Articles

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Global Ecological Balance (The human settlement that we need)

We are in the middle of a major ecological crisis on a global scale. We have no practical experience on how to face it, since it is the first time such a dangerous type of crisis has occurred on a global scale, at least in historical times. To face it humanity, since 1869, has started the science of ecology by using natural history approaches which go back to Aristotle's natural history. Now there are many studies, some of which are of very high quality, which begin to open our eyes to what really happens and what has to be done.

To learn more about ecology and to follow and implement the right policies against all ecological dangers will take many generations. In the meantime, even when we open our eyes completely to all partial problems and their causes we will continue making many mistakes. This is because we cannot and should not stop development as there are so many very poor countries and people which badly need it, and development means major works, a lot of industry and many ecological changes. To stop the changes is not realistic and not feasible. What we have to do is to guide them (Chapter B).

We know a great deal about many aspects of the ecological system we influence by our action, but we do not know many other things which we must learn and this requires time. To guide the changes, we need the knowledge and the courage to take some basic decisions. Human experience shows that the societies which managed to survive for a long time in the same location were those which managed to retain the same ecological balance by creating several types of zones, such as built-up areas, cultivation, forests, etc. and to keep them in the same places. This is also what we need now, only this time we need many more types of zones because we are dealing in much larger scales (Chapter C).

To conceive only the type of solution that we need is not enough. If we do not prove how it can be implemented, it may turn out to be a utopian one which cannot be implemented. We must there- fore conceive an implementation program and plan. This whole effort may not lead anywhere, at least not for quite same time, if we do not enter the phase of implementation as soon as possible. This is why I will present a plan for immediate action that can start at once (Chapter D).

B. FROM CRISIS TO SETTING OF GOALS

1. The Past

We do not know enough about ecological balances from the very beginning of life on our planet. What we are certain about is the general situation over the last tens of thousands of years (and especially during the last ten thousands) when humankind passed through the late Paleolithic and the Neolithic times quite successfully and managed to survive. This means that there was always a balance achieved between the natural resources and human intervention in using them.

It is quite probable that humans always attacked natural resources in order to use them to fulfill their needs. This action could be described as an aggression against an existing ecological system. This aggression was though so small at times that it did not cause any change, and thus it is not considered as aggression. Human aggression was always the beginning, although on many occasions it was limited within the frame of a balanced ecological system.

When this was not the case and aggression changed the balance, there were two roads ahead; either to lead towards a new ecological balance also serving the new human needs or to lead towards such over consumption of natural resources that no balance could be restored, and the ecological system was completely upset. This meant a disaster both for its human component as well as for many others.

There is no question that hunters, fishermen and farmers had to learn how many resources to use every year in order to be sure that they could draw the same, ones over the years to come.

This was quite a natural solution: to interfere only so much with the existing system that its operation could continue in a balanced way. This solution of an aggression leading to a settlement between all elements of the ecological system was not a human invention. We know from many animal experts that the same has been and is still achieved by all of them which manage to survive. The formation of the territories within which each animal group lives is one example of how the overexploitation of natural resources is avoided and the necessary balance is achieved.

When comparing animal with human ecological balances we find that the latter changes much more quickly. This clearly began about ten thousand years ago when humans began farming and cattle- breeding and thus changed the existing natural system into a farming and breeding area. The rate of this change was much greater than in any other case up until then. At times it led to local balances within the territories of a single human community and

later when urbanization and civilization began it was even accelerated and valid for broader territorial units because the changes within an urban community are much more speedy and dangerous. If humans understand the total system there is a balance achieved within the city-state's territory and no new dangers appear. The scale has changed but the result is a large-scale balanced system although its urban center could be called out of balance for those not used to the notion of urbanization, and its advantages and disadvantages.

We do not know how many times the system has failed in smaller scales; but we know that, at least since historical times, such changes due to aggressive and speedy development led to great disasters. As C.H. Waddington tells us: "The great ecological catastrophes of early civilization - and there were several - did not occur in Christian lands. The first civilization of Mesopotamia ruined its environment and destroyed itself by pushing its agricultural productivity beyond what the circumstances would bear, leading to erosion of the fertile soil into the rivers, and silting up of the harbours. The ecology of most of the eastern Mediterranean, particularly the Northern shores of Africa, was also ruined by unduly exploitative agriculture, under civilizations dominated by Greek, Roman and Islamic religions. In contrast it was mediaeval Christianity which turned the somewhat in- hospitable, swampy, tangled woodlands of northern Europe into agriculturally rich country" (1).

The situation was the same also in ether periods and areas. Even today we can see signs of it by looking at the mountains of Lebanon, which became famous and started the Phoenician civilization because of their famous trees, and finding that they no longer have any forests.

The rate of change and the degree of aggression increase even more with the beginning of industrialization and there are areas, like North America, where this happens at such high speeds and creates such enormous changes that people speak of industrial rape. This takes many forms ranging from purely urban expansion with no industry at all, but with complete ecological change, to atomic energy plants, oil distilleries and heavy industry to the indirect influence on land, water and air through the use of new chemicals in many areas. In such cases the aggression is disastrous as no overall view of the ecological system is applied and many values and balances are lost.

We are sure that animals and humans begin with their aggression against the ecological systems and more often than not do not upset the balances or lead to new ones. How else would they have survived? There are cases though, especially recent ones, where the balances are lost and the danger is great, Humans exist because they managed to lead from human aggression to human settlement with the nature around them. Animals and

humans are successful in the long run by leading from aggression to settlement.

2. The Present Crisis

At present we are in the middle of the greatest ecological crisis. This is the crisis which started two centuries ago when humanity entered the era of applied science and industry. We are really in the middle of it, because only once we open our eyes and see the problem, as we do now, do we begin to react properly and face it. Once we feel the pains we proceed to diagnosis and therapy. As this reaction to our disease does not happen overnight and every- where, since there are so many forces making therapy so difficult, we reckon that it will take humanity two more centuries to overcome all symptoms; and this makes sense (2).

It is the greatest crisis on a global scale that humanity has faced since the last radical changes of climate on a global scale. Many such crises must have been much more serious in the past, but they always were limited in space. To destroy a city during a war, as so often happened also during the last war, is much more dangerous for its citizens than what happens today, but only for a certain locality. On a global scale we really face such a danger for the first time since humans started a real developmental activity as happened with the cultivation of land. We really are in the middle of a human aggression on a global scale.

The causes of this aggression are very clear. Although many still connect them with the capitalist system, it is much more accurate to understand that they are due to industrialization. There is good documentation of the fact that in communist Russia the problems of pollution are very great and sometimes very dangerous and reach extremes not common in other industrialized areas (3). When for example we know that "sixty five per cent of all the factories in the largest Soviet republic, the Russian Soviet Federated Socialist Republic (RSFSR), discharge their waste without bothering to clean it up"(4) we become aware of the real causes of dangerous pollution. The great need for industrial production explains many things and explains that these causes are valid on a global scale.

The symptoms of this crisis are many and many experts are dealing with them. Lately several efforts have been made to present all of them in a systematic way and some people, like Konrad Lorenz, have tried this in an even broader way by speaking of the eight deadly sins (5). A systematic presentation is needed, but this would have to be long in order to include the very many symptoms and phenomena of the suffering global ecological system, ranging from real disasters, to overexploitation of natural resources, to the decline of many types of qualities (such

as nutritional quality in the U.S.A. which started since the last war) (6) to the speed at which all these changes take place. This last one is needed because a major change at a very low speed may create fewer problems than a small change at a very high speed, which creates sudden and dangerous influences.

As the presentation of the whole phenomenon of the present crisis is beyond the scope of this study, I will give a short and general picture of it in order to transmit the message of the complexity of this phenomenon and the need to face it systematically.

The total ecological system consists of many ports and many more interactions between them. In a simplified way we can speak of its five elements, Nature as a system, humans as individuals, which we had better call Anthropos rather than Man to avoid using only one sex. to represent all humans, Society as a system, Shells, that is all types of buildings, and Networks of all sorts. Through such a classification we can distinguish between the natural ecological system without the intervention of humans, (Nature) the human one in two parts, the single individual (Anthropos) which we tend to forget and humans as social systems (Society), and the Anthropos-made environment as expressed by Shells and Networks. Such a system is shown in Fig. 1(on the left hand side) where we see the five elements and their basic subdivisions, their interaction and their influence on the whole system (starting with aggression and ending with settlement) which we take as the study unit of Anthropocosmos, that is the world of Anthropos.

