



CENTRO DE ESTUDIOS EN TEORIA RELACIONAL Y SISTEMAS DE CONOCIMIENTO

ECOSYSTEM and ECOTOMO: a NATURE or SOCIETY-NATURE RELATIONSHIP?

ALEJANDRO MALPARTIDA & LEONARDO LAVANDEROS

ECOSYSTEM and ECOTOMO: a NATURE or SOCIETY-NATURE RELATIONSHIP?

ALEJANDRO MALPARTIDA¹ and LEONARDO LAVANDEROS²

1) Corporación Sintesisys
Calle 16 N° 4989, CP 1884 - Berazategui – Buenos Aires, Argentina
ecotomo@netizen.com.ar

2) Corporación Sintesisys
Las Dalias 2893, Providencia, Santiago de Chile
ecotomo@rdc.cl

ABSTRACT

The notion of *entorno* is discussed and its mutual dependence upon the organism is emphasised. Both the etymology and meaning of *ethos*, *oikos*, *entorno* and *ecotomo* are discussed. The intimate relation between Ethology and Ecology is also shown. A reference background is given to explain how the commonly considered isolated components organism/society and *entorno*/nature articulate in the form of a relation. It is argued that the integrated concepts that originated the notion of ecosystem have been set aside. The term *ecotomo* is proposed, which refers to any territorial unit that, considered at a local, regional or global level, emerges from the society-nature relationship.

Key words: *ecotomo*, relations, organism-*entorno*, society-nature.

INTRODUCTION

Simplifying thoughts coming from the time of Descartes and Bacon have influenced general scientific knowledge, in Natural Sciences and especially in Ecology. Many situations or problems that are commonly enunciated as complex, finally tend to “disappear” into a model due to a large process of simplification. A lot of “isms” such as idealism, realism, nominalism, solipsism, dualism and more recently environmentalism are to be added to the paradigm of simplification (Morin, 1984). These concepts have developed in the Sciences, either considered from a chronological or a conceptual point of view (Foucault, 1989), but cannot explain ideas such as environmental problems, environmental dimension, environmental protection, etc., in territorial organisation and planning.

In this paper we propose to overcome the idea of an «environmental dimension» *per se*, commonly considered as a whole, in order to establish it as an emerging component from the society-nature relation. We consider that the environmental dimension results from a differential behaviour of the economic-system reproduction conditions in response to the different combinations of resources in each territory. Thus, the distinction of the environmental dimension is relative to the organisation of each local society-nature system under study.

Even if we start from the smallest disaggregations of any society-nature system, it would not be possible to distinguish major levels of organisation. This situation is due to «the loss of information» that the unit of study suffers because of the change of scales (Lavanderos *et al.*, 1994).

Classification systems in the Natural Sciences are the product of scientists that produced them (Lamarck, 1873: 37,38) in their fields of specialisation and are based on properties that are inherent to objects. For example, the agricultural or forestry «aptitude» of a given soil is the product of an agro-forestry classification. The same way, a county, a state or a district are the result of an administrative classification. In Natural Sciences the distinction of systems, that are arbitrarily separated to be studied, results from researcher observation (Mires, 1990) which depends on his basic theory (Popper, 1982:238; Lakatos, 1983). Thus, soil aptitude for a given purpose neither considers the community involved with its resources nor existing society-nature relations.

Conventional systems of classification obey a dual world conception. They consider neither the reciprocity existing between man-nature / society-nature relations nor the evolution of the former in co-ordination with the latter. On the contrary, they establish potentialities to the « non-human system » according to the benefits that they can report to human society. Thus, natural resources are exploited according to a society's needs which have been determined *a priori* and generated within a political-administrative context. This situation would be quite different if needs were conceived as emerging from the cultural development of a society as a result of its relation with nature.

We assume that culture is emergent from the society-nature relation and that the knowledge generated in this relation will be used to maximise those processes that enable man to reach higher levels of cultural and social development.

The unitary conception proposed in this paper will allow us to begin to work with ideas based on the society-nature relation. The *ecotomo* may be understood as the smallest society-nature unit capable of maintaining its organisation and sustainability. Assuming complexity in the relation presupposes accepting the co-dependence of the object of study upon its *entorno*, the pertinence of the observer to his system of observation (Foester's (1974) second order cybernetics) and the centralisation of the organising unit (society).

