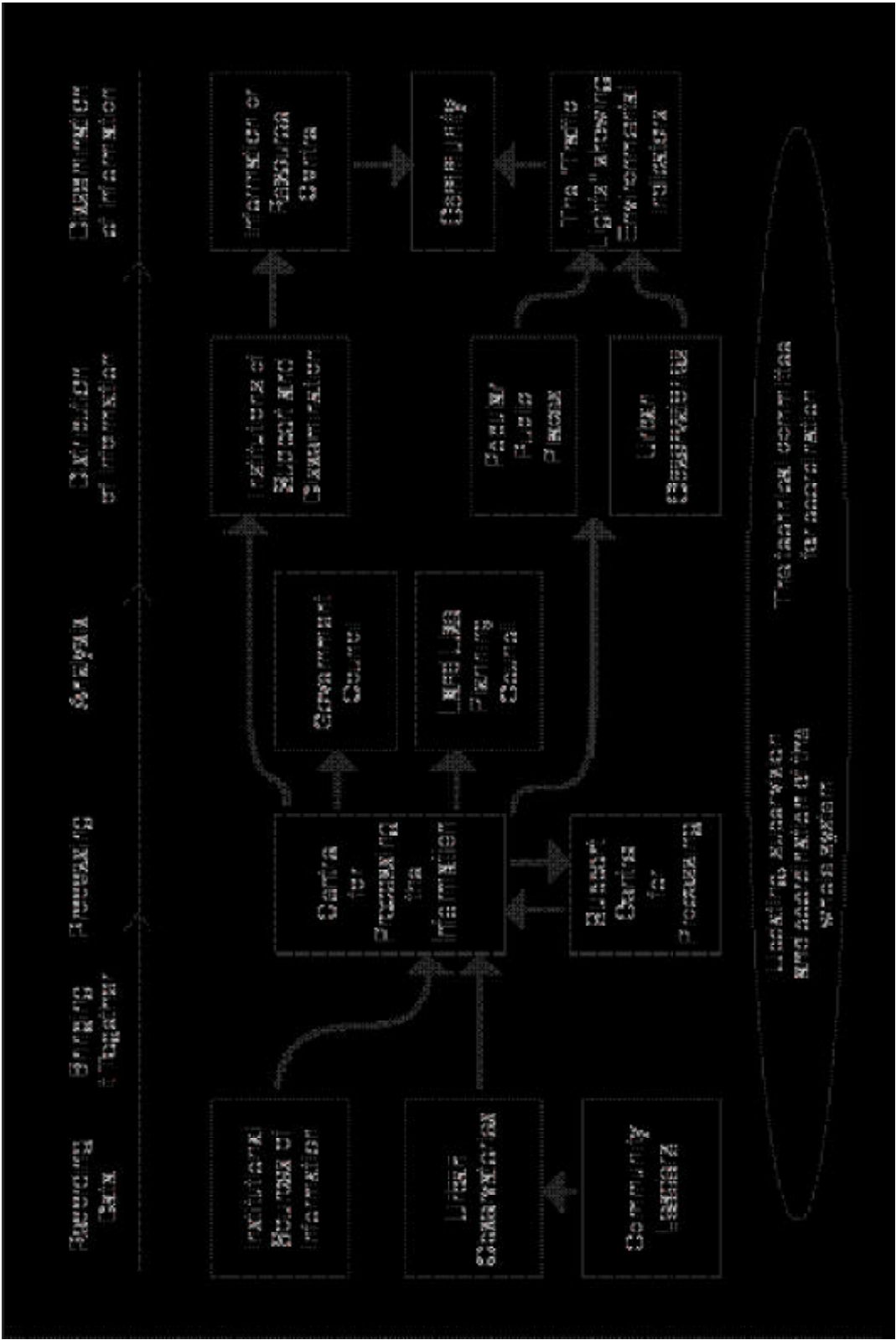
However, at present, there are still difficulties in covering the whole territory and in processing, verifying and analyzing the data. Systematization of the results is very slow and the information is not distributed regularly to the institutions and communities. Problems have also arisen in relation to the municipal office which collates, centralizes and distributes the information, as well as the commitment of the institutions supporting the process due to the magnitude of the human resources required during the evaluation of the results. As a result, IDEA and the Autonomous University of Manizales, using the environmental quality traffic lights methodology, technical advances in information technology and geo-referenced information, with technical support from the United Nations' ECLA and financial assistance from the Italian government, designed a system of urban environmental observatories for Manizales. The first stage of this will be implemented in 1998 with technical and financial support from Colombia's Ministry of the Environment.

c. The Urban Environmental Observatories

It is important to describe some of the main features of this system of observatories because it brings together much of the technical, economic and managerial effort which has succeeded in making popular participation in sustainable development a priority in Manizales today.