In such a way we can see for example how a climatic change is related to parts of Nature declining because of drought, how it affects the single individual which starves, the social relationships which can deteriorate by increasing thefts, etc., the buildings, (Shells) which may not be affected, the Networks where roads may not change but water supply may be led to disaster and the human settlement as a whole which may well be abandoned in some areas.

3. Greatest Dangers

The most difficult aspect in dealing with global ecology is the very great number and complexity of its problems. As we cannot deal with all of them at once, since, especially in the high- income countries, we are dealing with a great many problems, I will concentrate here on what 1 consider to be the greatest dangers in this field of the great crisis we are passing through.

As I am working for many countries and on many problems, I feel that we are facing two very great dangers. The first one is the lack of action for the whole ecological system on either a global or any large scale. If we wait

until we understand it as a whole scientifically, that is for example until we understand the system of oxygen production and consumption and how we can measure and control what happens in this field, it will take too long. It is very dangerous to wait until we achieve this in order to start action for the whole.

The second great danger, perhaps even more dangerous than the first because it is very specific, is that we overlook the greatest limitation of our globe - its own usable space. It is true that we face many dangers such as the elimination of several types of resources, but cur developing technology allows us to be optimistic that some day we will manage either to produce more from new sources or to recycle many resources so that they will never be exhausted. Are we not doing this already, with Nature being the leader, with the recycling of water in so many ways?

What we can never recycle is terrestrial space, and we cannot expand it either. The view that we can create many multi- story structures or go underground for several functions is a. reasonable one, but it cannot lead to any important solution on a global scale, because life in multi-storied buildings is in many respects inhuman(7). To live in satellites may make sense for scientific and related goals, but does not mean any real expansion of the space we can use for our global population.

It is very clear and certain that the capacity of our container is limited in terms of space and basic resources such as soil, water and air. What is this capacity though? Does it really set limits for humans? can we not be optimistic that better science, technology and full application of ecology will increase the global capacity for supporting even more people in a better way? Yes, we can believe in Anthropos and his capacity to develop better inside a much better system of life. But one aspect will not be altered and this is the space available to him. Thus there is a real limit on the number of humans who can live on our globe, and this is space measured as the global surface.

The limits given by space in terms of physiological considerations lead to the conclusion that the maximum number of humans who can live in a high-quality environment, even when they possess the best technology for their life, are 22 billion people or about 6 times more than at present (Appendix). But these upper limits are possible only if we use land, water and air resources properly; and we do not achieve these goals at all. We even overlook them completely.

The proof that we overlook these needs completely can be understood through the uncontrolled expansion of cities on the best agricultural land. If this continues there is no hope for achieving the global capacity, and the problems

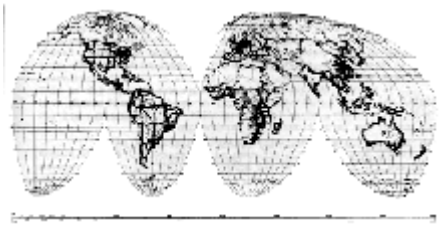

Fig. 2. Ecumenopolis, 2100 A.D.

will be huge even with the best technology. It is not possible to achieve the necessary agricultural production on the mountains and on poor soil. The estimated total capacity is based on the proper use of the global surface by mankind. Another example that we overlook this spatial aspect is the lack of any plan of action to face the problem of the expanding drought area in Africa where so many people suffer today. The conclusion is clear: there really is a very great danger for humanity due to the fact that we overlook the proper use of the total global space.

This great danger is due to the fact that we do not have any guidance for the global use of space, although several countries, like China, prove to be more concerned about this problem and are in better control of the situation especially in terms of water control. On a global scale not only do we not have any guidance, but we have many signs that private interests and profits bring about a continuous competition among humans which causes the wrong use of spatial resources. Some of these phenomena can be overcome by special agreements with total human interests as the main goal. Such is the case for example of the refusal in Australia to use a lot more land for agricultural production although there is a greater global need for food. But these are not the major problems with long- lasting effects as they can be solved some day. The greatest one is the conquest of the best agricultural areas by buildings, which means that turning them back into agricultural areas is impossible as buildings are no longer built with mud walls.

Thus when Ecumenopolis (Fig. 2} comes into being (8), as it inevitably will, the situation will be tragic (as many people are frightened it can be) because the lack of an overall ecological concept and guidance will have led to the wrong use of global space which can no longer be overcame. Ecumenopolis will in such a ease mean disaster.

4. The Solution

The big question is now clear: How can we face, the two great dangers menacing mankind? What is the solution that can help us to avoid a possible loss of the ecological balances which still exist today and therefore a decline of human development and a possible disaster for mankind? The ultimate solution is certainly a new Global Ecological Balance (G.E.B.) which will help mankind to develop properly by solving all its present and forthcoming problems and also to reach a steady level which will guarantee safety and happiness as Aristotle defined the goal of the city.

As we have the obligation to look at the situation in a realistic way we must state that although there is no doubt about the ultimate solution, there is no possibility of reaching it within one or two generations. The reasons are two:

First, although ecology is the science to provide the ultimate solutions it cannot be developed immediately to the point of providing the answer to the total problem.

Second, although there is much talk about and many efforts to stop the economic, energy, and population growth, it is not realistic to expect this to happen in one or two generations (9). If there is any doubt about this, the last United Nations Population Conference in Bucharest (August 1974) gave the answer: economic development and urbanization, are the answers to all our pending problems on a global scale. This will take a few generations to be accomplished.

The conclusion is clear: we have an ultimate goal but we know that it will and cannot be accomplished for a few generations. The big question is therefore: what can we do now? The answer is clear: try to overcome these two great difficulties which delay fulfillment of our ultimate goal. This means that we have to develop ecology as much as possible which has also been named the most basic science of the future. This means a great effort for synthesis of the many of its parts which we know or have to know well, a development and synthesis of many new sciences like ethnology which are needed as parts of the whole system of knowledge, etc. To achieve this will take a long time as we must develop both the ability to learn much more and to achieve the real synthesis that we need. This is the task of Geologists and of related scientists and many have already begun to work on it. This task is on the proper road for its solution.

While this great effort is under way, the big question is: should we wait for science to be completely ready to provide the proper solution for the whole system and then apply it, or should we act in the meantime, not only to solve partial problems, as we do, but also for the system as a whole?

The answer is difficult but very clear. The total system is a system of life that cannot be stopped in order to wait for the ideal solution. For every problem that we solve there are other problems appearing as the system changes, and it consists of many interacting activities. When we speak of development in all kinds of environments, both where Anthropos acted before and where he did not, it means that we create big ecological changes. Every day we really build our new environment and from now to the year 2000, humans will build more than they did since the beginning of their major activity, tens of thousands of years ago.

Anthropos must perform this task properly. The big question is how: without any guidance as happens today, or with guidance.

Before answering this last question we have to go back to history and remember that although many people must have been lost through lack of ecological balance, as still happens today, many others managed to survive for many generations within a balanced system. This happened to hunters, fishermen, farmers, cattle- breeders and urban dwellers. What was the reason? They were wise enough to use their territorial space in a reasonable way Depending on their needs they cultivated the area which could be properly irrigated in a natural or human-made way, they left forests where they needed them to collect water and other resources, and they only built a very small percentage of their territory.

What really happened with those that survived was that they had the courage to change the natural ecological system they inherited for a human one which, however, created new wise balances for the sake of humans. What they knew was the statement made in classical times by Protagoras that Anthropos is the measure of all things. They did not create the ecological balance that elephants or rats or cedar trees would prefer, but what humans needed.

Anthropos discovered the need to change the human aggression against Nature to a human settlement with it. Thus ecology was completed by ekistics. The discipline and later the science of human settlements. If there is any doubt about the existence of such a science the answer is: how else did they solve their problems - by real human settlements? The fact that we have no documents about this science does not mean that it did not exist In the human mind. We know now from experts who talked with primitive hunters and farmers about their territories that they answered as good ecologists, The wisdom and the science was there but it was limited to special cases and did not cover the system as a whole and thus when industrialization stepped in and the conditions changed the age-old wisdom was lost.