THE FIRST CONSIDERATIONS OF *ENTORNO*

Lamarck put special emphasis on investigating living beings in their **circumstances** and stated that such circumstances did not influence directly upon the morphology of those beings. On the other hand, he thought that they worked on habits and customs and that these modified the organisation of living beings. Finally this organisation was expressed in different somatic morphologies (Lahitte *et al.*, 1989:45).

In chapter VII of *Zoological Philosophy* may be read: " *De l'influence des circonstances sur les actions et les habitudes des animaux et de celle des actions et des habitudes de ces corps vivants, comme causes qui modifient leur organisation et leur parties* " (Lamarck, 1873, I:220). Lamarck's circumstances not only referred to what in Ecology is at present known as environmental

parameters but also included the way the organisms behave and conserve themselves: " *Les principales naissent de l'influence des climats, de celle des diverses températures de l'atmosphère et de tous les milieux environnant, de celle de la diversité des lieux et de leur situation, de celle des habitudes, des mouvements les plus ordinaires, des actions les plus fréquentes, enfin, de celle des moyens de se conserver, de la manière de vivre, de sa défendre, de se multiplier, etc.*" (Lamarck, 1873, I:238). This idea of circumstance is close to that of *entorno* in the field of Ecology. The Spanish word *entorno* has a more complete and relational sense according both to Greek language and its etymology. It derives from *en*: between and *tornos*: circular movement (Malpartida, 1991; 1992; Lahitte *et al.*, 1993).

For there to be *entorno* there must be something or somebody. This situation is not necessarily true with words such as *ambiente*, *medio ambiente*, *environ* or *milieu*. However, *umwelt* in the sense of von Uexküll (1945:64) has the closest meaning to our notion of *entorno* (Malpartida, *op.cit.*).

During the first decade of 19th. Century, Jean Baptiste Lamarck and Etienne Geoffroy Saint Hilaire were cloister colleagues. Though they shared the notions about the transformation of living organisms, the latter believed that changes started from the environment since he talked about environmental conditions rather than circumstances. This posture was later called "geoffroyism" (Rostand, 1985:97; Komarov, 1949: 50). The geoffroyism of that time has been kept to present as environmental determinism and has extended to concepts like environmental dimension and environmental protection, among others.

ETYMOLOGICAL AND EPISTEMOLOGICAL CONSIDERATIONS

In 1854 the French Isidore Geoffroy Saint Hilaire (Etienne's son) created the term **Ethology** by combining the Greek words *ethos* and *logos*. But the meaning of the former is somewhat unclear (Smith, 1982; Lahitte *et al.*, 1993). Bateson (1976:108) states that words are dangerous things and that *ethos* in some way is a very bad one.

In translating the Greek alphabet to Latin, it was not indicated how Ethology should be written. Either *épsilon* or *eta* may be the first letter and in each case the meaning varies lightly. If *ethos* is written with *épsilon* it means custom, habit, use, and it has the same root as *etnos* (village, group of people, race) and *ethic*. If *ethos* is written with *eta* it means place of birth, room, habitual residence (Pabón, 1979).

Thus, there exists some confusion about what Isidore Geoffroy referred to with his *Ethologie*. The author defined it as the study of animals in their natural environment. He considered it as a necessary complement to laboratory research such as systematics and comparative anatomy. As this definition implies the environment it is more consistent with *ethos* written with *eta*.

Smith (1982:13) agree with this concept but the latter states that the fundamentals of **Ethology** are the **habit** and the **custom**. This conception is related to the meaning of *ethos* written with *épsilon*. Medawar and Medawar (1988) also support the idea of habit and custom, but what cannot be affirmed is if Geoffroy considered habit and custom in conjunction with each other. Both Lorenz (1985) and Smith (1982) agree that the original idea of Ethology has derived to

present one which concerns the behaviour of animals, while Ecology studies the relation between the organisms and the environment.