The urban observatories are the physical locations where the community has access to environmental information. They are also the places where the programmes of environmental education for the implementation of the LEAP-Bioplan unfold and where the community is encouraged to improve the environ-

Figure 1: The System in Manizales to Monitor, Follow up and Manage the Implementation of the Development Plan



mental quality indicators. For this reason, their operational budget includes the resources necessary to develop activities which complement the planning process.

Figure 1 illustrates the role of the urban environmental observatories as intermediaries and information sources, linking the community and the municipal administration. They serve both as key points for collecting data and for analyzing and disseminating it.

It is around the action plan of these sites that the joint work for carrying out the programmes and projects are to be formulated and promoted. The observatories need not be separate from existing community meeting places. In each community, existing facilities were evaluated and the most suitable site was chosen, thus reducing running costs.

i. The Operation of the System: To help run the system, agreements were reached and an accord signed between the municipality, IDEA and the Ministry of the Environment. The system is part of the Bank for Programmes and Projects with Municipal Investment (BPIM) which will be responsible for supervising LEAP investments. At the BPIM, the technical and financial viability of the Bioplan's projects will be evaluated. These projects should be able to solve environmental problems and also draw on local resources in order to reduce costs and implementation time. The municipal budget provides 80 per cent of the financing and they can receive co-financing from regional or national governmental bodies.

ii. Technical Training of the Communities: In each *comuna*, people were called together to facilitate broad participation by the various working groups, cooperative residents' associations and community leaders. This led to the selection of individuals to receive technical training, leading in turn to subsequent selection of the operators and coordinators of the observatories.

iii. The Indicators for Monitoring the Environmental Action Plan – Bioplan: Following a careful bibliographic review of recent experiences with environmental management indicators, the components, factors, variables and indicators of the environmental quality traffic lights system were agreed, taking into account which were feasible in the municipality of Manizales. Thus, the most relevant and feasible indicators for implementing the system of environmental observatories took shape. A relatively simple way of classifying the factors into groups and, in turn, the groups into variables and sub-variables was chosen because of the desire for the procedure to be comprehensible to all – not only to experts. For Manizales, the system is made up of three components: the social component, the economic component and the environmental component. These are summarized briefly below – with Tables 2 and 3 giving more details of the indicators used for monitoring social and environmental conditions and trends.

Table 2: Examples of the Indicators used in Monitoring Social Conditions in Manizales

A. WELFARE

Sector	Indicator	Area for which available	Frequency
Education	Percentage of population who are literate	Commune and municipality	Annual
	Staff to student ratio	Commune and municipality	Annual
	Percentage of school age children not at school for: preschool; primary school; and secondary school	Commune and municipality	Annual
Health	Percentage of students not attending: preschool; primary school; and secondary school	Commune and municipality	Annual
	Morbidity	Municipality	Monthly
	General mortality rate	Municipality	Monthly
	Maternal mortality rate	Municipality	Annual
	Perinatal mortality rate	Municipality	Annual
Social security	Infant mortality rate Monthly	Municipality	Annual
	Life expectancy at birth	Municipality	Annual
Social security	Proportion of population covered by social and family security	Commune and municipality	Annual
	Number of persons by subsidized health care service	Commune and municipality	Annual
Citizen security	Number of murders per month	Commune and municipality	Quarterly
	Number of traffic accidents relative to number of automobiles	Commune and municipality	Quarterly
	Number of traffic accidents per month	Commune and municipality	Quarterly
	Number of assaults and homicide in public space per 10,000 persons	Commune and municipality	Quarterly
	Number of murders per month	Commune and municipality	Quarterly
Recreation and culture	Percentage green area	Commune and municipality	Six-monthly
	Number of inhabitants in relation to the number of cultural buildings	Commune and municipality	Six-monthly

NB: This list is to illustrate some of the social indicators collected or calculated; it is not a complete list and does not include the many economic indicators also collected.

B. EQUITY

Sector	Indicator	Area for which available	Frequency
Housing	Percentage of housing	Commune and municipality	Every three years
	— that is overcrowded	Commune and municipality	Every three years
	— with good quality construction	Commune and municipality	Every three years
	— with piped water, sewers, gas, electricity	Commune and municipality	Every three years
Income	— in areas served with public telephones	Commune and municipality	Every three years
	Dependency ratio	For low-income commune	Six-monthly
Urban poverty	Level of SIEMEN (municipal indicators of poverty)	Municipality and for poorer commune	Annual
	Proportion of population with unmet basic needs	Municipality and for poorer commune	Annual
	Proportion of population below poverty line	Municipality and for poorer commune	Annual
	Proportion of population in each socio-economic stratum	Municipality and for poorer commune	Annual
	Income per nuclear family for the vulnerable population	Municipality and for poorer commune	Annual
	Social composition; diversity of social strata	Municipality and for poorer commune	Annual

