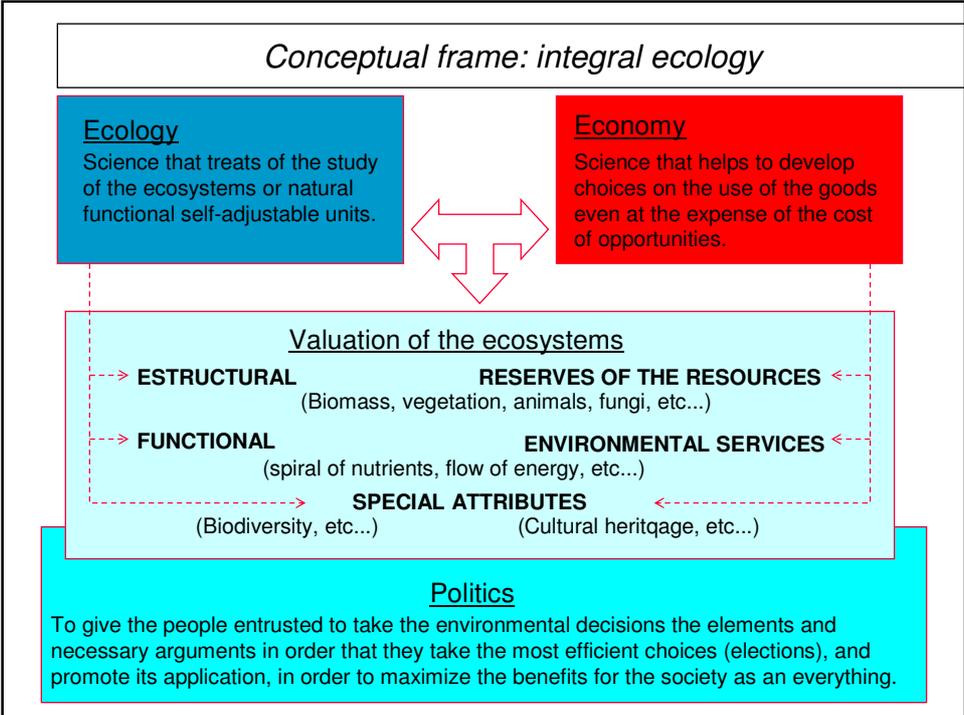


**THE MANAGEMENT OF THE  
EPICONTINENTAL WATERS  
IN THE NATURAL  
PROTECTED AREAS.**

**THE CASE OF THE  
CAMÉCUARO LAKE  
NATIONAL PARK,  
MICHOACÁN**

Pedro Joaquín Gutiérrez-Yurrita / Patricia Muñoz Sevilla  
CIEMAD-IPN  
Marzo / 2010



## Conservation Biology goals

To go to the famous sustainable development, it is necessary to approach the managing of the natural resources from the double perspective to assure

The water supply for the diverse human activities



The protection and conservation of the ecosystems subject to the pressures that endure such activities extractives or transformatives.



## Synoptic graph of the integral ecology

1  
Need to arrange the form in which we use the biotic resources

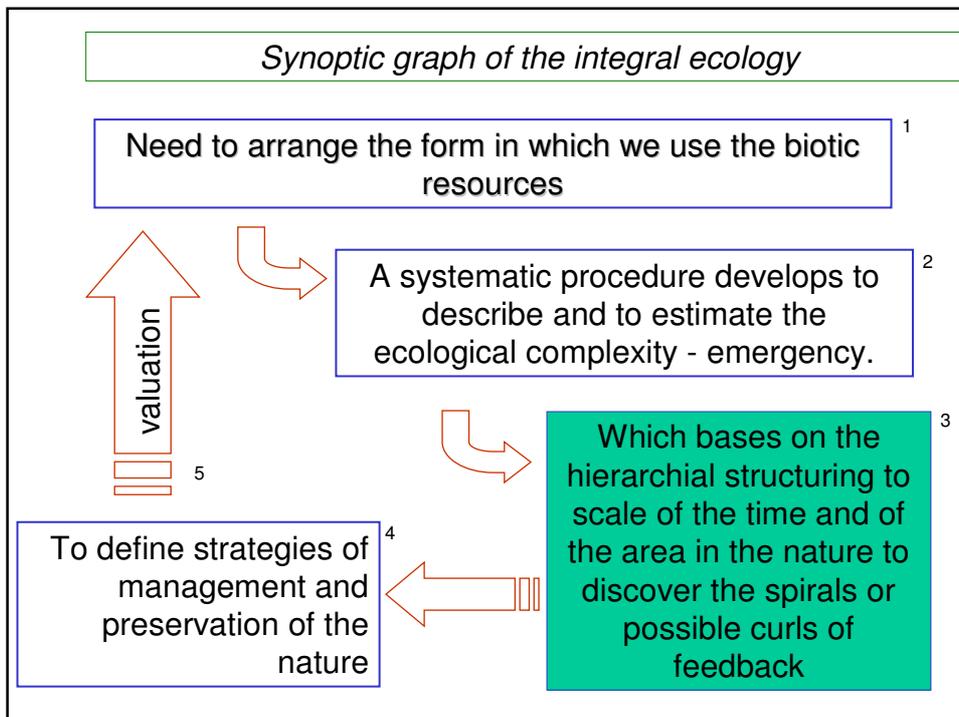
2  
A systematic procedure develops to describe and to estimate the ecological complexity - emergency.

3  
Which bases on the hierarchial structuring to scale of the time and of the area in the nature to discover the spirals or possible curls of feedback