It was in 1869 when the German Ernst Haeckel created the term **Ecology** (*oekologie*) referring to the study of the relations between the organisms and the environment. In the widest sense, including all the conditions of existence (Hurrell, 1991). Haeckel's *oekologie* is based on the Greek word *oikos* that means place of birth, house, residence, place of habitation and even to have a home (Pabón, 1979). Thus, it is more consistent with the idea of *ethos* when written with *eta*. Perhaps Haeckel's sense of *oikos* is even stronger if we pay attention to the word *oikopoiós* (= that makes habitable).

Haeckel defends the idea of natural selection involving **active** organisms with respect to the environment (like Lamarck's organisms) and not **passive** ones as those of Geoffroy (that are moulded by the environment). He appreciates the works of all Lamarck, Goethe and Darwin which evident in Chapters IV, V and VI of *Historia de la creación de los seres organizados* (1947), especially in Chapter V: 92-102 where he praises Lamarck. These pages have been included in the Spanish translation of *Filosofía Zoológica* (Lamarck, 1910, 1986). Haeckel would have opposed environmentalism that derives from past and present geoffroyism.

Though many ecologists consider the environment as something exterior to the living, others agree that every organism lives **in its entorno** rather than **in an entorno**. We support the idea of organism-*entorno* constituting a unity that must be studied by Ecology.

The links between Ethology and Ecology are narrower, tighter and more indissoluble than might be thought *a priori*. Ecologists do not study the relationship between organisms and *entornos* independently of the behaviours of those organisms in their *entornos*. This conception is not consistent with Smith's arguments (1982:13), as the author attributes the second task to ethologists.

At this point it should be asked if it is possible to study relations without considering the behaviours that express them and also, if it is possible to inquire into a conduct without taking into account the relations that make possible such manifestation.

The relation organism-*entorno* specifies a systemic context; one in which the relation itself constitutes a communicational system that is expressed in an emergent manifestation usually called **behaviour**. Thus, it is not possible to dissociate behaviour and relation. Ecology and Ethology should be understood as a unified field though having operational differences from a pragmatic, descriptive point of view. Today it is possible to affirm that both notions of Ecology and Ethology tend to a historical recursivity: "... *ni el comportamiento de una especie ni su evolución, se comprenden fuera del marco constituido por el ecosistema en que viven*" (Margalef, 1982:7).

Regarding to our unit of study, the etymology of **ecotomo** is formed from the Greek word **oikos** and **temein**. While the meaning of the first has been discussed above, the latter means cut, abscission, distinction. We are talking about distinguishing « an *oikos* » in its widest sense. *Oikos* does involve the society-nature relationship. *Oikos* cannot be contemplated without society, culture or human beings.

ORGANISM - ENTORNO or ORGANISM versus ENTORNO?

The existence of a duality concerning living beings both belonging to and participating in what surrounds them is in relation to the fact that the observer distinguishes them either through their identity or their difference. We talk about identity whenever the organism is a member: organism system inside *entorno* system. We refer to difference when the organism is a class: organism system either coupled or uncoupled to *entorno* system. Wilden (1979:127) says that "*La puntuación de lo analógico por medio de lo digital es un problema sin solución para la humanidad*".

The distinction between identity and difference is of great importance when examining the capacities of certain theoretical postures. For instance, the "Environment Tracking Theory" of Evolutionary Biology states that the organism is always lightly uncoupled to the environment, delayed in relation to changing environmental pressures (Lewontin, 1979). It is implicit in this scheme that both entities, the organism and the environment, may be defined either by difference in one moment or by identity in another one. In this conceptualization the adaptation is an optimizable process that may be described as oscillating between difference and identity. It may lead to the extremes of considering environments without organisms, potentially habitable environments as in the term bio-space (Dobzhansky *et al.*, 1980) or even "empty niches" (Hutchinson, 1965). Such considerations are of course not consistent with our arguments nor with the concept of *entorno*.

Since the beginnings of Ecology as a science, there has been support for the idea that the organism and the *entorno* conform a unit. Many terms and ideas increasingly closer to that concept have been used. For instance, the first approach to niche (Elton, 1927), the ideas of Jacob (1973) and the concept of *ecoide* as an equilibrated system of actions and reactions between the physical space and the organism (Negri *fide* Gola *et al.*, 1972). Ringuélet (1961) states that the living is inseparable from his environment, from what surrounds him, and in which he performs his activities. However, the Cartesian dualism has infiltrated each concept sooner or later; it is noticeable in any definition. It is not possible, at least up to the present, to conceive this unity while we live in and generate such ambiguity.

