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In what measure is urban ecology a biological science?*

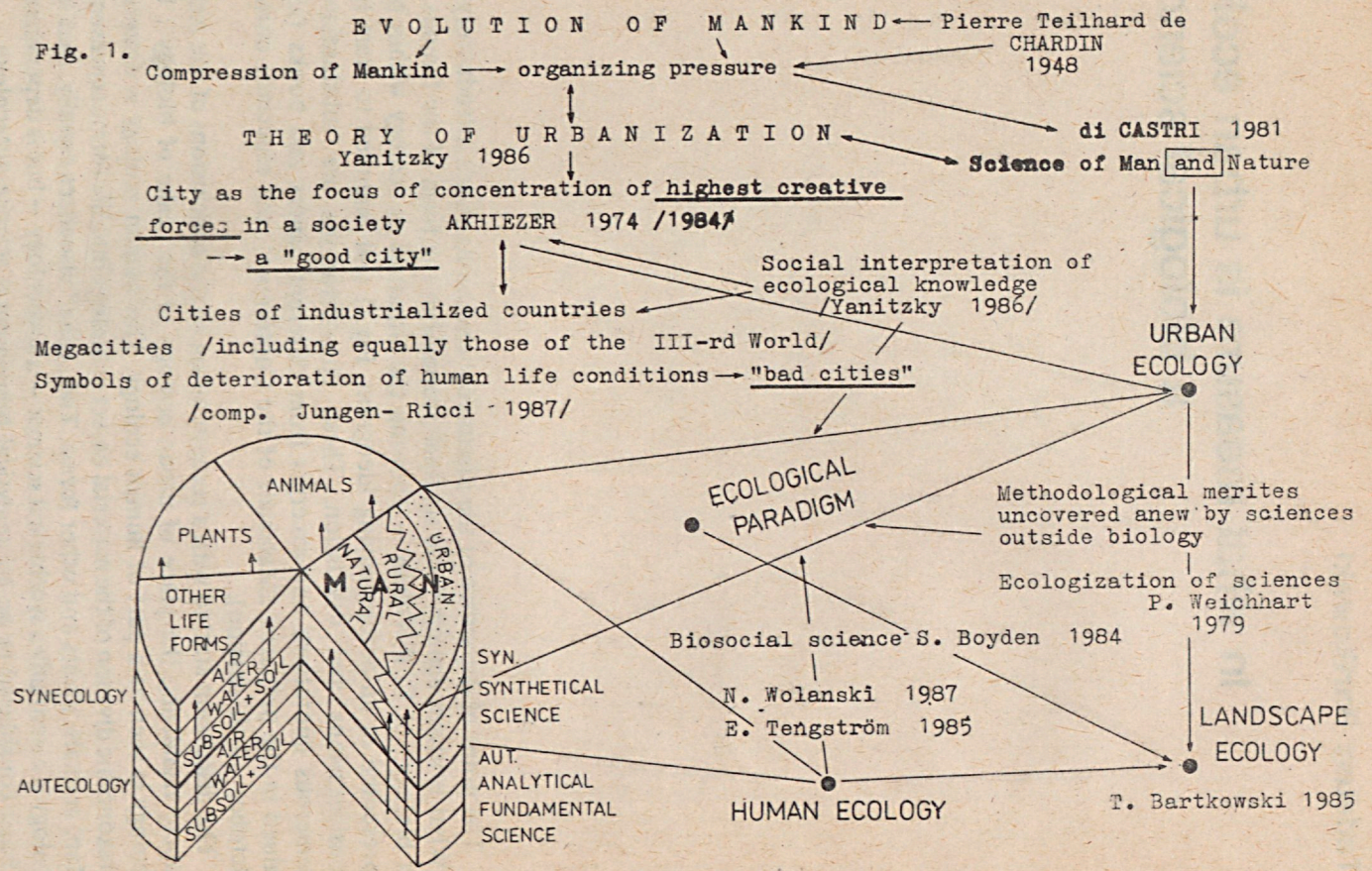
The point of departure of the discussion was the Author's introductory paper „What is urban ecology" and its final proposal in the form of the famous „cake of biology" of E. P. Odum – showing the situation of ecology within biology (presented in an accompanying ideogram, Fig.1) and intended to start further considerations and discussion. These considerations are substantiated by numerous quotations and excerpts from different papers and books (as contained in the prepared „Materials of the Conference" and especially during the October 18-th session).