4  
To define strategies of management and preservation of the nature

valuation

5

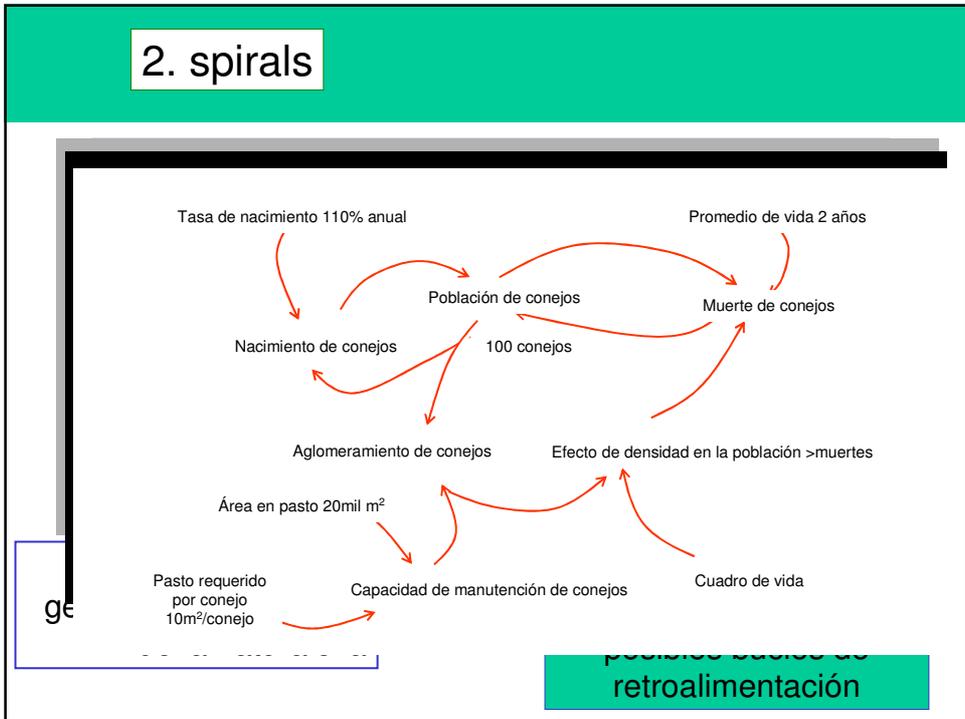


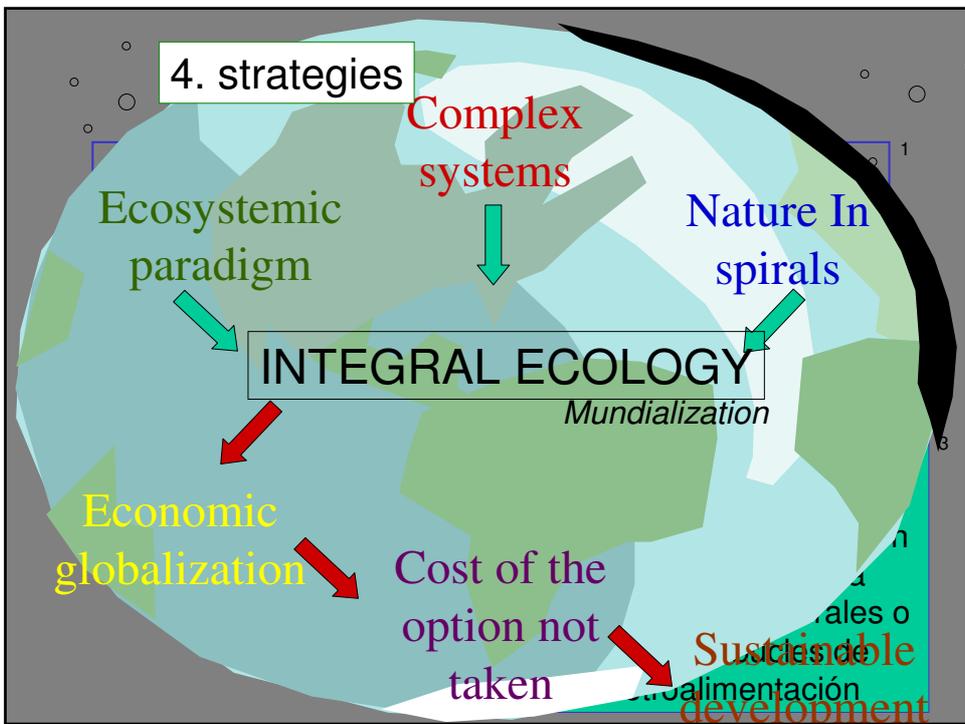
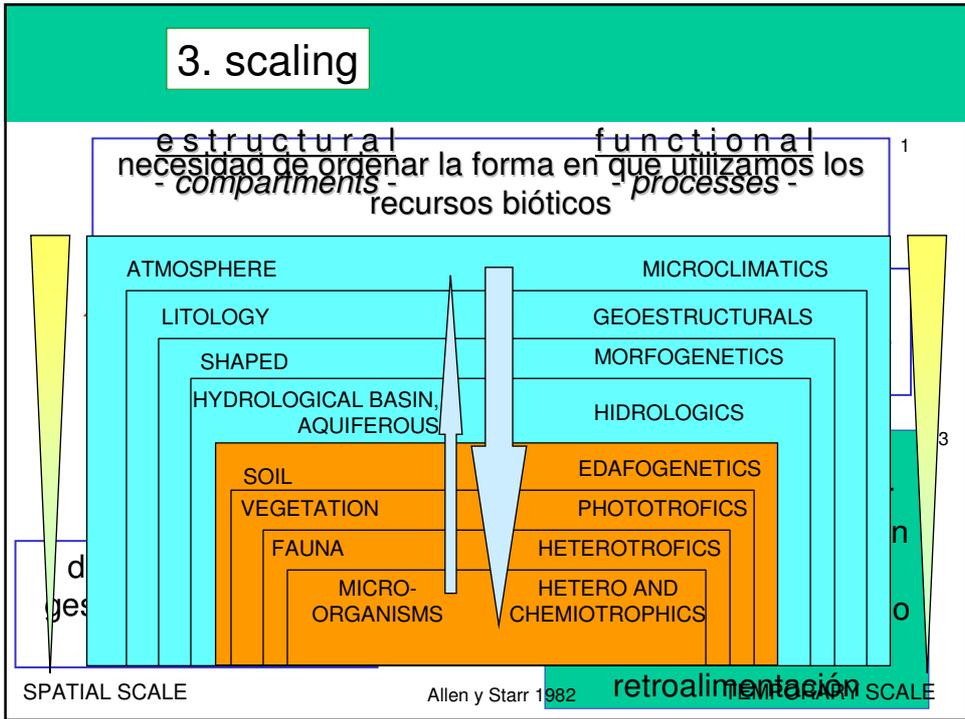
# 1. arrangement

RESERVA FLORISTICA MANEJADA  
SABANAS DE SANTA CLARA  
EXTENSION: 7237 Ha

*This world in which we live is a moral scandal that claims the alteration of the exploitation and of the abandon that weighs on the impoverished ones.*

*Francisco Fernández  
ecología y pobreza: mirar el mundo desde abajo (2003)*





## 5. valuation and indicators

*The valuations of type up-down values the changes directly for the communities and, the ecosystems for the natural way; that is to say the diagnosis of the problems and their causative agents.*  
**necesidad de ordenar la forma en que utilizamos los recursos bióticos**

*The valuations of type down-up use the analysis of simple systems to shape the changes of the most complex natural system (laboratory).*  
**se desarrolla un procedimiento sistemático para describir y estimar la complejidad ecológica – emergencia.**

valoración

**el cual se basa en la**

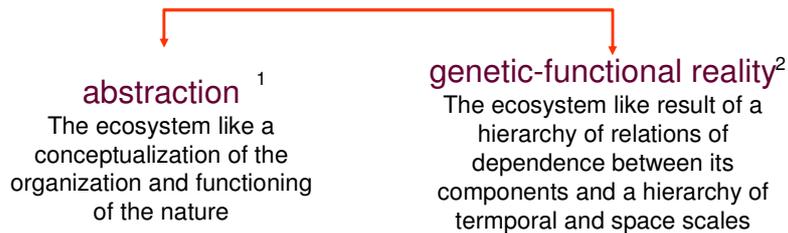
An indicator is a characteristic of the environment that quantifies

- the magnitude of the stress
- the properties of the habitat
- the degree of exhibition to the factor of stress
- the degree of ecological response to its exhibition

CONTROL  
DIAGNOSTIC  
PREDICTION

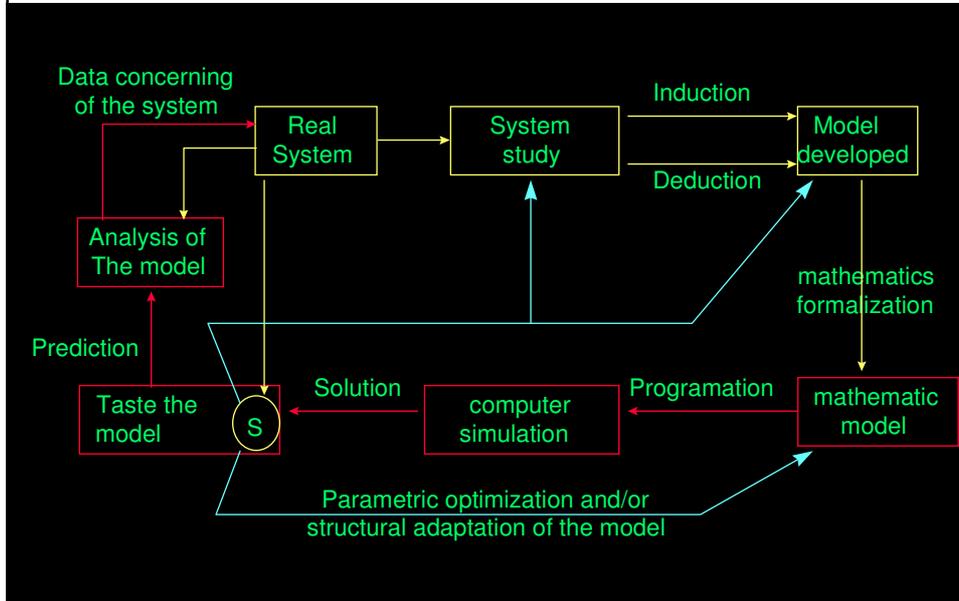
### The Ecosystem...