By considering that an organism is **in its** *entorno* the problem of identity and difference between them is diluted (Wilden, 1979:318). Whether the organism is **in** an *entorno* (to belong to / to be member of) or if it is **with** an *entorno* (to be different from / to be of the same class as the *entorno*) are no longer questions. They become subsumed in a meta-question: the unity of an organism **in its** *entorno*. This mutual dependence (eco-dependence) considers a shared origin from which neither life without an *entorno* nor an empty *entorno* can be considered. Differing from the Environment Tracking Theory, in this scheme adaptation is a condition in the maintenance of the organism-*entorno* system. If it does not occur the reference unit either becomes pathological (which is another system) or disappears.

The Autopoiesis Theory (Maturana & Varela, 1982) reflects the auto-organisational capability of living beings as systems. But the capability of forming itself - *autos* - (Morin, 1984) is inserted in the co-dependence that the "auto-organised" reference system has with its surroundings (Foerster, 1976). Following Morin (1983), *autopoiesis* requires *oikos*. The living being generates,

organises and reorganises itself permanently within the ecoorganization. Lahitte *et al.* (1987) state that while the word **autopoiesis** has its Greek correlate *autopoios* (= that grows spontaneously), **ecopoiesis** is the correlate to *oikopoios* (= that makes habitable).

Making reference to systemic levels of organisation, ecopoiesis is to the class as autopoiesis is to the member. That is to say, considering organism-*entorno* as the unit, the organism is autopoietical with respect to the unit, while the unit, as an emergent of organism-*entorno*, is ecopoietical. The organism-*entorno* relation constitutes the basic ecological unit. For this reason it is convenient to think about it as the minimal unit of survival, but not to consider the organism, population or species as individual entities, conceptually isolated from their *entorno*.

FOUNDATIONS FOR A RELATIONAL UNIT CONCEPT

Cartesianism and the image of a human world disjunctive from a natural one have been and continue to be the classical argumentative style used in science. Thousands of opposite expressions of the same argumentative axis can be given. For example, subject and object are *a priori* entities; chance consists in a measure of maximum indetermination; not yet determined regularities are called chaos; and so on.

Such a dual world is principally based upon the object, or better yet upon the "subject's objectivity".

This objectivity allows the validation of arguments by reference to experience, which corroborates the objectivity of the subject tautologically. The consideration of a philosophy of relations has had very little place in the classic conception of our world. For most scientific bodies this is a world full of factual objects that "are given" to scientists, who must then elucidate any kind of action (inter~, trans~, co~, etc.) among these objects.

From a philosophical point of view, the relationship is closely akin to a temporal/historical conception of experience. Along the history of knowledge, principle of identity and the descriptions of characters inherent in objects sustained in science, have long been in correspondence to basic conceptions such as essence, substance and the autonomous character of reality. The relational concept is immersed in experience, situation and circumstance; there is no possibility of experience without history. Irreversibility emerges as a condition of experience and not only as a reformulation of the thermodynamics of Prigogine's linear irreversible processes.

From a relational point of view, irreversibility is understood as the logic of history. Historical processes comprise the logic of "what is alive". Thus, the idea of probability emerges from irreversibility and not the converse (Paci, 1954). As entropy is usually defined statistically as the most probable state, it cannot be considered the basis of irreversibility. Since entropy is a form of probability, it is a result derived from irreversibility rather than a condition for it. In this scheme, irreversibility only requires process, novelty and organisation, and is basic to the conception of systems.

Since any communication must enter into the relational space of human nature and in so doing into the process of experience and history, reality emerges from this historical-existential situation

and it can only be comprehended and ordered inside the situation itself. Paci (op.cit.) says that the major fault of traditional metaphysics consists in considering the object itself as the substance of being and isolating "the world of substance" from "the world of experience".

To leave aside the relationship and the emergent feature of experience in decision making is to believe that the statements that scientific arguments have no context of significance, that events without process or history characterise the subject of a relationship and that they are the bases for both subject's objectivity and argumental validation.