In this way we reach the point of answering the big question about the action needed to avoid the great danger of allowing the system to get out of balance. We have to use the age-old method of defining the use of space by basic functions. We do not know exactly how. We do not have the ability for the necessary measurements. This will be done gradually by ecology and ekistics over a few generations. What we know is that we need the courage to take some decisions and to guide development in a practical way. From the past we have learned a lot through trial and error. If we use this wisdom we will be able to experiment and to learn again through trial and error and in this way we will gradually change the experimental solution into a wise and scientific one. After all ecology and ekistics as sciences need this experimentation in order to measure things and reach conclusions. This should not happen in a coincidental way,

but in a systematic one.

We need the courage to decide now on the best use of our terrestrial space. If we do it systematically then our march into the future will lead towards a humane Ecumenopolis based on a Global Ecological Balance serving human goals for survival of all necessary values and for a corresponding human ecological development.

C. THE ECOLOGICAL TYPES OF SPACE

1. The Confusion

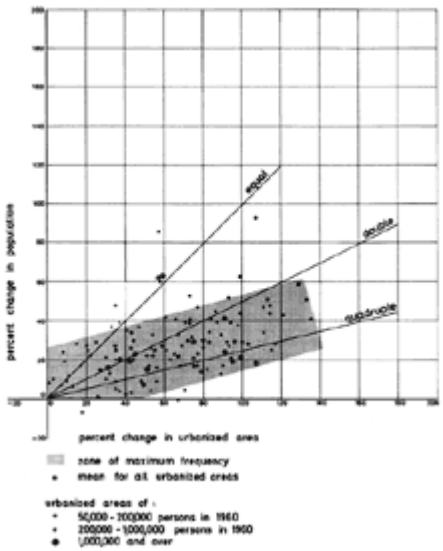

Fig. 3. Changes in area and population in urbanized areas of the USA, 1950-1960

Setting the goals is not enough. They very often prove good intentions, but cannot be reached in a practical way. They lead to utopias (u-topia, no place) which are necessary to help us dream in the right direction, but they are not enough. We have to clarify them as much as possible in order to turn them into entopias (en-topia (10), in place). This is not an easy task as it requires many very detailed studies on a global basis. To achieve these studies we have to mobilize the experts all over our globe and to achieve this task we have to convince them about the need and the feasibility of the goals we set for all of us. This is how far we can go here by explaining how far we can move in an attempt to reach our goals some day in the best possible way. After setting the goals and looking at the top of the mountain ahead of us which we want to reach, we make the first step in this direction. The one thing that we can prove here is how we can make the steps which some day will take us to the top. By making this first step we do not prove how the whole mountain path will go, but we prove that we have a direction and we can move to it.

To define the use of space for our future we have to look around and see and understand how we use it today. We will find that we really have no system and its uses are all mixed up in a confusing way. If we try to explain each one of the uses of space in detail we will find its causes which serve individual needs, but this will not form any reasonable system which serves any broader cause in a rational way. As we are in the middle of many explosions of population, economy, energy, mobility, etc.(11) and we don't have a goal set for the use of space we lead the whole system into confusion. It is very probable that when the population, economy and urbanization explosions took place in ancient Athens, that is in the classical period, Athens itself was led to a confusing pattern. We now have data to prove it with very concrete maps(12) and this explains why Plato was in favor of zero growth patterns when speaking about his ideal city-states and why he proposed very specific dimensions for them. This is another confirmation that our present-day confusion in the use of space is quite natural and should have been expected once we lack the overall concept and guidance.

Fig. 4. The present uncoordinated system of Networks in the Urban Detroit Area

Fig. 5. The present uncoordinated system of Networks in the Northern Ohio Urban System

This confusion can be seen on land by flying over it or even driving in the right direction and can be measured in the oceans and in the atmosphere. On land the cause is private interest which very often leads to and finally is guided by greed, as we can understand by the simple fact that I may buy a plot where three- story buildings are allowed and then convince the authorities to let me build twenty-story buildings. My profits are six times higher and the spatial disaster enormous (13).

In oceans and in water resources in general the problems are mainly created from the land which is in direct contact with them. It is from it that most of the pollution comes plus the pollution caused by boats of all kinds and from the air which brings pollutants into the water. The situation is the same for the atmosphere. It is polluted by the wrong use. Land resources and a much smaller degree by airplanes, etc. The lesson is clear: the great confusion in the use of space is mainly due to the wrong use of land resources and then of water and air.

The future as a projection of present trends does not look optimistic at all. Three examples are enough to prove it. We are going to have a great expansion of nuclear fission in the next six years only, the 134 plants existing today will increase to 401 on our globe and the 57 billions of watts produced in them will become 287, that is an increase of more than five times (14). This means a new huge problem for the proper use of space. The second example is the imperative need for recycling which will expand and for which there is however no overall concept of where, when and how it will take place without creating new problems of spatial use. The third problem is the continuous expansion of urban systems in a way that does not make sense and can be illustrated by the dropping urban densities (Fig. 3), which means an elimination of more and more precious land as well as many values existing near the expanding cities.

Such changes create many problems and increase the confusion in urban space uses because their influence on the total system is much greater then the rate of increase in terms of surfaces. The reason is that we don't deal with the expansion of one compact system but of multi-nuclei multi-network systems. The way we create today all kinds of Networks and 1st them expand without any coordination (Figs. 4, 5) explains the very high degree and speed of the spatial confusion we are in and are being led to.

The situation which is created by the changing system of the relationships of humans to space is much more complex than it appears by the confusion of the visual picture we get from the whole system. We have to realize that we don't know and therefore have no polic5.es on such problems as the elimination of the small farms which become less economic than large-scale agricultural

production, the types of urban systems that best serve all human needs and not only the private economic interests, the distances at which people could live best in the countryside in relation to cities and finally the rate at which human themselves are changing because of their move inside urban systems.

Finally if we look at some legal aspects of this overall situation we can easily recognize how its complexity is confusing us. I give two examples. The first one is the creation of skyscrapers since we did not realize that three-dimensional space no longer belongs to the landowner as was true in the past. This was legally accepted in the past because no one could build more than a few stories. So every landowner had the right to build as high as he wanted, but the value of this law was purely theoretical. Now that everybody con go much higher we have to revise the law and turn the ownership of space into a much more reasonable system (15). The second example is related to the question explained by Christopher Stone in his book (16). Should trees have legal standing? These two examples explain how many major legal problems which are directly related to ecology have to be answered.

The overall situation inside the system of life of mankind of our global space is very confusing indeed, A great revolutionary change is taking place but we have no idea of what exactly it is or whore it leads, We have the obligation to get out of this confusion oven in a simple and experimental way. It is our obligation to start the process by taking some decisions with courage.

2. The Balance

There is only one way now to get out of the confusion and reach the balance we badly need. This is the clarification of our intentions for ecological survival of humans and their normal life by types of spatial areas. In this way we will now clear our intentions and we will know at least who is responsible for what and where.

The basic types of areas we need are four:

1. The areas of Mature where our main intention is to preserve as much as we can of the natural values. These are the Naturareas.

2. The areas of cultivation where our main goal is cultivation of plants (agriculture), of animals (cattle-breeding) on land or in water for the sake of humans. These are the Cultivareas.

3. The areas of humans or of Anthropos, where our main goal is to serve the needs of human life excluding those served by the other types of areas. These are the areas we wrongly call built-up areas because only e small part of

them should be built. We forget this end finally we don't know whether a golf club or a city park belongs to them or not and we get confused. These are the Anthropareas and they comprise everything belonging to the system of human life except for the other three areas.

4. The areas of industry and mining where humans process natural resources in their awn ways which are artificial but may turn into more and more biological ones as in recycling of water and other materials. These are the Industrareas.

The four types of areas have been presented in the order in which they were created on our globe by humans who first lived in Nature as it was and then cultivated it, thus needing their own areas for permanent life and only later turned to industry. For the same reasons and for other reasons also such as the degree of energy humans spend in them or in terms of space required for them, these areas follow the same order. The largest ones are the Naturareas, followed by the Cultivareas, Anthropareas with Industrareas being the smallest ones. In a certain way we can say that the more Anthropos uses energy the less area he occupies.

In a similar, way we can state that the process of building and covering the natural part of the space WE use increases very much from Naturareas where we build the minimum possible, to Industrareas where we build the maximum reasonable which can in some cases be well near the 100% mark.

The way we can be assisted by the definition of these four types Of areas can be understood if we think that our administration can separate the responsibility of dealing with them into four secretariats or ministries, one dealing with Nature or Natural Environment, one with Cultivation, wrongly called only Agriculture in some countries, one dealing with Human Settlements, wrongly called Housing (too Limited), Urban Affairs (too narrow), Public Works (too old) etc. etc. and one dealing with Industry. Four goals and four administrative units which will be much more successful if they have their territories connected with their goals.