The managing of the resources address from the functional perspective there are articulated about three inherent meanings of the concept Ecosystem



**landscape<sup>3</sup>**  
 The ecosystem as stage, basically visual, of a complex system of relations biophysics. Plurisensorially is understood as a perceptible entity by operative limits, therefore it can be put into a map

## Ecosystemic functioning

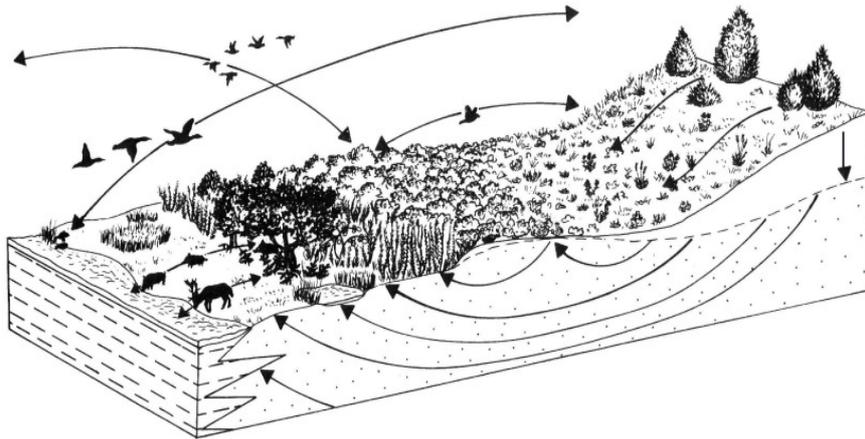


## Ecological operability



*Interpretation of the ecosystem*

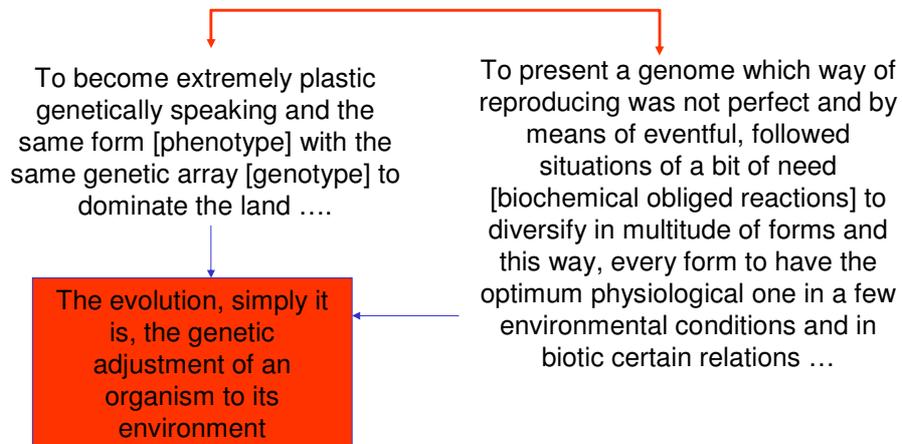
# LANDSCAPE



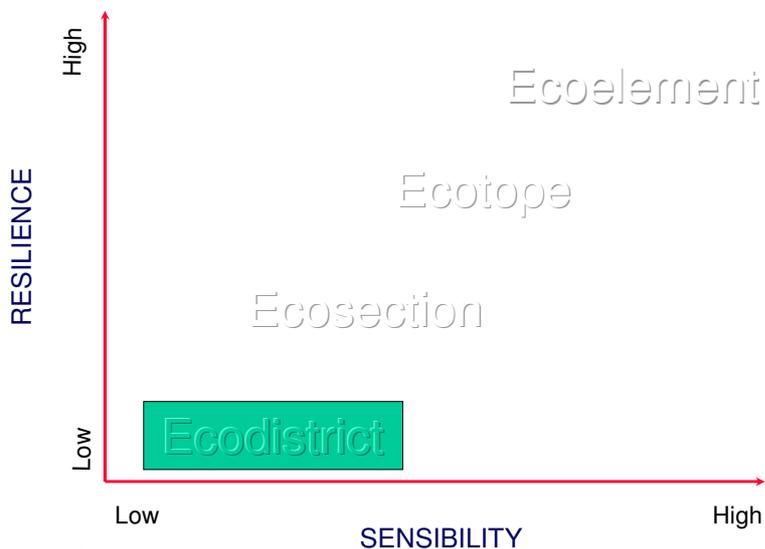
Alcorlo 1998

*Ecology plus evolution*

The life in the earth, when it was originated, could have followed one of two ways

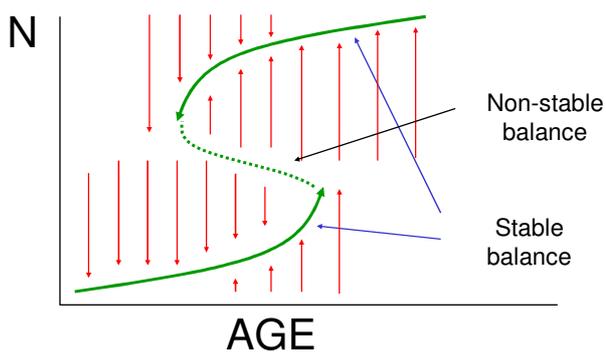


1st Ecological Principle



Montes y col. 1998

2nd Ecological Principle



Stability or balance: it refers to a system that it remains stable though it registers a change (impact).

Qualitative change or discontinuity: it happens when what they are simple quantitative changes they pass to generate a totally different environment.

Thom 1993

## Objectives of the Camécuaro Lake National Park:

The basic objective of the CLNP is to safeguard the scenic beauty of its landscape in order that it could continue being a place of scattering and recreation without compromising the ecological - evolutionary processes that configures its singularities

Associate aims :

- ✓ To preserve the biota and conservation of germoplasm
- ✓ To protect the hydrological natural cycle of the microbasin
- ✓ To foment the creation of an ecological conscience in the visitors
- ✓ To support a space of recreation, leisure, contemplation and sustainable production

## Objectives of the Governing Plan of CLNP Managing

To have a document that serves as a governing instrument where there is established and regulates the integral management of the resources of the Park and the development of the actions needed for its conservation, sustainable use and fulfillment of its aims of creation

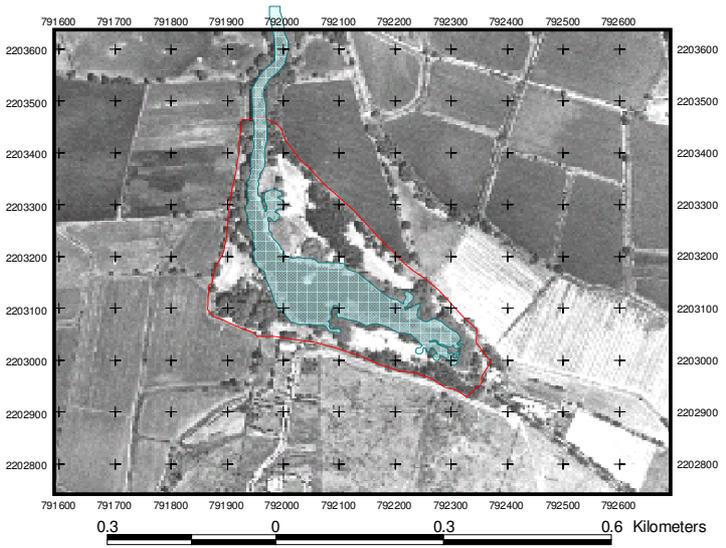
This way, goals and scopes are had to:

- ✓ Short term (1 to 3 years): to implement the Plan of Managing and to strengthen productive successful systems
- ✓ Medium term (3 to 5 years): diversification of activities
- ✓ Long term (5 to 10 years): To increase the protected area
- ✓ Permanent: programs of conservation, sustainable production, education and ecological and economic training