The discussion started with a recapitulation of the conclusions of the Author's paper, visualizing the place of urban ecology in the „cake of biology", Urban ecology is seen as a part of human ecology. This human ecology is discerned as a taxonomic division of the material object of biology into life forms represented by Man, animals, plants and other forms. The „cake" visualizes equally, that human ecology is essentially a synthetical science – a synecology – but is dependant upon a basis considered to be an analytical fundamental science-autecology.

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* Some results of the discussion at the Conference „Upon the Notion of Urban Ecology", held in Poznań, October 26-29 1987.

Fig. 1.


EVOLUTION OF MANKIND
Pierre Teilhard de CHARDIN 1948
Compression of Mankind
organizing pressure
THEORY OF URBANIZATION
Yanitzky 1986
di CASTRI 1981
Science of Man and Nature
City as the focus of concentration of highest creative forces in a society AKHIEZER 1974 /1984/
a "good city"
Social interpretation of ecological knowledge /Yanitzky 1986/
Cities of industrialized countries
Megacities /including equally those of the III-rd World/
Symbols of deterioration of human life conditions
"bad cities"
/comp. Jungen- Ricci 1987/
URBAN ECOLOGY
ECOLOGICAL PARADIGM
Methodological merites uncovered anew by sciences outside biology
Ecologization of sciences P. Weichhart 1979
Biosocial science S. Boyden 1984
N. Wolanski 1987
E. Tengström 1985
LANDSCAPE ECOLOGY
T. Bartkowski 1985
HUMAN ECOLOGY
ANIMALS
PLANTS
OTHER LIFE FORMS
AIR
WATER
SOIL
SUBSOIL
NATURAL
RURAL
URBAN
SYNECOLOGY
AUTECOLOGY
SYN. SYNTHETICAL SCIENCE
AUT. ANALYTICAL FUNDAMENTAL SCIENCE

As we can conclude from this visualization urban ecology is considered *basically as a biological science*. The discussion showed that *one cannot accept this concept without restrictions*, that there are doubts that arise from a more attentive consideration of the meaning of the two composing words of the name of this science: what does mean „ecology" in general and what does „urban" and „town" mean?

The first topic is indicated with the key word *ecological paradigm*. It stems directly from the Haeckel's definition of ecology as „relations of organism(s) to its (their) environment (Umwelt)", It concerns also *the interaction system* consisting of „supplying organism(s) from outside" – also a spatial relation. This supply consists of flows, of thoroughputs of matter, energy and information from the environment to the organism(s) and from the organism(s) to the environment (action and reaction). It is a property of an organism to be an *open system*, fed (subsided) and maintained by inputs and leading to outputs and this constatation reveals very well the merits of considering *open systems in the studies of interaction systems* (the very object of ecology in general). Thanks to this there can be observed in the science a wide tendency for the so called „ecologisation" of the sciences (see P. Weichhart 1979). The methodological merits of ecology, very strongly supported by the well known v. Bertalanffy's „General Systems Theory" (1951) have been *discovered anew* since Haeckel's time (1866) *by sciences outside biology* and have been used in the form of the said *ecological paradigm* which is conceived as a general methodological approach in the systemic study of the interactions. Valuated is also not simply ecology as a biological science but as the ecological paradigm, which is something different and much wider than a narrow biological point of view.

To this area of concern about ecology in general belong considerations concerning the ecology e.i. *human ecology* (see N. Wolański 1987, E. Tengström 1985 and T. Bartkowski and J. Nowak 1987) as a *biosocial science* (see S. Boyden 1984) and the „social interpretation of ecological knowledge" (O. Yanitzky 1986), Man as the bearer and builder of culture deserves an other approach then that of solely biological beings, e.i. animals. It is generally recognized that there exists *a fundamental antinomy between nature and culture* and especially between the biological and cultural *flow of information* in organism(s) and their groupings. Let us discuss this topic in more detail.