This way of solutions by the acceptance of four types of areas is very important, but does not lead to a balance until we define how large a percentage of the total space available should be covered by every type and what it should contain. Such a need leads to the next organizational step which is the subdivision of the four areas into zones covering these two requirements of more detailed definitions and of dimensions expressed in percentages. This also means that we have to deal not only with space in general but with land, water and air separately.

Before proceeding to do this more detailed arrangement for the Global, Ecological Balance (G.E.B.) we have to clarify two things: First the basic types of zones and second that even very well-defined zones do not salve problem unless they are subdivided into subzones, which will then be further subdivided into sectors, sub-sectors etc. It is certainly clear that proper application of ecology as of every other science requires as great a detailed work as possible. This will happen by stages but here we stop at the second one, the definition of the twelve types of ecological zones which will be then applied to land, water and air.

Speaking of land, water and air we have to add one more type of territory, the coastal area, because it presents some situations and problems which are a combination of land and water. Thus we need to examine further the four types of territories, land, water, coastal and air.

In every type of territory we need twelve types of zones which are the following and range from the most virgin one of Nature to the most raped one of industry. Theoretically we could say that the first types are ecological and the last ones ekistic but really they all belong to ecology, (representing Nature and its laws) which guarantees the total balance and to ekistics (representing human activity) which looks after the human settlements for it.

The basic principles for the Twelve Zones are the following:

A. Naturareas

Zone 1. As virgin as possible.
Zone 2. Entered by humans but only a love affair without any permanent human installation.
Zone 3. Humans enter and stay but without machines and their energy.
Zone 4. Same as 3, but with naturally built human settlements.
Zone 5, Nature prevails but humans enter with machines and con use it (forests, etc.) by stages and parts.

B. Cultivareas

Zone 6. Natural cultivation in traditional ways, that is without coverage of plants and animals by artificial roofs, no controlled climate, etc.
Zone 7. Cultivation but with new methods allowing for much greater exploitation.

C. Antropareas

Zone 8. Natural areas used as resorts, for sports, etc.
Zone 9. Inhabited but at reasonable low density.
Zone 10. Inhabited but at middle density.
Zone 11. Inhabited at the highest reasonable density.

D. Industrareas

Zone 12. Every possible use for achieving the goal of the best industrialization.

3. The Twelve Land Zones

Out of the whole terrestrial space which is connected with Anthropos, that is the Anthropocosmos, we start with the definition of the twelve types of zones on land. Although land represents the smallest area in relation to water and air (smallest surface and much smaller usable volume), land is the center of human activities and the territory where most of them take place. Although when studying the whole global biological and ecological system we may have to start with water resources for historical and many other reasons, when we deal with Anthropocosmos we start with land.

The total land surface can be called the land empire which is divided into two kingdoms, the open land one and the below water one. Although they are both very important, for the economy, their resources and the total ecological system, we will deal here with the first kingdom only as the influence of the second one is indirect and can be dealt with in another phase of this study.

The twelve types of land zones in this kingdom are the following ones in the order already set.

Zone One is Real Wildlife. It is here that no human activity should be allowed with the exception of scientific research. Not even visits should be allowed, except by scientists with specific tasks. If we are right in saying that we know very little about the global ecological system, we should keep as many parts of it as possible as natural as we can. We should not forget that many natural preserves suffer a lot from invasions, such as safaris.

The big question is how much of the global surface should be characterized as Zone One. There is no scientific answer to this question, but what we need to state is that such areas should be in the polar zones and the deserts as well as in well-planted and animal populated areas like the Amazon Basin, parts of Canada etc., as well as in every climate and every type of environment even in very small dimensions. We badly need to save all types of natural areas without humans and learn from their evolution.

If we manage to preserve such areas in all types of

environments and without creating any problems because of no use of these areas, there is good hope that they can cover, at least, at the beginning of this effort until we learn more, 40% of the global land surface.

Zone Two is Wildlife Visited, unlike Zone One. It resembles Zone One in many ways but it has to be visited in order to give humans the opportunity to come as close as possible to real Nature and to study its resources for eventual use of some parts of it for other purposes (in which case they will shift to another Zone). Visits in Zone Two should not be allowed with machines, but should be by humans using only their own energy and not staying in any types of camps. This is really the. Zone of natural and not commercial safaris where youth can discover real Nature.

The total area which can be covered by Zone Two reaches 17% of the global land surface, comprising again all types of environments from deserts to thick forests.

Zone Three is Wildlife Embraced. This means that humans live a natural life there without machines and commercial forms of energy. This is the Zone where natives who have not entered the era of cultivation can live, as long as they continue this type of life, and others can enter to visit them or to live on their own in temporary camps. Here the human knowledge of Nature increases more because of their possibility of staying longer. It is no longer the Zone of" short visits where humans learn by seeing, hearing and smelling Nature, but, where they can learn by really living with it, collecting food, hunting, etc.

The total area of Zone Three can be 10% of the global land surface. A part of it is already inhabited by many sorts of primitive tribes and another part has to be added for the broader goals to be served.

Zone Four is Wildlife Invaded. Humans enter into it and build permanent camps which can be visited by many as now happens in some mountain tops where people go and live for mountain climbing, skiing and related purposes.

Similar solutions with permanent and well organized camps are necessary for other types of areas also and such an effort can save many areas from too many non-organized individual efforts.

The total area of Zone Four can be 8% of the global land surface. It is the type of area that has to be visited very systematically in a natural way, that is without the use of machines and this means that it has to be relatively close to the inhabited areas or Anthropareas, that is Zones 8,9,10 and 11.

Zone Five is Wildlife Conquered, that is natural wildlife but completely controlled and exploited by humans. Here belongs a large part of forestry which is commercially

exploited, the part where forests grow in a natural way and not as cultivated areas of Zone Six. Here also belong the areas visited by people with machines, motor cars, railways, etc., where hotels and other facilities are built for temporary visitors.

The total area of Zone Five can be 7% of the global land surface; it is the type of area that gets completely under human control as well as receiving human protection. As it is the area that is visited by much larger numbers of people than all four previous Zones together which cover 75% of the global land surface, it is exposed to humans tens of times more than the other Zones and for this reason it needs much greater care and protection.

Zone Six is Natural Cultivation, that is the type of area where agriculture and cattle-breeding take place in the traditional way in the open-air with buildings used only as storerooms and for protection of animals from weather, animal attack etc. A big part of this area is irrigated because non-irrigated cultivation does not yield enough and will be gradually abandoned. A part though will remain without irrigation as there are some areas which do not need it or cannot have it.

The total area of Zone Six can be 5.5% of the global land surface and many parts of it will be in isolated areas away from Anthropareas. These will be the more natural and traditional ones representing many values of the past, present and future. Other parts will be near the inhabited or Anthropareas, but a big effort will be required to ascertain their safety, because for many reasons (cultural protection, education of children on what cultivation meant and means, esthetic, etc.) there will be a tendency to turn these areas into Zone Seven which will be more easily developed near the Anthropareas for economic and technological reasons.

Zone Seven is Industrial Cultivation. This really means the use of much more modern methods through the use of many types of roofs and complete buildings for both agricultural and cattle production. It is the type of area that will require a much larger investment, but will yield much more by the use of commercial forms of energy, industrialized methods, machines of all sorts, of automation etc. It is a Zone that will create many new types of problems such as the complete elimination of the natural landscape in many of its parts where a system of roofs will be seen from a distance instead of beautiful fields and orchards. In spite of these difficulties Zone Seven will be badly needed for greater production and we have to be prepared for it.

The total area of Zone Seven will some day reach 5%. It is really the newest type of Zone which will tend to be very close to urbanized regions. But proper preparation for it and action in time can help us face many of the problems

that will be created by it and the enormous number of Networks, from water to electricity and pipes for movement of products, that will be needed.

The importance of Zones Six and Seven is very great as no matter how much food may be produced in the distant future by industry (Zone Twelve), the importance of the production based on these Zones will be very great and there is no question that human survival for the foreseeable future depends on them. This is why the greatest percentage of the gravest danger we have seen (the lack of an overall ecological concept and guidance leading to the wrong use of global space) lies within these two Zones which are now attacked by many expanding cities, industries etc. For them our ecological goal is to save them from attack and to help them expand as much as possible within the best types of areas for them. Their development then for increased production will certainly take place some day. The big task is to save them from invasion of buildings as otherwise they cannot be turned into natural cultivation areas even in the distant future.