Location of the National Park Camécuaro's Lake

# Lake of Camécuaro



Lago\_camecuaro.shp  
56740.278  
Parque.shp

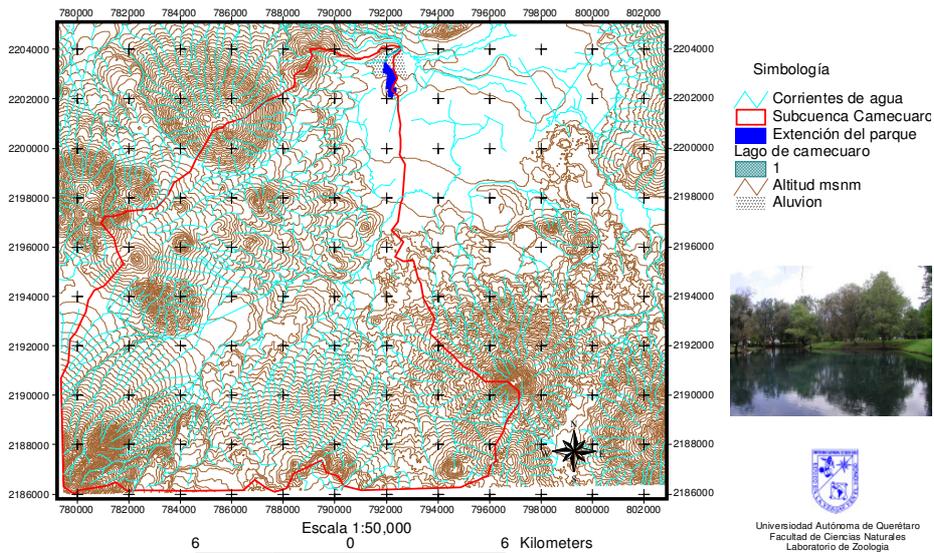




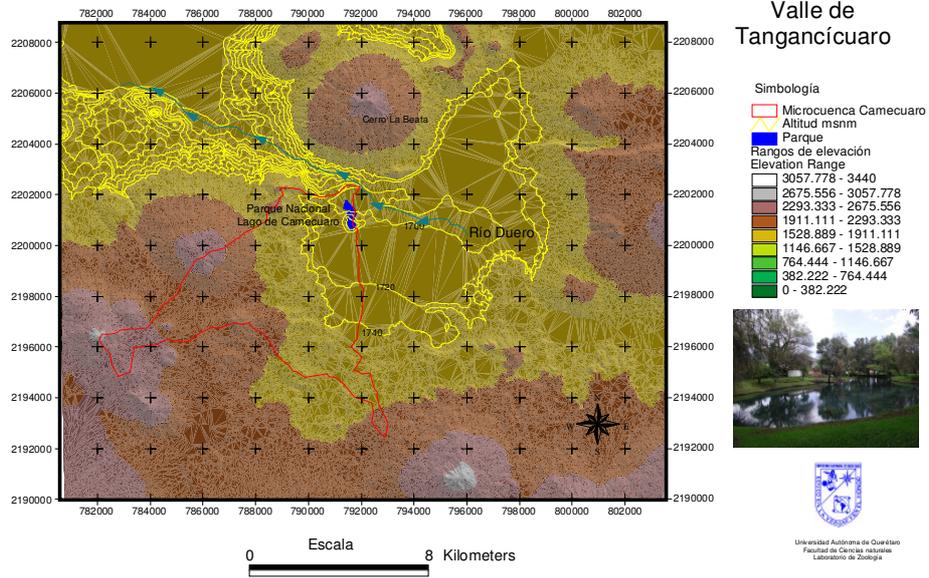
Air photo  
(1:5000) of the  
Camécuaro Lake  
microbasin taken  
in 1995.



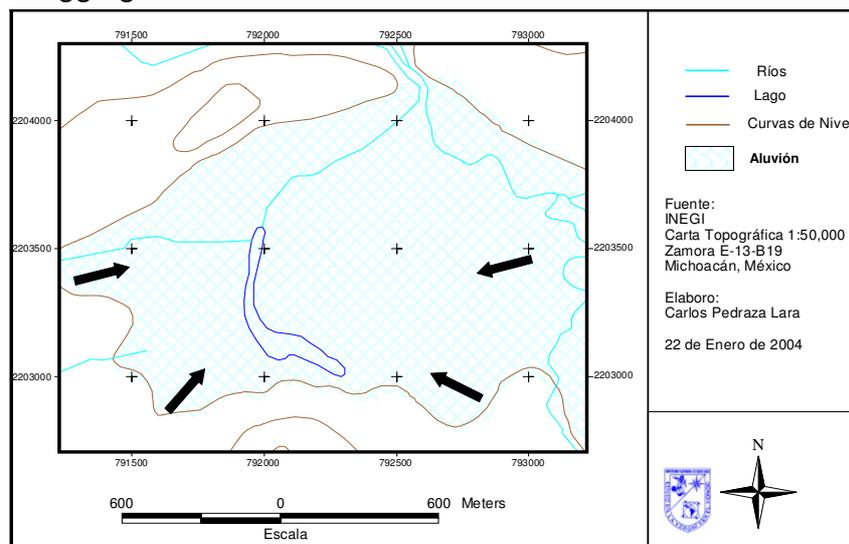
Valle de Tangancícuaro (depression of the river Lerma)  
Microbasin of Camécuaro Lake

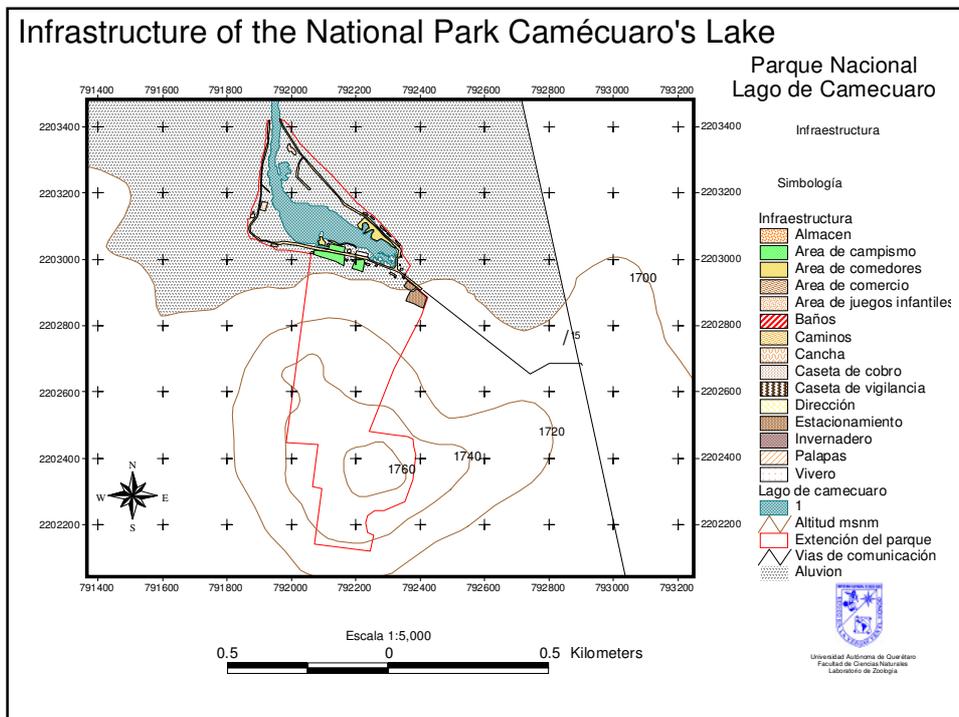
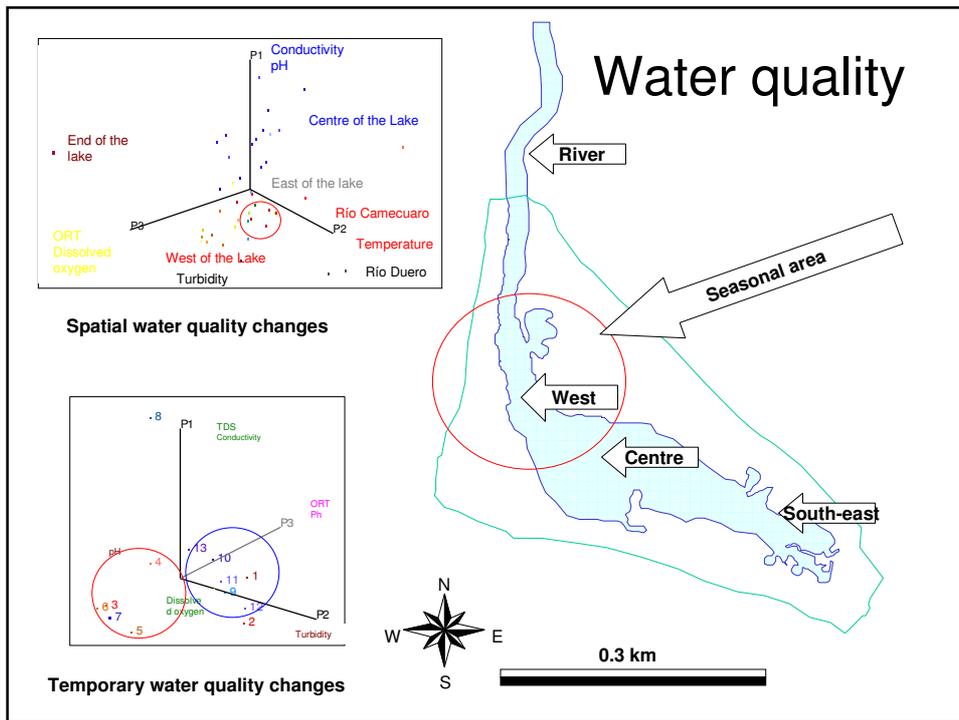