The adjoining second diagram (Fig.2) visualizes different ways of flows of information in populations and in organisms, as they have developed in the course of becoming the *antinomy nature-culture*. In „I" we have the flow of information, of biological information, by means of the „genetic code" while in „I A" there focusses upon information being constantly and infinitely (E) transferred from parents to offspring *without any accumulation*, e.i. without its growth. The only changes in information occur by means of mutations (generally speaking) that are added to the biological information and because this information does lead not to the transformation of biological information *biological organisms do not form culture* e.i. do not augment their inherited knowledge. This same transfer of

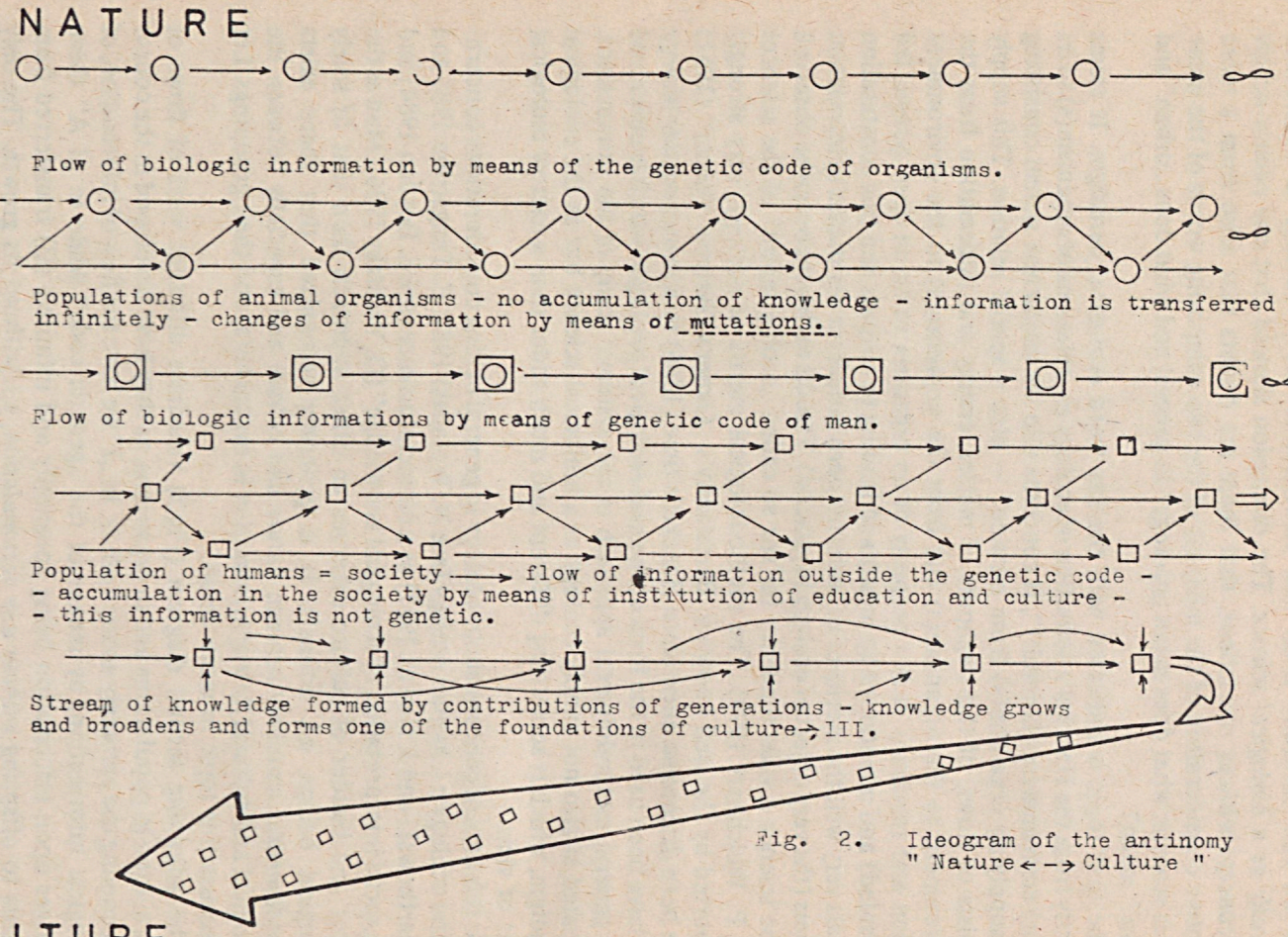


Fig. 2. Ideogram of the antinomy " Nature ← → Culture "