At this point of discussion it can be asked what kind of ideas we generate with reference to relationships. Are they unchangeable images of a given world that is submerged into a mechanical determinism? Or, are they changing, dynamic, different possibilities derived from a historical comprehension of natural social processes?

THE SOCIAL FEATURE IN THE ORGANISM-ENTORNO UNIT: THE *ECOTOMO*

Environment and *entorno* must be distinguished as different concepts. All the parameters distinguished by an observer without considering the organism constitute the environment. Everything that is specified by the organism is *entorno* and it is expressed by the present emergent behaviours of their historical relationship. It is clear that the former idea makes no reference to the relational unit organism-*entorno*, which is the basis of the latter. Since the concept of *entorno* comprises historical processes, in this context there is no individual, species or population evolution, but an organism-*entorno* evolution.

The access to *entorno* of any organism is not necessarily experienciable by the observer. We cannot determine the *entorno* of a starfish or a T-virus, we only know that they do discriminate something. From our observer viewpoint and through the relations generated, we postulate that they answer to differences.

The *entorno* must be treated from a monist conception (Lavanderos *et al.*, 1994), as the product of a relation in our case. In complex units such as the society-nature relation, the *entorno* is evidently expressed through culture. It is the society as an organisation of relations and transformations which operates on a given environment both **fitting it in *entorno*** and re-creating those relations that eventually define its identity as society-*entorno*.

The generation of information, as part of the process of maintaining the organisation of the organism-*entorno* unit, is directly orientated to the conservation of identity: *idem*, of a group and *ipse*, of self-reference (Morin, *op.cit.*). That is, the decisions must conserve the organisation. On this basis an organism that destroys its *entorno*, destroys itself (*ipse*).

For the same reasons that the dissociation of an organism and its *entorno* is not acceptable, any explanation of society development is inadmissible if only based on «internal relations» without making reference to an *entorno* which is generated by society and which makes possible the organisation of society.

The concept of ecosystem as introduced by Tansley (1935) and later developed by Lindeman (1941), who conceived it only in terms of energy exchange, has varied from its original sense in different uses and partial meanings over the years. For instance, the general confusion generated between the environmental point of view and the ecosystemic one (Vallentyne, 1993) or when natural and human ecosystems are considered as different. Moreover, for many ecologists the idea of ecosystem, instead of being an integrating concept, has become an « external object ». It is worse yet when in a scientific paper it is possible to read « Present (simplified) landscape of a small river valley village in the Norte Chico showing highly disturbed ecosystems and bioresources suffering from "artificial negative selection"» in a graphic footnote (Ovalle *et al.*, 1993). It is necessary to have a unit that makes it possible to dissolve the opposition between social and natural states, as the ecosystem concept has proved to be unsuccessful to resolve this dichotomy.

Taken as a system, **we define the *ECOTOMO* as the whole of the relations that is capable of maintaining the emergent organisation of the society-nature complex unit, which at the same time is capable of re-organising and reproducing itself in a manner that permits its energetic and informational sustainability along the space-time axis.**

Ecotomos do not possess strict limits but diffuse frontiers. They must be thought of as auto-organised units without forgetting the contours that allow their re-organisation. Both the *ecotomo* and its constituent process must be considered in relation to their organisation, structure and architecture, the first of these giving an *ecotomo* its characteristic of stability.

The organisation is defined by the whole of relations existing among the components that qualify the unit and that the observer distinguishes as belonging to a given class within its reproductive process. The structure corresponds to the relations of the unit components that enable the emergence (by means of re-enforcement and restriction) of a given organisation. The architecture is the aspect that allows the representation of the topological relations of the involved components.

Because the organisation of the unit must be conserved, it is necessary to determine which processes characterise its continuity through time. That is to say the production mechanisms of units that are all historical process. The concepts of replica, copy and reproduction express the strategies of production of the unit of study (Maturana y Varela, 1982; 1984). The historical process is defined as the state that emerges from the modification of a previous state (Maturana y Varela, 1982) and cannot be considered trivially in the sense of Foerster (1976, 1985).