There is now a very serious effort towards a world food bank which can yield a lot for humanity provided that we have enough land for production. Thus the percentage of 10.5% of the global land surface which has been set aside for this purpose must be achieved as the calculation leading to it is a realistic one and if possible it has to be increased by proper reduction of the first five Zones which represent 82% of the total and will not really suffer at all if they lose a few percentages. A loss of 4% for them means only a reduction of 5% of their total value while its addition to the Cultivareas means their increase by

Now we enter the four Zones of the Anthroparea which together with the Industrarea represent the dangerous forces of the systems created by humans which are aggression forces until we again reach the permanent human settlement that guarantees the Global Ecological Balance (G.E.B.). While we don't know everything we want about natural ecology, we definitely know much less about human settlements and this is why we have to acquire the courage and develop once again the science of Ekistics which people knew subconsciously in earlier times in order to survive. The task is very difficult because of the appearance of so many new forces like the motor car and television about which we have so little historical experience or none whatsoever, but it has to be carried out.

When we look at all cities we can state with certainty that we are in the middle of the era of the four explosions (17) (population, economy, energy, and mobility). Those four explosions, which really were superimposed during our present century and in many countries and cities begin only now to be superimposed, are not yet completely understood and the problems which are created by them

cannot be faced in a rational way.

I mention only one example of this phenomenon as it is very characteristic of the great confusion. The income and energy explosions have lad almost all existing cities to grow in area at a speed three times more than their population. "(his means a great danger for Cultivareas that is their conquest and the danger of unreasonable low densities which increase the cost and the problems of urban function enormously not only economically but also socially etc. Although this is a global phenomenon, that we witness inside urban areas, we also witness the opposite one, that is very high densities which create other types of problems. This is not only true for American cities where this phenomenon started. It is also true for many parts of other cities like Paris where only now have the problems of too high densities been under- stood and a new goal has been set to reduce them. We have to increase urban densities all over the globe end still we have to reduce them in many parts of cities. That explains how little we knew when acting and how difficult an effort lies ahead. It is in this spirit that I examine the remaining Zones of the Anthropareas and Industrareas.

Zone Eight is meant for Physical Human Life. It is this type of function that has not been completely clarified and it is one of the main reasons for the confusion we are in. Every human needs, apart from the home and other buildings that form his built-up settlement, open areas to walk in, to relax and to train in all sorts of sports from very natural ones like mountain climbing to very organized ones requiring stadiums, etc. In many ways these areas look like Nature, but unlike Zones One to Five, where the goal is to preserve and develop Nature, the goal here is to serve only human needs. In this direction we have to develop them and change them where needed from natural relationships to Anthropos-made ones. The goal is to serve human need: and we have to understand it. In this way we can, in an environment which is no more than 10% built-up and looks very green and natural, build all sorts of sports grounds, entertainment installations (luna parks and the like, etc.) hot for big masses of people, second homes, etc. It is in this Zone that humans must be given the opportunity for all sorts of relationships with Nature reaching up to sexual ones where humans can, as nudists, embrace and touch Nature by swimming or lying on the grass among flowers.

The total area of this Zone can reach 5% of the global land surface twice as much as the four remaining Zones of Anthropos and Industry which we call built up. With such an extent this Zone can serve all types of inter- related human needs in an ideal way.

Zone Nine is the Low Density City. It is the area which in some countries is called the suburb, but in reality it is an organic part of the city as it cannot exist without it. It

really is the purely residential Zone where the main function is residence with all the facilities needed by it from social and other services to non-disturbing areas of employment in commerce, handicrafts, research and light industry. Low density does not mean at all the existing low densities in some cities which are completely unreasonable but the low reasonable densities which are about 70 persons per hectare (28 per acre).

The total area of Zone Nine should not exceed 1.3% of the global land surface. This means a little more than the total of the remaining three Zones. Its development should be guided by the desire for the best type of human development (18). This means two and three-story houses and some higher ones only for special groups of people like the very old, sick etc. who need very well organized care.

Zone Ten is the Middle Density City. It is the area where residence does prevail but is no longer the main function as in Zone Nine. The other functions which exist in Zone Nine in a small percentage each in order to serve but not to disturb the residential structure and function exist here also but in a higher percentage and thus this Zone could be called "mainly residential" versus Zone Mine which is really only "residential" as its other functions have to be justified by the main one. Middle density, in the spirit already explained about densities means an average of 110 persons per hectare (45 per acre) the total area of this Zone should not exceed 0.7% or about half of the previous one. This means an almost equal population with Zone Nine at twice its density. Its development should also be guided by the desire for the best human development but the open areas, the gardens, etc. should be limited so that the area can reach the maximum reasonable limit for human development Zones, as opposed to Zone Nine which has to keep the middle density.

Zone Eleven is the High Density City. This means the central areas of large cities where there is a mixture of all types of functions from residence in a certain percentage of 30-50% to central administration and all other types of central functions. High densities for this Zone mean an average of 300 persons per hectare (120 per acre) which starts with 200 persons per hectare (80 per acre) which is the density of the traditional cities we now admire, like ancient Athens, and goes up. to higher densities made possible by special central functions (not so much housing) and modern proper techno- logical solutions like the multi-level city separating humans from machines at different levels.The total area of this Zone should not exceed 0.3% of the total land surface. The character of this Zone is not at all meant for complete human development. Children cannot properly grow in these high densities and thus the residence is meant either for young unmarried or married people without children like students, to very old couples or single individuals who need all types of contacts in an

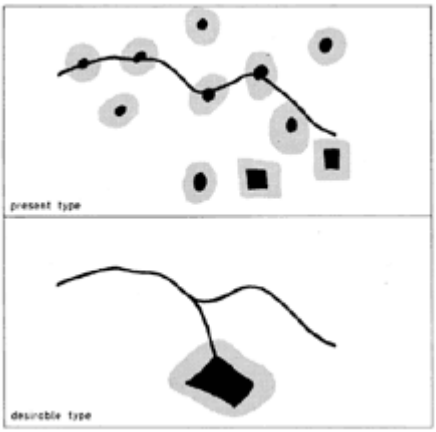

Fig. 6. Distribution of the Heavy Industry and Waste Zones

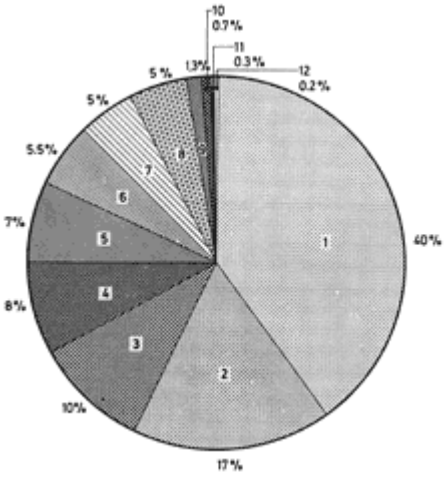

Fig. 7. The Twelve global Zones of Land

easy way, to all part-time residents, visitors etc. All these, clarifications mean that it is a very necessary type of Zone, but very dangerous for human development if we allow families with children to live in it. It is very useful, but for central functions only.

Zone Twelve is the Heavy Industry and Waste Zone. This is the Zone that we are lacking today and thus we make a very big mistake both for the quality of the total environment and for industrial development also. Although there are several industrial Zones all over our globe, some few of which are very well organized and served by facilities, nowhere are there the big and isolated Zones that we badly need. In some way we can state that we are out of scale and thus the big industries which are very disturbing instead of being concentrated inside special Zones and isolated by special measures are distributed one by one and create much greater problems as we see in the example of Figure 6. Waste disposal, when disturbing aesthetically (eyes, ears, nose, etc.) should be limited to this Zone as well as all corresponding types of recycling. The total area of Zone Twelve does not need to exceed 0.2% of the global land surface. The solution is for it to be created in the right locations so that it can be isolated because of natural formations (hills, etc.) or human-made modern city walls(this means walls in the sense of old fortified cities but now consisting of special dams, plantations, etc.) from all Zones that should not be disturbed. This may well mean a larger distance from the Anthropareas but with modern means of organized transportation (high-speed trains, etc.) and because of the concentration instead of dispersion it will not moan any additional problems. Industry, provided proper technology is properly applied, is not disturbing at all. What is disturbing is its mixture with other functions and Zones. We should not forget that even the worst deserts or polar areas of our globe do not disturb most humans if they don't contact them. What disaster the Industrareas may cause from some ecological points of view is related to what they absorb and turn out, but this is not a problem of location, which is our subject in this study.