information occurs (in general) by means of the genetic code of Man (see „II") – it is equally biological information transferred from human parents to human children and persisting as the genetic heritage in the human generations that follow. „II A" visualizes the transfer of extrabiological information, in this case the information that Humans use besides their genetic code information and which depends upon the accumulation in society of means and institutions for education and for culture (e.g. different organizational devices, language symbol record etc). This information is not transferred biologically in the way of a continuous code transfer in civilisational-cultural techniques. „II B" visualizes information transfer of cultural heritage from one generation to another as:

– the enriching of the already accumulated information, its developing by new sources (see side arrows) coming from the creative contribution of the human mind,
– continuous transformation due not to biological processes but to *logical properties of knowledge* which are something different from the first ones.

Finally in „III" there is visualized *a stream of knowledge* (that is of accumulated information) as it broadens and becomes greater and greater, deeper and more sophisticated, structured and intensified and as it builds the system of culture. It is now evident that culture is formed by a wholly new kind of information in contrast to the biological information of the genetic code. It also has a wholly different quality and this fact constitutes the justification of setting up the *antinomy nature-culture*. This same fact also justifies the conclusion that human ecology is much more than only a biological science.

More arguments substantiating this conclusion are gained when it is understood what the second composing word of the term „urban ecology", namely what „urban" and „town" (city) means. This is visualized by the key words and sentences in the upper part of the scheme of Fig.1. In order to understand wholly what means „urban" let us focus first upon the key word „theory of urbanization" (as substantiated by O. Yanitzky 1986). *Urbanization* as the form of development (evolution) of Man's „adaptation to" and „the adaptation of Man's environment by Man himself" (then forming *a milieu-an urban milieu*) must and can be fully understood in the light of the *evolution of Man (kind)* (see e.g. N. Wolański 1987). As P. Teilhard de Chardin has stated (see 1948) Mankind is subject to processes of compression that lead to emergence of so called *organizing pressure*.

As he has worded it „nothing will hinder the changes that are leading to more and more powerful tightening of social bonds and to strenghtening of consolidation. But why? On the limited surface of the Earth Mankind, after *age of expansion*, that was completed in historical time, enters actually (as the result of a sudden but not accidental *acceleration* of the increase of the population) into the *phase of compression*. Bacause the organizing pressure acts uniformly upon the whole surface of the „human surface" of the globe there must arise an unique-all Earths social organism"... The organizing pressure and compression of Mankind are equally well substantiated in the famous paper of Fr. di Castri in the Unesco Courrier (1981) who concludes, that „ecology is developing more and more as

a „science upon Man *and* nature" and in the graphical model of the cited paper. He emphasizes the *impact of man upon nature* in such an impressive manner that this *dominance of man upon nature* appears as being generally accepted in the science too.

What are the consequences of this? *Urbanization* means firstly *concentration of people in towns (the compression)* and the fate of such concentrated Mankind in the future will be undoubtedly bound to the *urban way of life* (comp. the notion of „urbanism" and study the „cake" on Fig.1). Of course there is no need to consider and to prophesy that all world will become a giant city as it was seen by H. Cox (1967) or to coin the term „secular city" of the same H. Cox (1965) when dealing with the notions of „megalopolis" or „technopolis". This *first meaning of urbanization* leads to an encompassing of the spatial expansion of the city, of its infrastructure, as occuring in the *horizontal dimension*, that can eventually lead to an immerse deterioration of the conditions of human life and of the environment of the cities (comp. the contribution of B. Jungen and M. Ricci 1987) but this is not the inevitable fate of the urbanization in general. It depends upon our *definition of the city*. As was proposed by the Author's contribution to the conference („What is urban ecology?") city means not only the space occupied by the so called „skeleton system" (urban infrastructure) but equally well the immediate suburban zone — the suburban zone of immediate subsiding of the city, forming both an ecosystem of the city (then *urban ecosystem*) that is simultaneously an *urban geosystem* (or *geo--ecosystem of the city*) as it was stated in the mentioned contribution. It follows from this that in such a conception of urbanization urban ecology concerns not only the urban but also the suburban way of life (urban and suburban-rural occupations) and when extending these consequences to the problem of deterioration of the global environment by future total world urbanization, as feared by H. Cox (op. cit.) or by J. Mac Harg (1964) we can see an optimistic solution in imagining the Globe as occupied by numerous cities (even megacities) — the „central places" in the world which will transform into a giant suburban zone of these central places (excluding most of deserts, polar ice caps, lakes and seas and great forest biomes of the world-taiga, selvas).