CONCLUSION

The *ecotomo* is the ecological unit proposed in this paper. Since the possibility of establishing units in a territory begins only when the distinctions enter into the space of human communication, and thus are shared by a society, it is not possible for the so-called natural units or ecosystems to exist independently of the society that contemplates them. In fact, conservation, management, exploitation of natural resources are directly related to society. Therefore, thinking of ecosystems existing outside the ecological planning of territories is false and only corresponds to the idea of keeping society and nature concepts apart. This practice cannot be supported any longer unless one insists that scientific knowledge must continue to be based upon the Cartesian paradigm.

Thinking about and re-creating the idea of *entorno*, as stated in this paper, implies both an aesthetic and ethic re-education. It involves a different way of acting. *Entorno* is not "something out there", it must be understood as the emergence of our behaviour, which at the same time modifies our actions. The *entorno* is not independent of us, nor are we independent of it.

In this context, we no longer act upon forest, aquatic or grasslands ecosystems as if they were outside of society. We act upon *ecotomos* which - being the society-nature emergence - involve our future actions. Thus quick foreign-model-based decisions, far different from those merging from local society-nature relations, should not be taken any more. These constitute the fundamentals of a profound change that, emerging from Ecology theory, projects the possibilities of a way of living that has still to be learnt. We should start from totalities in order to reproduce totalities and should not conceive the idea of a world dissociated into nature, social or cultural states existing independently.

ACKNOWLEDGMENTS. We want to thank Lic. Patricia Pastore and Dr Lafayette Eaton for the critical review and translation of the manuscript.

BIBLIOGRAPHY

BATESON, G. (1976). Pasos hacia una ecología de la mente. Carlos Lohlé Editorial. Buenos Aires,

DOBZHANSKY, Th., F. AYALA, G. STEBBINS, J. VALANTINE. (1980). Evolución. Editorial Omega. Barcelona.

ELTON, C.S. (1927) Animal Ecology. Sidgwick and Jackson, London.

FOERSTER, H. von. 1976. *Sobre sistemas autoorganizados y sus contornos*. En: Bonfill, J.(Editor): *Epistemología de la comunicación*. Ed. Torres , Valencia.

FOERSTER, H. von. 1985. *Máquinas triviales y no triviales*. II° Coloquio International IFTC, Institute de Formation et d` Application des Therapies de la Communication. St. Etienne, Francia.

GOLA, G., NEGRI, G. y C. CAPELETTI (1965). Tratado de Botánica.Ed. Labor S.A. Barcelona.

HAECKEL, E. (1866). *Generelle Morphologie*. Berlín, Reimer.

HAECKEL, E. (1947). Historia de la creación de los seres organizados. Buenos Aires, Editorial Americana.

HURREL, J. (1991).Evolución de la Ecología. Reflexiones sobre la Morfogénesis de la Ecología como actividad científica. *Ecognición* 2 (1):47-58. Universidad CAECE , Buenos Aires.

HUTCHINSON, G.E. (1965). The ecological theater and the evolutionary play. Yale University Press,

KOMAROV, V. (1949). Lamarck. Ed.Lautaro. Buenos Aires.

LAHITTE, H.B., J.A HURRELL y A.R. MALPARTIDA. (1987). Relaciones: De la ecología de las ideas a la idea de ecología. Ed. Nuevo Siglo.

LAHITTE, H.B., J.A HURRELL y A.R. MALPARTIDA. (1989). Relaciones 2: crítica y expansión de la ecología de las ideas. Ed. Nuevo Siglo. La Plata.

LAHITTE, H.B., J.A HURRELL y A.R. MALPARTIDA. (1993). Ecología de la conducta. Nuevo Siglo. La Plata.

LAKATOS, I. 1983. *La metodología de los programas de investigación científica*. Editorial Alianza Universidad. Madrid..

LAMARCK, J.B. (1835). *Histoire Naturelle des Animaux sans Vertèbres*. Libraire J.B. Ballière, Paris.

LAMARCK, J.B. (1873). *Philosophie Zoologique*. Librairie F. Savy. Paris.

-----, 1910. *Filosofía Zoológica*. Sempere y Co. Editorial. Valencia.

-----, 1986. *Filosofía Zoológica*. Editorial Alta Fulla. Barcelona.