## Alluvium and Microbasin of Camécuaro's Lake



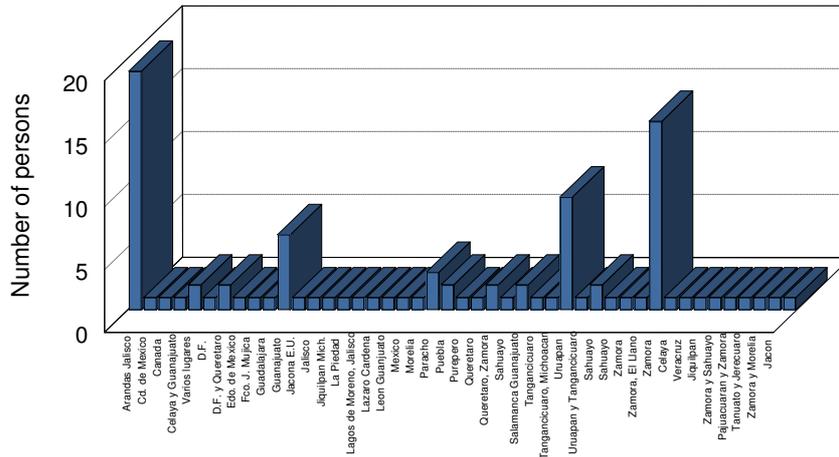
## Principal routes of entry of the forces of energy to the Microbasin of Camécuaro's Lake: water of run-off and dragging sediment





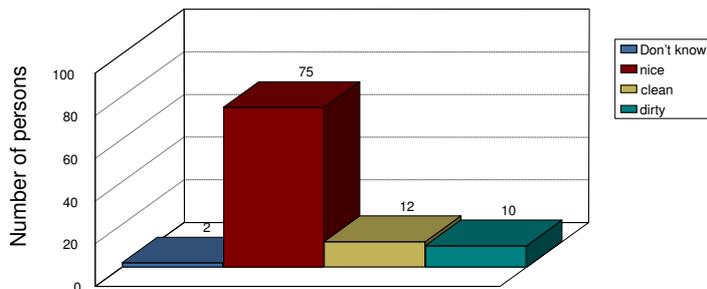
## Social Aspects<sup>1</sup>

Question:  
Wherefrom do you visit us?



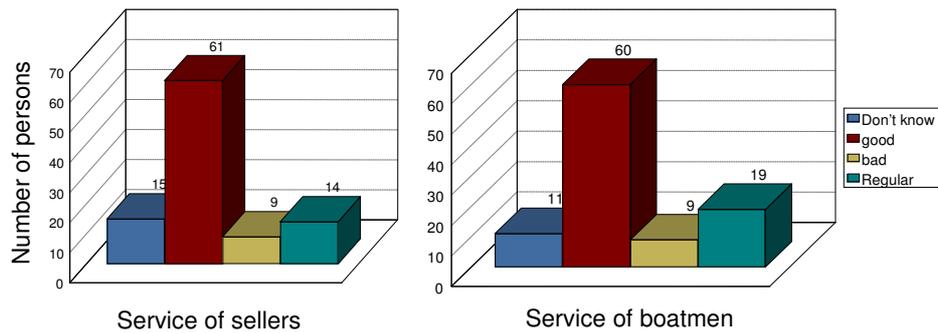
## Social Aspects<sup>2</sup>

Question:  
What did look like to you  
the Park?



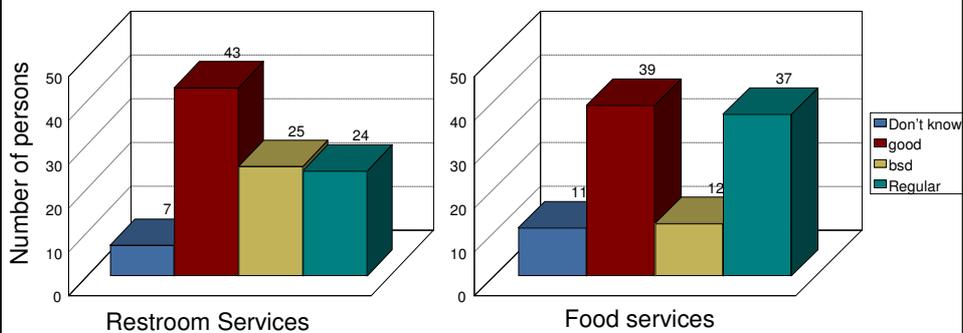
## Socio-economic aspects

Question:  
What did look like to you the service of  
sellers and boatmen?



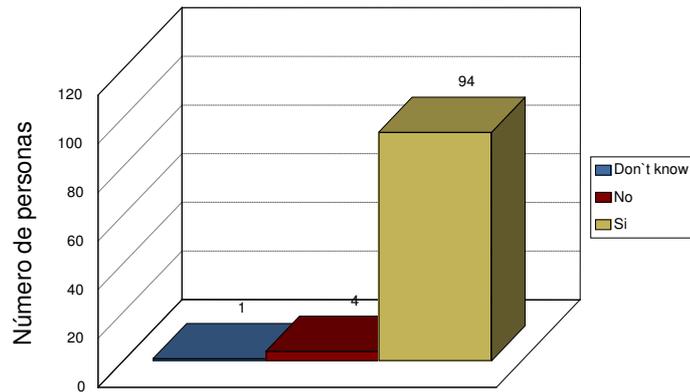
## Aspects of health

Question:  
What did look like to you the service of restrooms and food?



## Conclusion

Question:  
Would you like that one was giving better service of food?



## Biological index<sup>1</sup>



**PLANKTON**  
3 DIVISIONS  
17 SPECIES  
0 NOM-059-ECOL-2001  
2 IMPORTANT SPECIES –BIOINDICATORS  
*Mycrocystis aeruginosa*  
*Merismopedia convoluta,*



**AQUATIC VEGETATION**  
21 FAMILIES  
34 SPECIES  
0 NOM-059-ECOL-2001  
18 ECONOMIC IMPORTANT SPECIES  
Food  
Ornamental  
Medicinal,



**INVERTEBRATES**  
11 ORDENS  
17 FAMILIES  
0 NOM-059-ECOL-2001  
*Procambarus digueti* (A) chapo  
3 ECONOMIC POTENTIAL SPECIES