The *second meaning of urbanization* concerns this process as considered in its *vertical dimension*, which is the acceptance of an *urban way of life* not only in towns but equally in rural areas (villages, farms) where there is no great concentration of people. In this last case it could be encompassed in the notion of the world as a suburban zone, as formulated before. In this case as a consequence of avoiding complete concentration, the crowding of people in towns to such a dangerous degree as to provoke global deterioration of the environment, the notion of urbanization could be applied equally on this second meaning and the future *giant world city* could be accepted.

These considerations are the reflection of two general attitudes towards cities. The first attitude is reflected in-besides the already cited opinions of Cox and Mac Harg, the paper of Jungen-Ricci (1987) and placed in Fig.1, as the key-sentences: „cities of industrialized countries (in this the new cities of the III-rd World) as sym-

bols of the deterioration of human life conditions in them – named „bad cities". The second attitude is worded in the key sentence of Akhiezer (1974 and 1984) of „city as a focus of concentration of highest creative forces in a society", named „good cities". It seems that both ways of considering cities are legitimate and reflect real situations. *Bad cities* are the object of *urban pathology and of pathology of cities* (comp. Author's contribution „What is urban ecology?") and *good cities* are the material object of urban planning (the Author's contribution and Jungen--Ricci 1987). They are even one of the main topics of the recently developing new approach in ecology termed *landscape ecology* (see T. Bartkowski 1985).

Before explaining this statement in more detail let us return again to the „cake of biology". Under the heading (key word) of „MAN", three main „ways of life" are indicated, representing three main developmental phases of the history of the Mankind: the natural, the rural, the urban (recall the well known contribution of L. Mumford (1961)). They are arranged in such a way as to suggest the dynamic succession, an expansion of these phases and to indicate the next phase. This phase was already intimated in the *future of Mankind*. Although in the „cake" urban ecology appears as only a branch, a subordinate part of human ecology, parallel to rural ecology or the ecology of rural areas the *wild life ecology* of primary or primitive people must also be treated as a kind of human ecology. It seems that in the future, when the urbanization of the world will be completed, the actual human ecology of this future will be identical with the scope of urban ecology. This conclusion now gives full reason for the thesis that urban ecology is only partly a biological discipline because it deals and will deal in the future with the *fate* of Mankind in general. The second reason for such independence and autonomy of urban ecology is given by the focussing upon the methodological values of the ecological paradigm and this justifies the conclusion that will now follow. This conclusion will be a consequence of the fact that the *ecological paradigm concerns the spatial relations of open systems* because of their subsiding from the outside. Because of this property we arrive at *the notion of landscape ecology*. In Fig.1 the key word „landscape ecology" shows especially its essential connections with all the notions discussed till now, namely these of urban ecology, human ecology and ecological paradigm.

In the Author's „working definition of landscape ecology" (see T. Bartkowski 1985) the formulation is almost identical with that of urban ecology: Landscape ecology is termed as „a gathering of scientific theses (a science?) concerning an *interdisciplinary problem to solve* formulated as *relations (trophis and other) between organism(s) and its (their) environment"*. In a special sense these relations can be formulated as *the problem Man(kind) or Society <—> Nature*. This methodological side of landscape ecology is, however, in the Author's definition completed by the following statements that demonstrate the „differentia specifica" of landscape ecology. In explaining the term landscape the Author states, that landscape ecology must be approached by taking in consideration three dimensions or levels of landscape (consider now Fig.3):