LAVANDEROS, L., GASTO J. y RODRIGO, P. (1994). *Hacia un ordenamiento Ecológico-Administrativo del Territorio. Sistemas de Información Territorial*. Ministerio de Bienes Nacionales, Pontificia Universidad Católica de Chile, Universidad Católica de Valparaíso, Corporación Chile-Ambiente.

LEWONTIN, R. C. (1979). La adaptación. pp. 139-151 En: Piel, G., D. Flanagan, F. Gracia, F. Bello, P. Morrison, T. E. Bell, B. P. Hayes, J. B. Piel, J. P. James, T. Rogers, A. Schwab Jr., J. B. Tucker, J. M. Valderas y J. Wisnowsky (Editores): *La Evolución, 1979*. Editorial Labor, Barcelona.

LINDEMAN, R. 1941. Seasonal food-cycle dynamics in a senescent lake. *The American Midland Naturalist*, 26: 636-673.

LORENZ, K. (1985). *Consideraciones sobre la conducta animal y humana*. Barcelona, Planeta.

MALPARTIDA, A.R. (1991). La noción de entorno en etología (una discusión etimopistemológica). *Ecognición*, 2(1): 39-46. Universidad CAECE, Buenos Aires.

MALPARTIDA, A.R. (1992). Caracterización Eco-Etológica de *Fulica leucoptera* Vieillot. en los arroyos asociados a la laguna de Chascomús, provincia de Buenos Aires. Tesis Doctoral N° 591, Facultad de Ciencias Naturales y Museo de La Universidad Nacional de la Plata - UNLP.

MARGALEF, R. (1982). *Ecología*. Editorial Omega. Barcelona.

MARGALEF, R. (1991). *Teoría de los sistemas ecológicos*. Publicacions de la Universitat de Barcelona. Barcelona.

MATURANA, H Y VARELA, F. (1982). Teoría de la autopoiesis. Cuadernos del GESI (Grupo de Estudio sobre Sistemas Integrados), N° 4. Buenos Aires.

- MATURANA, H. y VARELA, F. (1984). El árbol del conocimiento. Las bases biológicas del entendimiento humano. Editorial Universitaria. Santiago de Chile.
- MEDAWAR, P. y J. MEDAWAR. (1988). De Aristóteles a Zoológicos: un diccionario filosófico de biología. Fondo de Cultura Económica, Mexico.
- MIRES, F. (1990). El Discurso de la Naturaleza. Ecología y Política en America Latina. Editorial Amerinda. Santiago de Chile.
- MORIN, E. (1984). Ciencia con conciencia. Editorial Anthopos. Barcelona.
- OVALLE C., ARONSON J., AVENDAÑO J., MENESES R. Y R. MORENO. 1993. Rehabilitation of degraded ecosystems in central Chile and its relevance to the arid "Norte Chico". Revista Chilena de Historia Natural. 66: 291-303.
- PACI, E. (1954). *Tempo e Relazione*. Taylor-Torino, Torino.
- PABON, J. (1979). Diccionario griego-español. 11va. Edición. Vox. Barcelona.
- POPPER, K. 1982. La evolución y el árbol del conocimiento. pp 237-249. In: *Conocimiento objetivo*. Editorial Tecnos, Madrid.
- RINGUELET, R. (1962). Ecología acuática continental. Buenos Aires, Editorial Eudeba.
- ROSTAND, J. (1985). Introducción a la historia de la biología. Barcelona, Planeta.
- SMITH, J.W. (1982). Etología de la comunicación. Fondo de Cultura Económica. Mexico.
- TANSLEY, A.G. 1935. The use and abuse of vegetational concepts and terms. *Ecology*, 16: 284-307.
- UEXKULL, J. von, 1945. *Ideas para una concepción biológica del mundo*. Espasa-Calpe, Buenos Aires.
- VALLENTYNE, J.R. 1993. *Fundamentos biosféricos del enfoque ecosistémico*. pp 9-17. En: A. Boltovskoy y H. Lopez (Editores). 1993. Conferencias de Limnología. Instituto de limnología «Dr. Raúl A. Ringuelet». La Plata.
- WILDEN, A. (1979). Sistema y estructura. Alianza Editorial., Madrid.