## Biological index<sup>2</sup>



### FISHES

13 SPECIES

2 NOM-059-ECOL-2001

*Zoogoneticus quitzeoensis* (A) Picote

*Lampreta spadiceus* (P) Lamprea

9 ECONOMIC POTENTIAL SPECIES



### AVES

108 SPECIES

4 NOM-059-ECOL-2001

*Cairina moschata* (P) Pato

*Anas platyrhynchos diazi* (A) Ganso

*Accipiter cooperi* (Pr) Aguillita

*Catharus frantzii* (A) Zorzal

23 ECONOMIC POTENTIAL SPECIES



### REPTILES AND AMPHIBIAN

31 SPECIES

11 NOM-059-ECOL-2001

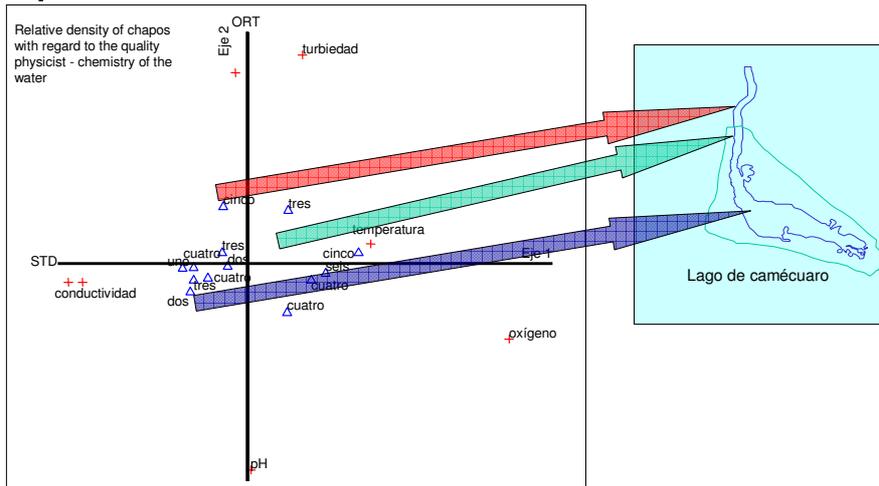
2 ECONOMIC POTENTIAL SPECIES

### MAMMALS

11 SPECIES

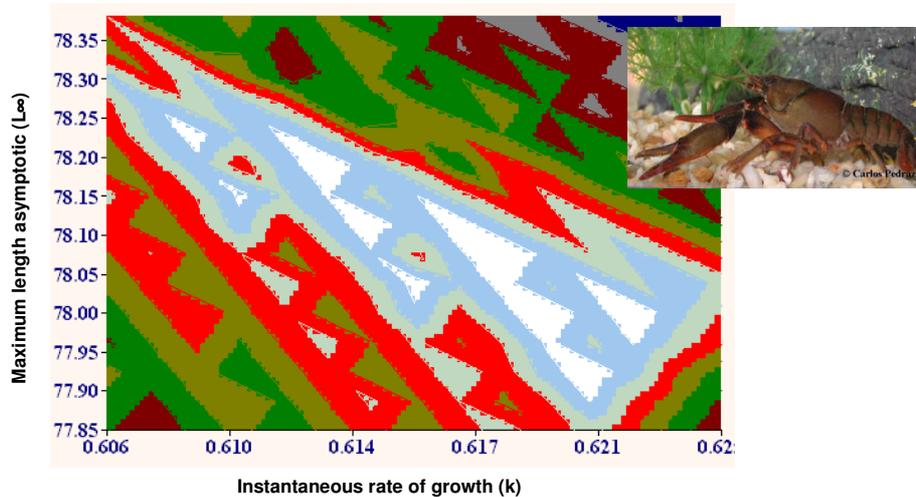
PRELIMINARY LIST IS INCOMPLETE

## Spatial effect of the environment



Analysis of Canonical Correspondence that shows the arrangement of CHAPOS's abundances, in relation to the physicochemical factors (variance accumulated with the first two axes = 84 %). The crosses represent the environmental parameters and the triangles the different densities. The factors associated with the variables in the first axis are the conductivity, Solid total dissolved and Oxygen; whereas with the second axis the pH and the turbidity are associated.

## Temporary effect of the environment



Contour graph for the rate of growth and the maximum growth, which shows the areas in which the environmental conditions of the water propitiate the maximum growth of the chapos in the year. They appreciate clearly two critical points for the maximum growth of chapos, which fits with the periods of major abundance. This information can help to the fishing classification of the resource.

## Principal conflicts: ORGANIZATION

MEMBERS OF A COOPERATIVE	PATRONAGE P.N.L.C.	DIRECTION OF THE PARK	MUNICIPAL PRESIDENCY	INSTITUTIONS
<ul style="list-style-type: none"> <li>•Obsolete, paternalism, apathy centralized decision.</li> <li>•Lack of a plan of work.</li> <li>•Ignorance of their rights and obligations.</li> <li>•the work individual gives itself more that collective.</li> <li>•paralyzed Leaders.</li> <li>•Few participation of the community.</li> <li>•there is no dialog with other actors</li> <li>•Problems of communication among cooperativists.</li> <li>•there is no organization for the marketing of their services.</li> <li>•very limited Services centered on the food sale.</li> <li>•Lost of the vision of sale of services tourist.</li> <li>•there is no clarity of plan of integral managing, much less conservation.</li> </ul>	<ul style="list-style-type: none"> <li>•Autonomy needs.</li> <li>•Problems of communication with the different actors.</li> <li>•do not possess integral project of managing of the park.</li> <li>•Limitation for the management and search of resources with not governmental institutions. its participation meets limited by the municipal policy.</li> <li>•there is no information of the patronage to the society by what the aims are not known.</li> <li>•its function meets limited by the intervention of several institutions</li> </ul>	<ul style="list-style-type: none"> <li>•Problems of communication with the merchants and leaders of the park.</li> <li>•one does not possess a plan of operation multi annual.</li> <li>•Lack an administrative project.</li> </ul>	<p>Problems of capture of decisions for interests of federal and state institutions.</p>	<p>There is no communication of the institutions involved in the conservation and managing of the park.</p> <p>opposite decisions</p> <p>Exist it seems to be that each one takes care mas of its own interests provoking disinformation(misinformation) between municipal patronage - presidency and users of the park.</p> <p>Excessive bureaucracy and protection political clientele.</p>

# Principal conflicts: ORGANIZATION

MEMBERS OF A COOPERATIVE	PATRONAGE P.N.L.C.	DIRECTION OF THE PARK	MUNICIPAL PRESIDENCY
<ul style="list-style-type: none"> <li>•do not have strategic project.</li> <li>•There is no vision of micro-company.</li> <li>•diversification of services is absent.</li> <li>•do not possess a system of promotion and tourist spreading.</li> <li>•do not possess a plan of business for the diversification of the services.</li> <li>•there does not exist plan of tourist promotion.</li> </ul>	<ul style="list-style-type: none"> <li>•has not proposed of long-term project to generate company.</li> <li>•they meet limited of economic resources to reactivate economic activities.</li> <li>•it is needed to involve to other sectors of the society.</li> </ul>	<ul style="list-style-type: none"> <li>•economic dependence and decisions with the patronage.</li> <li>•For the lack of integral project of managing the capacity of management limits, what bureaucrate the activities.</li> </ul>	<ul style="list-style-type: none"> <li>•there meets to the park as a small-cash box of the municipal presidency, which generates discord, intrigue and apathy for taking part of the merchants and boatmen of the park.</li> </ul>

# Principal conflicts: SOCIAL

MEMBERS OF A COOPERATIVE	PATRONAGE P.N.L.C.	DIRECTION OF THE PARK	MUNICIPAL PRESIDENCY
<ul style="list-style-type: none"> <li>•internal Conflicts of the cooperative.</li> <li>•Detached from the society.</li> <li>•The activities that they realize it has the political approach.</li> <li>•personal Interests and not of the cooperative.</li> <li>•Little importance gives him to the conservation of the park.</li> <li>•its vision centered as tourist part, and not as microbasin of protected area.</li> <li>•there is no dialog with the rest of the society and with the municipal presidency and the director of the park.</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>its activities it is prevented by the political interests</li> </ul>	<ul style="list-style-type: none"> <li>•there is no continuity of work for policy.</li> <li>•Policy depends of the municipality and of the patronage.</li> <li>•there is no a project of information and communication towards the rest of the society.</li> <li>•Generates conflicts of political interests for the administration of the economic resources that enter to the park.</li> </ul>	<ul style="list-style-type: none"> <li>The activities of conservation see limited by the interests of the federal and state institutions, which provokes that conflicts are generated to the interior of the groups of Camecuaro's Lake.</li> </ul>

## Diagnosis: Human medium<sup>1</sup>

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- ❖ Lack of knowledge of what it is a National Park, why, what functions it plays in the natural environment and in the social and economic issues
- ❖ The quality of the services must get improved considerably
- ❖ Lack of understanding among the different levels of government (federal, state, municipal and the administrative officer of the park) and the sectors that use the facilities of the park (merchants, boatmen, craftsmen, guides, musicians).
- ❖ It exists too many bureaucracy to solve any problem, since the same manager of the park, must be the technical person in charge of the same one without being able to take own decisions either as manager or as technician, must transmit the decisions to the Patronage, which is the decisive organ.