This description of the Twelve Zones was a very short one with the intention of transmitting the substance of some basic characteristics which help to define the criteria of all of them which are too many to be described here. As an example of how many they are, apart from those already mentioned and how we will deal with them, I give three cases which have not been mentioned but are very important. The first one is that the speeds of all sorts of machines will defer very much by Zone. In Zones One to Four there are no machines and therefore speeds are defined only by human and animal energy. From then on speeds begin at low levels in Zone Five and up in very high ones in Zones Eleven and Twelve or between some Zones in special corridors.

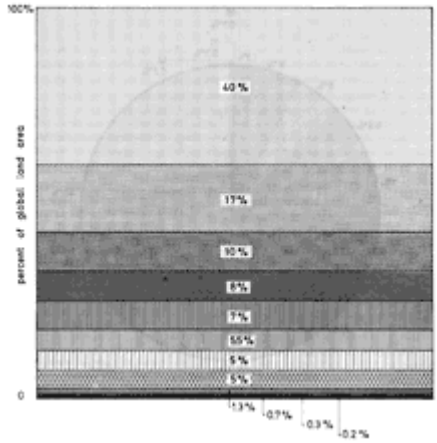

Fig. 8. The Twelve global Zones of Land

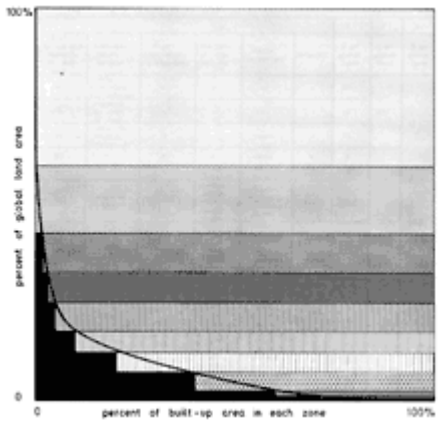

Fig. 9. The Twelve global Zones of Land and their built-up areas

The second case is lights outside of buildings, whether existing outside or generated inside but influencing the outer environment also. Again they differ very much from Zone to Zone and start with zero value in Zones One, Two, Three, reaching the maximum in Zones Eleven and Twelve. The case of Zone Eight of human physical life for example allows very few lights because people do not go to a resort hotel to see big advertisements when they sit by their windows at night to enjoy the peaceful environment. In Zone Nine (mainly low density residences) the conditions are the same, only here we can have the lighted sign of first-aid stations etc. In this spirit the lights increase to the maximum in Zones Eleven and especially in Zone Twelve which may have to operate day and night. These characteristics are not only related to the amount of energy we use for lighting but also to the location of lights for circulation, security and advertisements and therefore lighting has its own rules and very many ways in which its use will be regulated.

The third case is the use of fire or fire-producing machines or materials. It is certain that one of our main tasks is to save Nature and Anthropos-made environment from fire. This means that in some Zones people should not even be allowed to enter with matches and in other Zones should be allowed to use fires only under certain rules. These rules will have to be more strict in regions like the Mediterranean where forest fires can start, and be spread much more easily. Thus we conceive also the notion that, apart from the general rules about each type of Zone on a global basis, we will also have special rules for every type of area and region.

Another point to be clarified about the Twelve Zones is that every figure already given is valid in a tentative way until further detailed studies can be carried out, only on a global scale. Every continent, nation, region, etc. will follow different percentages, depending on their geography, development up to now, values of the existing natural environment, potential for growth, productivity, services, etc. The policies on this aspect depend on too many factors and will be influenced by political systems as it is easier for example for China and Russia to preserve values than for countries with a large percentage of private ownership of natural resources. I deal briefly with this aspect of the total situation in section D1.

Finally we need a clarification of the relationship of natural or wildlife areas with those where human aggression takes place as there is always a confusion about what a human settlement, like a city is, what a built-up area means, etc. To achieve this, we proceed in the following way. We first clarify the percentages of the global land surface taken by every Zone as already explained. The total picture is given in Table 1 where we see the percentages by Zone, by groups of Zones and by areas. From this we see that the four areas cover the following percentages: Naturareas

82%, Cultivareas 10.5%, Anthroparea 7.3% and Industrareas 0.2%. In Table 2 we see though that as some Wildlife Zones include roads or buildings and lose a part end the other areas keep a part of wildlife, 83.7% of the total land surface is given to wildlife and this rises to 94,1% if we also add the cultivated percentage of land.

In such a way we can better understand how the global ecological balance depends on more careful and very detailed studies for which the present percentages provide only the first frame. The Twelve Zones are given in Figure;7, 8 where we can see the. difference between Nature and human settlements as represented by basic Zones. In reality humans attack smaller areas in terms of surface then the previous Zones (Fig. 9).

4. The Twelve Water Zones

The water territory is much larger than that of land, not so much in terms of surface, where it is about three times larger then land, but mainly in terms of volume as it goes deep into the oceans and high in the air. It is a territory that has direct relations with humans and that is hundreds of times larger than the land which is so limited in the depth that has a direct relation with humans. On the other hand, water is the territory that suffers more from pollution. For example "most of the oil reaching the sea does onot come from the tankers, it comes from the atmosphere, from auto-mobile emissions and industrial wastes" (19). What really happens is that a lot of the overall chemical pollution starts on land, air and water and ends in the water empire which finally means in the oceans.

The total water territory is a huge empire which is divided into three kingdoms: the open water one, the underground one and the atmospheric one. Here we will deal with the first kingdom only and the others will be dealt with in another phase of this study as the relations inside them are more complicated. This huge empire is also a very big reservoir of energy and "the sea is the boiler and the condenser of a giant thermodynamic machine, the sun being the heat source" (20). In spite of the great importance of the. water empire we do not yet know enough about it as a whole system although there are some very detailed studies for some of its parts like atmosphere, rivers, lakes down to the deep oceans. The reason is not only due to the huge dimensions and the many forms of the system but also to the need to study it with too many sciences from physics to ecology which have not made yet all the connections which are needed.

In terms of Zones we still do not have any systematic approach except for the oceans for which we have the territorial seas, the inter-national straits and the economic Zones which are now beginning to be faced. It seems that in 1975 we will have a basic United Nations agreement,

but we still lack it. Thus the big question is what kind of Zones we can set in the water empire to serve the Global Ecological Balance (G.E.B.) which is our goal. The answer may seem strange to some people dealing only with the oceans as I propose the same types of Zones as for the land empire. The reason for such a reaction will be: But how can we separate a Wild-life Zone from an Industrial one in the oceans? The oceans are unified systems and water runs everywhere without our control which is very small. My answer is the following: First, the water empire does not only consist of the oceans, but is much larger and has many forms and although we cannot isolate these zones of water in the air or the oceans, we can achieve much more for water on land. A small isolated lake in a small valley can be definitely isolated from direct human intervention. Second, the definition of Twelve Zones does not mean that we can realize them immediately, not even on land. What it really means is that we will have set our goals because if we do not we will never achieve anything.

It is in this spirit that we look at the Twelve Water Zones. A systematic approach requires that we see them separately as Water Zones on the land kingdom and water in its own kingdom of the oceans which is a part of the water empire. We certainly have the Water Zones in the kingdom of the air also, but we deal with them in section C6.

Here we start with the Water Zones on land. What we can say for them is the following. When we speak of the water kingdom on land we mean all forms of water resources from rain falling and running on the land surface to rivers and lakes, up to the underground water. These all form a system which also feeds the ocean kingdom but can be definitely looked at as a separate one. The Zones of this kingdom do not present any problems which are very different from those of the Land Zones to which they belong, so we will look anthem in a short way.

Zone One, that is Real Wildlife, can contain some lakes and rivers as well as sources of water etc. provided they also cover the whole system feeding them. There is no reason why countries like Canada cannot declare some lakes as completely off limits to Anthropos, even for swimming, and why every country cannot do the same for at least the upper parts of some of its rivers. Only scientists should be-allowed to enter them for research. Many cases now such as the Lake Nakuru in Kenya (21) which is a wonder of the Asian world and is threatened by the pollution coming down from the Great Rift Valley, clearly demonstrate how carefully the territories comprised within every Zone have to be defined.