– *sublandscape level* – concerning the so called (in topoclimatology) „active surfaces" (as related to the generally called „lower" organisms (microbes,

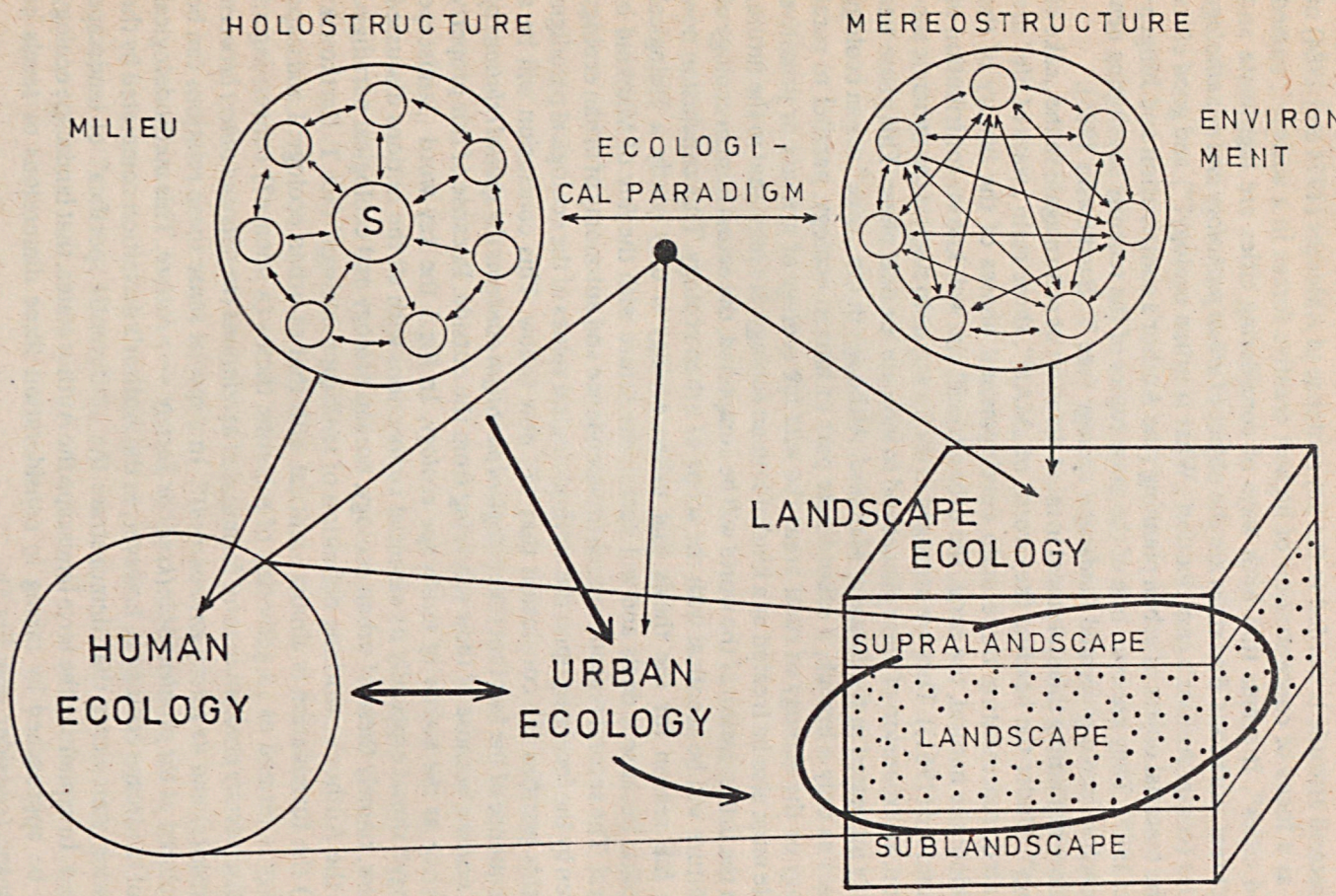


Fig.3 Situation of urban ecology in respect to Human- and Landscape Ecology.

plants, other organisms of small size). Compare at this place the „morphological" and the „cascading" systems of Chorley-Kennedy (1971).