## Diagnosis: Human medium<sup>2</sup>

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- ❖ There is a visitors' excess.
- ❖ The recreative activities most requested (baths in the lake, trip in boats, children's game, places to eat, etc.) they centre on a very small area located in the area with major number of springs and aquatic native fauna.
- ❖ The commercial establishments are not totally located in an area, but they are located dispersed by the whole Park like conglomerates. This situation impedes the zoning of the park.
- ❖ The commercial disorder generates a chaos in the solid wastes

## Diagnosis: Biotic Medium<sup>1</sup>

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- Phytosanitary problems; Trees burned intentionally; necessary Pruning of trees.
- Some ahuehetes have remained surrounded by a belt of asphalt, separating them from their basic source of water on having hung their system radicular, for what their survival is in risk.
- Soil affected by alelopatic substances of the exotic vegetation: eucalyptuses and casuarines.
- The high part of the new land of the National Park has been used by agriculture purposes, for what it is necessary to regenerate its soil and develop programs to return its natural vegetation.

## Diagnosis: Biotic Medium<sup>2</sup>

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- There are excessive growth of exotic plant species, consuming water as the aquatic iris; as well as of plants who grow in disturbed places.
- In the first term it is necessary to say that it is necessary to realize studies of terrestrial invertebrates and to complete the lists of aquatic invertebrates.
- There are species protected by the NOM-059-ECOL-2001, for what it is commanding, for its survival, to stop the environmental deterioration, the habitat fragmentation, the channeling and the embanking of the rivers and springs, as well as the chemical pollution of the water.
- There is a constant increase of harmful fauna: rates, mice, squirrels. Many species of these groups are carriers of contagious diseases to the man or to other animals.

## Diagnosis: Biotic Medium<sup>3</sup>

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- Increase of erosive processes in the hillsides of the Hill of the Cross and bordering hills.
- The introduction of aquatic species like black bass, rainbow trout, types of bream, tench and guppies, it is one of the major threats that faces nowadays the native fishes of the Lake.
- The alteration continues and fragmentation of the National Park favors the dispersion of some species of animals.

## Diagnosis: Physical Medium<sup>1</sup>

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- ❑ Overexploitation of the aquiferous ones that feed directly and indirectly the springs that give origin to the lake; as well as the channeling of natural riverbeds with purposes of irrigation; the water transfers of a microbasin to other one by means of channels of irrigation or for water of supply for human consumption; and the embanking of the rivers, they are the mainsprings of the physicochemical deterioration, of the alterations in the hydroperiod and the water regime of Camécuaro's aquatic system, affecting directly the biological composition of the zone and its expectations of survival.
- ❑ The felling tree of the hillsides of the microbasin they promote the rate of erosion of the soil, producing higher rates of sedimentation in the river system.
- ❑ The system of irrigation contributes to the increase of chemical and organic pollutants in the water, reverberating in the state of health of the biological populations.

## Diagnosis: Physical Medium<sup>2</sup>

- ❑ Camécuaro's Lake presents one marked regionalization, owed to the multiple environmental factors that impress it.
- ❑ The wrong utilization of the resources of Camécuaro's microbasin, it harms directly the aquiferous one that feeds Camécuaro's springs, since the zones are not restored in their ecologically damaged, recharges rates are lower than in past years.
- ❑ The decrease in the rates of recharges of the aquiferous one they result in discouragement of the wealths of the springs; and as consequence in the flow of the same lake, in its rates of water refill and in the power of its microturbulences that the nutriments help to mix and to break stratifications.
- ❑ The presence of coliforms faecal and mesophyl bacterial in the water of the Lake, they represent a threat for the human health.

## Solutions: human medium <sup>1</sup>

It is needed to have very much dialog and sensibility to involve the already established merchants, boatmen, musicians and ambulant sellers to establish together a program of operative work of conservation, alertness, cleanliness, tourist, like that information also is suitable to propose a reorganization of all the groups in new juridical forms of economic organization, in order to establish a law administrative officer with different purposes such as promote social participation to encourage environmental conservation.

The actions that they propose to continue to preserve Camécuaro's Lake could be:

To consolidate the patronage of an autonomous way in order which it has capacity of management;  
Urgent to have a plan of integral managing in order to manage and to know the real problematics and to depoliticize the ecological managing of the Park;

To elaborate with the merchants a strategic project where they propose:

- Reactivation of their organization; business plan and marketing;
- Plan of tourist promotion; program of diversification of services;
- Program of permanent training; program of conservation; program of improvement of commercial infrastructure and of services;
- To establish agile channels of communication and without bureaucracy with the patronage;
- To elaborate a catalogue of the different species to announce the tourists;
- To elaborate a strategy of permanent and systematic information to the tourists;
- To establish a program of permanent training to all the groups;
- To establish a countable system and of planning participative.

## Solutions: Human Medium<sup>2</sup>

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Finally, in view of the ancient and complex of the internal regulation of the Park and the lack of an administrative regulation, its restructuring is suggested under the following criteria:

- ❖ The patronage once elaborated its own bylaws, of how it is going to operate, and of definition of the prerogatives and obligations of each one of its members; as well as of de-bouocratization and update of the internal regulation, it will to elaborate the administrative and operative system.
- ❖ It proposes that this one must have a board of directors that is the maximum authority of the patronage (in this meeting it will be represented by merchants, civil society, public and private authorities).
- ❖ The board of directors will be the committee in charge of naming the director of the park as well as evaluating permanently the advance, approving the operative annual program and the strategic projects that the director presents to the meeting for its approval, and allow it to manage resources in the different public and private authorities.
- ❖ The administration of the park will have to possess a minimal structure like: an administrative countable area, a technical area of managing and environmental conservation and an area of maintenance.
- ❖ There will have to be elaborated operative annual programs and be generated a system of systematic and permanent information to the patronage. The director of the park will be the person in charge of coordinating, projecting, supervising and establishing strategies to short and medium term for the operation of the park

## Solutions: Biotic Medium<sup>1</sup>

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Camécuaro's lake is in a process of clear environmental degradation due to the ecological deterioration of all its microbasin, there becoming necessary and urgent actions of protection and recovery among those that they include:

- To control the visitors' abundance to the Park, by means of a study of capacity of tourist load of each one of the zones of the plan of managing.
- To realize biological studies with multispecific approach in order to establish the scientific bases for the managing of the different groups of aquatic fauna, with special reference to the protected species by the Mexican authorities.
- To establish areas of biotic reserve, for that of reproduction of the native species;
- To establish programs of environmental education;
- To develop a complete catalogue (biological inventory) of the species;
- To establish a program of redoubling of native species that contemplates the exhibition in aquariums, reptil-houses, etc. And strengthen the programs of environmental education.
- To introduce programs and technologies for the biological conservation of species focused on the preservation of certain natural areas or to the banks of genes. Thinking that the species can be the clearest indicators of the state of health or integrity of the ecosystems, it is important its conservation already is in situ (preserving to ecosystems and its species) or ex-situ (creation of banks of seeds, germoplasm and / or genes) that it is the most viable option for the Park, creating an aquarium and a reptil-house.