Zones Two, Three and Four also need very careful definition of their boundaries. Water coming out of them into other Zones can be very well used as its only pollution will be from the air coming down into it or from the rain.

This is 3 problem that can be chocked at the entrance of the other Zones and gradually controlled.

Zone Five, that is Wildlife Conquered, is the first Zone where water must be completely controlled and used by humans for the sake of Nature inside it and for their own sake when it flows above or below the surface outside them. This will happen through canals, dams, etc. as this is the Zone entered by humans with their machines.

Zones Six and Seven are the ones where water plays and will play a much greater role than at present in two ways. First, the water circulation must be completely controlled and extended. A process that started to become a system thousands of years ago in Asia and helped so greatly the development not only of production but also of civilization and, which is so much developed now even in low-income countries like China with courage has to be much more developed allover our globe. Although in some of its parts it moves well, as a whole it lags behind what could already have been done. The second way which lags behind much more is aquaculture which can be enormously strengthened in many places and lead to a very high productivity of food and other resources. It may even perhaps lead to the solution of turning some aspects of pollution into food production as is being tried and experimented by some scientists in Belgium (22) and elsewhere .The kingdoms of land and water must be married in a very tight way in these two Zones.

Zone Eight can be handled in the same way as Zones Six and Seven with one difference: if some of its parts become useful for production they will be transferred to Zones Six and Seven even if they are small because food production is a major goal. If the physical formation of the separation needed takes place in the proper way there will be no problem. On the contrary the proper formation of the Cultivareas inside Zone Eight can help very much for educational and other social goals.

In Zones Nine, Ten, Eleven and Twelve there is no special need for any radical change of what has been attempted since ancient days, that is to have enough water for all urban needs and proper ways to get the waste out. Present-day and developing technology will help very much to achieve these goals in the best possible way. Water circulation will be mostly underground, but we should never forget that water in canals and lakes can help not only to solve problems of entertainment but also to change the climate and the esthetic environment. The effort has to be made for these Zones to look at water as a very positive element in many respects and not only as water supply and sewage system.

In terms of surfaces to be covered by the Zones of this kingdom we cannot state anything more at this phase of the study but that they should correspond to the Twelve

Land Zones because they have to be very well coordinated with them. More detailed studies will prove where coordination may not be practical, especially where we may have to cross a Land Wildlife Zone by a canal or pipe belonging to a higher order Water Zone. It is a matter of studies for implementation of the whole system.

We now move to the other water kingdom, that is to the oceans. Again our goal is the same type of Twelve Zones and it is here that the objections already mentioned are valid. There is no reason for saying, however, that because pollution with several chemicals spreads over the oceans we should not try and save some areas as wildlife in water. The fact that a slightly polluted current alters a certain port because of its opening to the ocean does not mean that we should not try and save it from every other type of pollution coming from very small distances or entering the port by polluting boats. In this spirit I say a few words about these Zones because their basic characteristics and our goals are the same as with the Twelve Land Zones.

Zone One is the most difficult to be created in the oceans. If, though, some isolated bays in several parts of the oceans which receive water from the land could be fed only from Land Zone One or related zones and not from the oceans then there is hope for keeping thorn as Water Zone One. To go to an extreme solution in order to open our minds to many alternatives, we can say that someday we may find bays which receive so much water from land that there is not water entering them from the ocean or a greater extreme, we can someday close a bay by a dam and use it for large-scale experimentation.

Zone Two, or Wildlife Visited, is easier to achieve in the sense of Zone One as the demands are not so great. Here humans will enter, but as primitives did, that is they can swim or use timber or timber boats for sailing or fishing, but they cannot bring any machines or industrially packaged food. The situation will be similar for Zone Three, that is Wildlife Embraced, where humans cannot only pay a daily visit, but can also live in it provided they forget modern technology and all sorts of chemicals.

Zone Four, or Wildlife Invaded, needs greater care as it is the Zone to be kept as virgin as Zone Three, but with one difference: that it has to be visited by too many people. It is the Zone where the education of children, and students, and grown-ups even as tourists will take place in order to open their eyes to what wildlife is in water. This will take place through specially designed boats crossing this Zone at low speeds with no material discarded and all waste being removed to special areas of Zone Twelve of Land or Water.

Zone Five or Wildlife Conquered is the same as Zone four but needs some harbors for the above-mentioned boats

and full coordination with Land Zone Five or at least with Coastal Zone Five (see section 5).

Zone Six for Natural Fishing is easier to define in the coastal seabed for coastal species, but more difficult for anadromous fish (coming from Zone Six in the water kingdom of land) and much more difficult if not impossible for anadromous and migratory fish which move at times into the oceans. At present we only speak about what can be territorially defined. It is the Zone for the natural and human-made natural cultivation of fish and other sea organisms. Every type of action with this goal is allowed provided that boats and methods used do not cause any pollution problem for the plant and animal life. It is in the direction of saving such natural Zones as well as the corresponding coastal ones that ecology has won some battles as in the North Sea where natural environment has been saved from the construction of oil platforms (23).

Zone Seven, of Industrial Mariculture, is one of revolutionary importance, as is the corresponding Land Zone Seven. The meaning of it is to locate and develop the areas which can be dedicated to industrial production of plants and animals of all sorts. The meaning of it is to change the old habit of fishing or animal collecting to their production in the best automatic way. Jacques Cousteau is right when he states that we will have to "abandon industrial fishing and turn to aquaculture"(24). We definitely have to and we can increase the productivity of the sea many times.

The remaining five Zones are related to increasing human activities and development projects and therefore they come close to land and in many ways they coincide with the Coastal Zones which follow.

Zone Eight for physical human life is where every human action is allowed provided it serves human entertainment without disturbing the ecological balances which exist. Or even better, it establishes the values that may have been lost by some previous wrong action. This means all types of small or major installations are permitted allowing humans to indulge in all sports by using all sorts of machines which are not allowed in the Natural Environment Zones(One to Five).


Fig. 10. Entopia

Zone Nine contains what corresponds to the low-density Land Zone: for example, all sorts of small ports for all sorts of boats are used in a way allowing people to live around and enjoy them. In some ways it is like Zone Eight but with the addition of commerce and transportation to entertainment.

To illustrate what we mean by this definition of Zone Nine and the ones which follow we can look at Fig.10. To the left we see the small traditional port which receives only traditional boats and to the right the more modern port

meant for boats sailing at high speeds. If we mix these two very different systems we have them both out of scale and they will disturb greatly many aspects of our system of life from the organic to the esthetic.

Zones Ten and Eleven are one and two steps up from Zone Nine as both contain modern technology. The first contains ports for more and more larger boats, let us say up to 30,000 tons and life in it depends on commerce and trade. The second contains every larger type of port facilities for all possible sizes of present and future boats and very special installations for containers of all sorts allowing complete interconnection with city, commerce and industry.

Zone Twelve is another new and revolutionary type of Zone which is meant to serve certain needs for a few generations at least or possibly forever. It is the Waste Disposal Zone where the waste which is now thrown into the oceans by boats or from the land as it cannot be recycled yet, will be collected for gradual future chemical and bio-logical processes which will turn the polluted water and waste into something useful, first for Nature and later for humans also.

In closing this section we must again remind ourselves that we are not ready to define the surface, or even the depth, of all these Zones but this gradually has to be achieved by steps. What can help is the definition of the territories and the water agencies as is beginning to happen, in France for example, but not yet for multi-national territories or international ones. At present we don't have the complete concept of the water empire, its kingdoms and its parts and thus we cannot help to conceive its future and its necessary management. Here we only start with the basic concept and process.

5. The Twelve Coastal Zones

The empires of land and water are married in many ways as we have seen and the area where this marriage takes a very specific form and expression is the coastal one. It is here that the land kingdom above the sea surface embraces the water kingdom of the oceans as well as lakes, rivers, etc. The official figures of the length of Coastal Zones in the oceans on a global scale is 261.3 thousand kilometers but the real length is much longer because in morn detailed scales the lengths increase and we have to add the Coastal Zones of lakes, etc.

Theoretically we have already covered these Coastal Zones because we already spoke of their land and water parts. In reality though we have to face them as a separate element because they have very interesting characteristics. A land surface may be Zone One {Real Wildlife) but its Coastal Zone may have such a great esthetic or educational interest that it should be visited by people and thus it may

have to belong to Zone Four (Wildlife Invaded). Only a detailed study can answer how fare inland it should go and how deep into the sea which may be again a different type of Water Zone let us say even of higher order because big boats have to sail near it.