—*landscape level* — concerning the area of activity and of „interests" of „higher" organisms (including especially Man). It is simultaneously an „anthropic" dimension. Compare here the notion of so called „control" systems of Chorley--Kennedy (1971).

—*supralandscape level* — a global dimension, concerning the whole Earth — conceived by means of such notions as biosphere or better as ecosphere, as epigeosphere.

These three „dimensions-levels" of landscape-delimit very well the material object of the notion of landscape ecology. They show especially the *central area of landscape ecology* as indicated by the *landscape dimension* and by both the peripheral dimensions. The scheme of Fig.3 equally indicates this central area-as coinciding with the area of urban ecology and has relations to human ecology by the intermedium of this urban ecology. It is the result of identifying the landscape dimension with the „anthropic" dimension (comp. the quotation from P. Teilhard de Chardin and the following conclusion). It is now understandable why urban ecology „dissects" or „crosses" the whole area of the landscape dimension.

Finally the scheme of Fig.3 indicates very well, as a very important comment, the relation of the three discussed disciplines to the two fundamental notions used in the definitions namely *the environment* and *the milieu*, as its special „competitor". They are not synonimes as most scientists indiscriminately think. Environment is a structure composed of elements joined together by interrelations without a central relation, e.i. without the relation to something in the centre (to the subject of the relations). It is also a set of elements that becomes meaning as a sum of partial relations (also as a „mereo"-structure). In this sense environment means something that is oriented outside the centre (f.in. Nature surrounding Man, animal, plant, etc).

Contrary to this *milieu-holostructure* — designates something oriented towards the centre and forming then „a whole" („Holos") a structure, also a set of elements determined by interrelations not only to each other but equally to the central element, that can be named the subject(„s"). In our case it would be an organism or a population of organisms (plants, animals, Humans). In both cases these relations indicate the fact of the subsiding of something from the outside of the recipient of the relation in a kind of spatial interaction and this fact already is the foundation of the methodological principle of the ecological paradigm (consider the arrows). This paradigm also concerns the subsiding of subjects in milieu as it occurs in human ecology (Man as species) or in urban ecology (Man as species inhabiting towns) and as subsiding elements of the environment occuring in landscape ecology. The thick black arrow that comes from the holostructure-milieu to urban ecology emphasizes the specific character of towns spatial systems having subsides in their suburban zone and by the same constraining people living in the towns, to take part in the centre-oriented circulation of materials, goods, people, that is from outside towards the centre and vice versa. In order to eliminate possible

Fig.3 Situation of urban ecology in respect to human- and landscape-

misunderstandings there is necessary to elucidate one point in determining the relation of milieu to environments. In milieu — a holostructure — there are occuring relations in the form of flows coming from the elements of environment to the centhre where resides the subject. They are not all relations that are „produced" by the environment but only these the subject is „sensitive to". It means that the subject selects from the „signals" coming from environment's elements only those that are perceived. It means equally that „environment" is much larger than „milieu" and is not, in this sense, identical with „milieu".

Having thus arrived at the explanation of interdependency between the two-fold area of the ecological paradigm and the three discussed disciplines we are now able to answer the question „in what measure is urban ecology a biological science?" and „what role plays the ecological paradigm in the constitution of its notion?". It is only partly biological in a measure that relates to Man as a biological species and when living the „natural" way of life (as a „primary Man" — Man as part of the natural biocenose). Since Man is becoming a culture builder and bearer (in the adaptation of Man to the environment —> milieu by means of culture) he is „ruled" more and more by extrasomatic and by artificial, also more than natural, resources and then is dependant more and more on inputs from outside the place of a constant settlement — the town. At this moment the main methodological concept of ecological discipline approaches the study of the extrabiological concept of ecological paradigm, and by this *urban ecology becomes a nonbiological discipline*, a very autonomous one (especially because of the systemic approach — the approach to the study of open systems). In respect to landscape ecology urban ecology reveals itself as a part of this great „interdisciplinary problem to solve" (op. cit.) in order to be a discipline or to be a science, with the focus on urban milieu — that is on the holostructure concentrated on the main subject: Man inhabiting a city.

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