## Solutions: Biotic Medium<sup>2</sup>

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To carry out actions of control of the introduced species:

- The impacts and costs of the biological invasions are enormous, so much in ecological as economic terms. To establish programs of utilization of the exotic species, in such a way that the program of uses is also a program of control of the impact of this one populations on the native ones or on its physical environment.
- To carry out actions of control of avoiding new biological invasions, establishing an efficient control and alertness of such species, evaluating the ecological and genetic risks and establishing a better integration and cooperation between sectors and institutions to assure a better strategic planning, a major participation and commitment of the interested parts and a better use of the resources, instruments and general existing procedures of environmental management.
- To develop a program with fishermen and bathers to assure that they have their equipment and suits clean and disinfected at least with chlorinated water, specially if they have led it to other places to going fishing or diving, and they can move in the boots, nets, etc. Spores, microsporas, larvaes of insects, eggs, etc. And to introduce them accidental in Camécuaro's Lake.
- To continue with the program of plant health.

## Solutions: Physical Medium<sup>1</sup>

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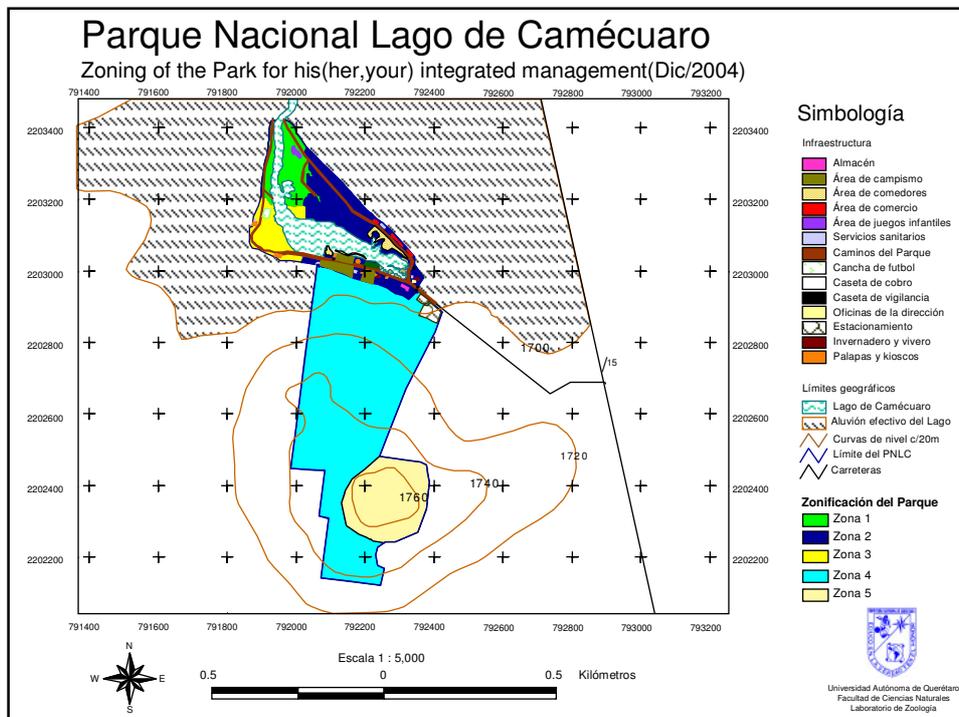
To promote a plan of adaptative management with the current idea of the integral participative ecology, which includes the following concrete actions:

To improve the environmental management by means of changes in the policies, which must be accompanied by programs of ecological restoration of the areas that have been damaged by wrong practices in the use of biotic resources.

- To formulate new legislations where there is born in mind the participation of all groups interested and / or affected by law: merchants, farmers, recollectors of fruits and seeds, cutters of trees, ranchers, town planners, politicians, etc.
- To remember that the policies and already established regulations must not be applied to a place different from that of its elaboration, until the necessary adjustments are done to it, with ecological and economic - social previous studies.
- To stop the felling tree intensifying the alertness in collaboration with the local or federal authorities (Profepa), specially to take care of the zone protected by the CONANP;
- To stop the processes of erosion caused by the disappearance of the vegetation coverture in the hillsides and high part of the mountains;
- Natural barriers use for stop action of the wind and of the water on having transported sediments for the superficial torrential run-offs, product of the deforestation, overexploitation, or wrong practices of compilation of medicinal herbs, etc.

## Solutions: Physical Medium<sup>2</sup>

- ☐ To take care of the alluvium of the overcharge of sediments, specially in the season of rain or of winds;
- ☐ To take care of the lake, specially in its western part of the massive entry of sediments transported by the wind or the torrential run-offs, using traps of sedimentation;
- ☐ To avoid that beech comes out of waters of irrigation, urban drainages or of the wash of the fields of culturing, by means of the creation of a general collector **channel** who takes the water to a plant of biological treatment and who comes out into the river Duero;
- ☐ To control the places for garbage of the Park and of the Municipality to prevent it from contaminating the soil and the underground water for the lixivate of the tailing;
- ☐ To foment a vision of managing resource under the paradigm of the integral ecology, which visualizes to the landscape as a series of microbasins (ecosections) connected in net, being the water the conductive thread of the ecological processes; the ecosystems are not isolated entities, but they have a very narrow relation with the man, for what conflicts take place intra and intergenerational for its use, which relapses into the area of the ecological economy.
- ☐ To promote multidisciplinary groups of work that there include different points of view of the use of the land (agriculture, urbanism, fishing ...) and public dependences (agriculture, communications, environment ...).
- ☐ To join the benefits of the conservation to the benefits of a rural economy and to identify the conflicts between the traditional uses of the resources and the strategies of conservation projected.



# Zoning of the PNLC for its management

## Zona 1

### Priority of conservation

This one is the zone of major ecological fragility and threatened of losing its resilience capacity due to the human activities. Nevertheless in this zone a small area is located by infantile games that there would be necessary to move.

## Zona 2

### Recreation and tourist development

This zone is the most disturbed zone of the Park and the one that visitors' major abundance has. In this area there are located the majority of the services of the Park towards the visitors. Nevertheless, this one is the zone with which the visitor enters direct contact with the nature, for what can be suitable for the development of programs of environmental education.

## Zona 3

### Ecological restoration

This zone of the park has ecological interesting attributes that it is necessary to preserve; nevertheless, the degree of deterioration that it presents they do not make its conservation capable at this moment, for first what it is necessary to restore the ecological damaged processes.

## Zona 4

### Recreation of limited use

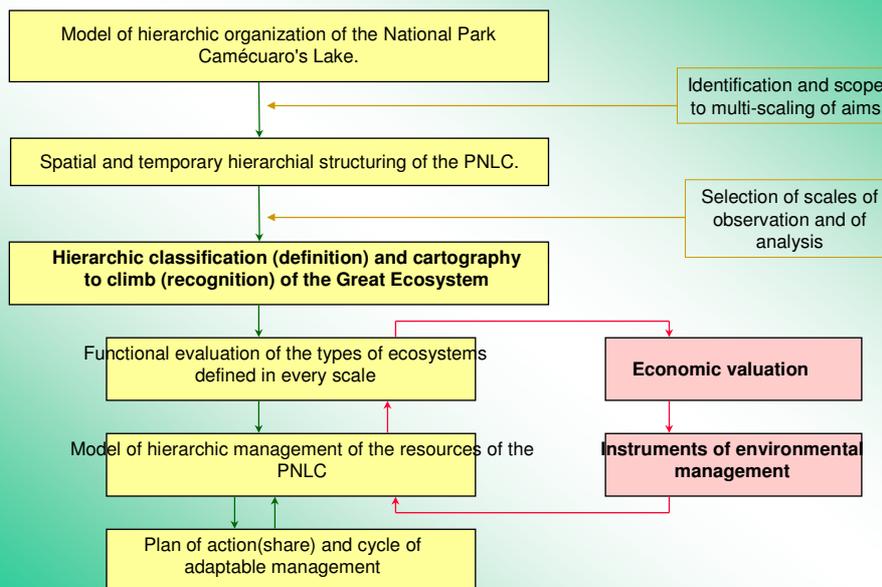
This zone has a moderate degree of disturbance, for what its ecological values are not severely damaged, though maybe they are vulnerable. For its scenic and educational value, its uses must be restricted and propitiate a directed tourism, not only recreative.

## Zona 5

### Ecological rehabilitation

This zone presents a degree of such deterioration that is not possible its restoration, that is to say, the ecological processes and its ecosystemic functioning that survive allow only actions of rehabilitation. Many ecological values have got lost.

# Follow-up



# Evaluation of the Efficiency