C. ORGANIZATION FOR CITIZEN PARTICIPATION

Sector	Indicator	Area for which available	Frequency
Participation in politics	In relation to the population of voting age	Commune and municipality	Whenever elections take place
	— number of active political groups	Commune and municipality	Whenever elections take place
Community participation	— number of people who vote	Commune and municipality	Whenever elections take place
	Number of active community representatives	Commune and municipality	Annual
	Number of community organizations	Commune and municipality	Annual
Governmental	Number of projects presented by the community to the BPM	Commune and municipality	Annual
	Number of projects executed by the community	Commune and municipality	Annual
	Number of public projects	Municipality	Annual
NGOs	Percentage of municipal budget for inter-institutional cooperation	Municipality	Annual
	Number of international agreements	Municipality	Annual
Private sector	Percentage of municipal budget going to projects executed by NGOs	Municipality	Annual
	Percentage of municipal budget for projects and programmes executed by the private sector	Municipality	Annual

iv. The Social Component

- **Welfare:** This concentrates on measuring the population's quality of life so it is a decisive factor for interpreting municipal environmental quality. As shown in Table 2, a variety of indicators are available for the quality and coverage of education, health, social security, citizen security, and recreation and culture.
- **Equity:** This is intimately linked to the urban quality offered by the municipality to the lowest-income population. Within each *comuna*, and for the whole municipality, the quality of housing is monitored, including the proportion of households with basic services, as is the proportion of the population that is below the poverty line or which has unsatisfied basic needs.
- **Organization for citizen participation:** Improving the population's quality of life depends, to a considerable degree, on this factor. It is necessary to evaluate the degree of genuine popular participation in management processes and the options for such participation offered by the municipality. As shown in Table 2, a variety of indicators are used to monitor the level of participation in politics, community action and public programmes, and the extent of NGO and private sector involvement.
- **Investment:** Here, the interest lies in evaluating and measuring the implementation of programmes and projects in the municipality which improve the population's quality of life. Among the variables to be taken into account are investment in infrastructure for community services, investment in education for participation, and investment in improving dwellings and their surroundings.

v. The Economic Component

- **Efficiency:** Various indicators are used to measure and monitor the proportion of regional and national production that the municipality contributes; the main sources of funds for the municipality including local, national and international sources; the management of the debt; and administrative efficiency.
- **Production:** Various indicators are used to monitor the scale and nature of economic activity and of the labour force within the municipality.
- **Investment:** Here, the main interests are in monitoring the number of projects started and completed by BPIM; the efficiency of tax collection; the proportion of the municipal budget destined for technical assistance to the productive sector; and the level of investment within the municipality.

vi. The Environmental Component

- **Natural resources:** As Table 3 shows, a variety of indicators

Table 3: Examples of the Indicators used in Monitoring Environmental Conditions in Manizales**A. NATURAL RESOURCES**

Sector	Indicators	Area for which available	Frequency
Air, water, soil, flora and fauna	Volume of water extracted by sector	Municipality and the wider region (some data also available at the level of the commune)	Monthly
	Water quality		Monthly
	Proportion of total potential of the river basin/catchment area used		Annual
	Proportion of area deforested		Quarterly
	Proportion of protected watershed areas reforested	Annual	Annual
	Proportion of land covered with primary and secondary forest		
	Relative importance of vehicles, commerce and industry in air pollution		
Physical security	Percentage of land area: — subject to erosion — with potential for agriculture — unstable geologically — protected from development	Municipality and commune	Annual
	Number of registered events in attending to and preventing disasters (broken down by income group)		
	Proportion of housing: — with earthquake resistant construction — in zones of high risk		
	Proportion of municipal budget allocated to research on disaster prevention		
	Proportion of municipal budget going to improvement of degraded areas		

B. ENERGY EFFICIENCY

Sector	Indicators	Area for which available	Frequency
Clean production	Percentage of industries using cleantechologies	Municipality	Annual
	Percentage of industries using alternative energy		Annual
Efficient production	Percentage of plant wastes recycled	Municipality	Monthly
	Percentage of industries internalizing their environmental costs		Annual
Energy consumption	Total energy consumption by sector	Region and municipality	Monthly
	Total energy consumption relative to municipal GDP		Monthly
Urban system Transport	Number of industries who are re-using or recycling	Municipality	Annual
	Average velocity of road traffic	Municipality and some communes	Monthly
	Number of vehicles relative to road length		Annual
	State and type of road paving		Six-monthly
	Percentage of vehicles that are for public transport		Annual
	Number of passenger-km travelled per km of road		Annual
	Indices of accidents		Monthly

C. CLEANING UP

Sector	Indicators	Area for which available	Frequency
Particular impacts	Percentage of population affected by water-related disease (by social group)	Municipality	Monthly
	Percentage of households without treated water		Annual
	Proportion of water bodies contaminated		Monthly
	Percentage of population suffering respiratory diseases		Annual
	Concentration of different polluting gases at certain critical points		Annual
	Noise levels		Annual
	Population relocated from areas of high risk		Annual

D. INVESTMENT

Sector	Indicators	Area for which available	Frequency
Infrastructure	Percentage of municipal budget for infrastructure investment	Municipality	Annual
	Percentage of investment for managing and treating water		Annual
	Percentage of investment on research on biodiversity		Annual
	Percentage of public and private investment in control of contamination		Annual
	Municipal budget for funds for local emergencies		Annual
	Scale of construction of basic infrastructure		Annual
Environmental education	Number of programmes for environmental education within higher education	Municipality	Annual

are available to monitor the quality and use of water, soil and air.

- **Physical security of the surroundings:** Including the levels of risk arising from floods, landslides, avalanches, forest fires, and geological and seismic risks,.
- **Energy efficiency:** Here, the interest lies in monitoring the proportion of industries using clean production methods and alternative energies; the extent of recycling; the efficiency with which energy is being used; and the performance of the transport sector.
- **Cleaning up:** Here, the interest lies in monitoring the extent of particular environmental hazards such as the percentage of the population affected by water related diseases or by respiratory diseases (see Table 3 for more details).
- **Investment:** This includes investment in environmental education and investment in infrastructure (see Table 3).

vii. Developing the System's Computerized Logical Support (software): This involves writing computer programmes to support the processes of recording and processing the data and of distributing the information produced by the system. It includes tests of the software's reliability and consistency and the production of complete documentation (user's manual, administrator's manual, and maintenance and updating manual).

viii. Data-processing: This includes all the activities of grouping, arranging and performing calculations on the data in order to obtain all the indicators showing the state of the environment in the municipality and in particular the impact of the actions considered in the LEAP. These indicators are produced in detailed form for each *comuna* as well as for each evaluation factor aggregated at the level of the whole municipality. As a result of this process, it is possible to make changes in the indicators. Similarly, a relationship is to be established of projects and investments associated with improvements in each indicator, comparing the positive or negative variations achieved by the investment.

ix. Continuous Assessment: All the indicators determining environmental quality and the achievements of the LEAP are to be assessed by the technical committee, the council of municipal government and the territorial planning council. Once values for the indicators have been obtained for a set period, they need to be analyzed by the municipal government with the aim of evaluating the advances achieved and seeking explanations for the setbacks. This should allow corresponding decisions to be taken to promote the desired goals. In order for the mayor and his group of immediate collaborators to make a complete analysis of the results, they need to have available all the indicators calculated and to have at their disposal their variation

over time; also, the indicators applicable to the *comunas* or the territorial unit, as a point of reference. The system will supply this information, with the values corresponding to investments in the BPIM's projects and programmes.

x. Socialization and Dissemination of the Information to the Residents:

To achieve effective dissemination of environmental information, the mass media (press, radio and television) will be used, supported by the production and distribution of printed leaflets and direct interaction with the community through activities coordinated by the secretariat of community development and the university. An intense campaign of information dissemination regarding the system is to be carried out, telling people about the system's goals, its manner of operation, the function of the urban observatories and, above all, about the role which the community is to play in the system's operative structure. The most suitable locations for the dissemination of information about the system's results are, in the first instance, the urban environmental observatories which will assume responsibility for the continuous promotion of training and actions to address social, economic and environmental problems in the communities corresponding to their respective areas of influence. Other information dissemination sites are busy public places such as the airport, the transport terminal, Bolívar Square and the commercial centres, among others, where it would be appropriate to have effective means of communicating the state of the indicators – for example with an electronic panel displaying the environmental quality traffic lights.

xi. The Environmental Bulletin: To help disseminate the results in the urban observatories and public places, it would be useful to produce periodically a bulletin containing the most important indicators, together with explanatory notes and commentaries in order to motivate action. The bulletins should be oriented towards producing greater popular awareness of the need to improve certain aspects of the city and the importance for this of popular participation. It would also be useful to employ the mass media such as radio, the press and television to disseminate results and to educate citizens to interpret these and to assume responsibility vis-à-vis the variations.

The establishment of the system of environmental observatories for monitoring and evaluating the LEAP-Bioplan aims to facilitate decision-making and provide a continuous evaluation of the indicators making up social, economic and environmental components. For the construction and activation of the system, various technological alternatives were considered and their respective set-up and running costs compared. As a result of analyzing and comparing them, it was possible to select the one offering the greatest possibility for the integration of inter-institutional management and for socialization among the population.