The other reason for looking at the Coastal Zones as separate ones is that in many cases they do have and they attract much greater activity than the land and water ones. One coastal area may well have to be Zone Eight for physical human life, while the land behind it may be Zone Six for natural cultivation and the ocean next to it a Wildlife Zone.

The third reason for the need of separate classification of Coastal Zones is that because of pollution coming to them and the great attraction they have for humans and the activity they raise, they are in much greater danger of lack of balances than any other type of area on a global basis. They are also exposed to greater danger in case of wars. For all these reasons and for several others there is an imperative need to look at them as separate Zones and sometimes with great priority for proper action.

The classification of the Twelve Coastal Zones fallows the same principles as for the Land and Water ones. The first five are the Naturarea Zones. These will not cover as large a percentage as the land of this category because of the special needs of the transportation systems, etc. The Cultivarea is again divided into Zones Six and Seven, but these Zones are neither so long as the corresponding Land ones nor very deep because of the special attraction the coast has for many other human functions.

The four Zones that will be strengthened in length on a percentage basis in relation to the Land ones belong to the Anthroparea (Eight, Nine, Ten and Eleven) as we know that the trend towards Ecumenopolis strengthens coastal development. This is a natural trend but very dangerous if we let it remain uncontrolled as we can understand in the Ecumenopolis study (25). We should not forget that the trend to Ecumenopolis does not mean that we do not need an Ecumenokepos or global garden also. This is one of the reasons we try to see and understand all these Zones and their real meaning.

The Industrial and Waste Zone Two also needs to be on the coast very often and creates the greatest danger of all in many ways. To face it we have to remember that industry is needed and we can face the ecological dangers from it if we face the problems in a creative way. This does not mean that we should say "no" to industry but that we should create the proper Zones for it, since a total of 0.2% of the global land area does not create any danger if it is shaped in the right way. The Industrial. Coastal Zone may have to cover a higher percentage in length but even if it reaches 1% in some regions there is

no danger, provided we select the proper bays for it and establish the right type of landscape formation as we already said for Land Zone Twelve, To sail for a length of 200 miles near the const and to see a two-mile bay full of industries cannot bother anyone if things are done properly and no dangerous pollution takes place.

This last example of sailing along the coast explains in how many ways we have to look at the coastal areas, as we can remember by looking at the Anthropocosmos Model (Fig. l) and all its elements. Coming to Athens for tens of centuries from the sea people could see the Acropolis above everything else as its symbol, and it was. During the last few years the attempt was made to build twenty-story buildings on the coast. Thus the Acropolis would be reduced to a small sign of the past and the new towers, making many people very rich overnight, would become the new symbol of our civilization. The cultural aspect of ecology as well as others was forgotten, but the proper battle and government action saved the situation and finally kept the Athens Coastal Zone in balance with the total environment. It is in this spirit that we must "see" our total system and the very great role of the Coastal Zones which are so important for the quality of our life.

6. The Twelve Air Zones

Air covers the largest territory of all. This empire cannot be divided into kingdoms as happened with land and water. It is a unified empire which has its thickest layer directly over the other empires from which it takes a lot of elements and forces and its lighter ones higher up. There is a very great action in it and many forces which change its balances continuously, sometimes in a dangerous way.

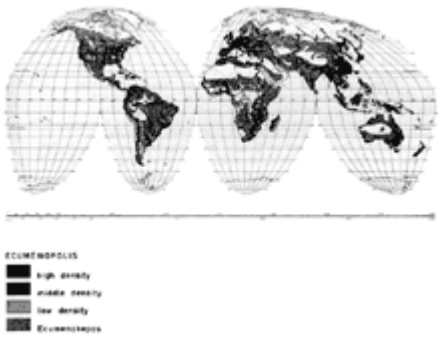

Fig. 11. Ecumenokepos or the global garden

It is in this empire that we have the smallest human action as even the huge airplanes do not represent forces surpassing the ones on water and much less the ones on land. This statement does not comprise the human activity at the outer limits of this empire where it touches the other ones, especially the land one. It is here that the human activity takes place in the normal human height and as high as the buildings go. Although lately we have some huge towers, the height of human activity has not really increased by more than a small percentage and we can still speak of an average human activity on a global scale of no more than six feet. This activity is therefore covered by the one on land and in an extended way on water and therefore the main characteristics defining the Air Zones are the characteristics of the Zones below them.

On this basis we can say that the Air Zones are twelve and each one of them is above a similar type of Zone. This does not mean though that this basic rule commits the Air Zone only to the one below it. The most characteristic case is the problem created by airplanes and the direction they

Heavy Industry, means necessarily that the Air Zone above it cannot be anything else but Zone Twelve. We cannot always keep the air above the land Wildlife Zones absolutely correctly as some airlines may have to cross them. This case is characteristic of what our goal may have to be. If we can keep certain wildlife areas on land why not try to achieve them in the air also. We will not achieve it up to 100%, but if we try it we will be given the opportunity to study the possibility of air corridors based on ecological considerations. We need in any case a much better approach of the overall problem of air transportation or better air movement (26).

When we try a scientific approach, as has not yet occurred, we will find that even from the economic and organizational point of view what happens today in air movement is wrong. When we face it properly by reducing the number of sir corridors, we will serve better humans and Nature from the ecological point of view also. As seen from the rational movement point of view, and if we set the proper ecological goals, there is good hope for the achievement of some coordination of the two desires to move better and to disturb balances much less. Setting of goals is the only sound foundation for a much better future.

In this spirit we proceed and define the twelve types of Air Zones on a global map and then we study where the action in the atmosphere which is caused by Nature or where the human action as expressed by pollution of all sorts, from carbon monoxide which spreads so much, to the S.S.T., can allow the full correspondence of one Land or Water Zone to a similar one for the air or not. In this way the initial map set as a goal will be readjusted to correspond to reality and the Twelve Air Zones will be finalized and will be probably a bit less in extent for Naturareas than the land and water ones, but the difference can really be small.

As this is the territory which is really common to all nations (not legally but in substance) the effort in this direction is the one that is mostly internationally needed and it is not coincidental that collaboration has already started, especially for the understanding of climate. There are some good signs in certain disciplines and we begin to see how much they all need coordination. Ecology can provide it.

D. FROM SETTING OF GOALS TO ACTUAL EMPLEMENTATION

1. Can we really achieve our goals?

After setting the goals of order in our space for a Global Ecological Balance (G.E.B.) I made specific proposals for the ecological types of space that we need. As the purpose of this study is not to create a theory, but actual

implementation of a practical plan, we have to answer the question: What is the value of these proposals? They are the basis for a move from well meaning, idealistic declarations and uncoordinated action towards a realistic, coordinated action pro- gram for implementation. Many efforts are being made all over the globe and Anthropos is moving from declarations to specific studies, especially after the UN Stockholm Conference, with such efforts like the UNESCO program on Man and the Biosphere (27), the Pacem in Maribus movement to save the Mediterranean (28), the U.N. Caracas Conference on the law of the sea, the IFIAS (International Federation of Institutes for Advanced Study) program on World Water Resources and Strategies for Management and several others. The meaning of my proposals is to help, to insert dimensions in all our decisions in order to make them work, and to remember that Anthropos is the measure of all things as Protagoras told us very early.

Are not the dimensions of these proposals so huge that their realization is improbable? No, for they are not really "huge" because this word is meaningless unless we connect it with time, space, and resources. When humans tried to create their first small and elementary network for water 500,000 years ago, as we learn now from Mary D. Leaky (30), when they created irrigation systems 5,000 years ago in Egypt (31), complete sewerage systems 3,750 years ago in Nippur, India (32), a water supply tunnel 4,260 feet long in Samos, Greece 2,500 years ago (33), and when, more than 2,000 years ago, humans were building dams in China (34), we must be careful about what we call "huge". In those days humans used from 2,500 to 10,000 calories per day per capita and had an annual income per capita of less than $100. Now incomes have increased more than 40 times and energy more than 80 times. For many people this means that on the basis of income and energy, our irrigation systems can reach lengths of 20,000 km (12,400 miles), that is one half of the global periphery or the maximum distance we have to face, and our tunnels can reach more than 200 km (124 miles), that is tunnels crossing the largest mountainous areas. With such systems we can solve all our problems just by keeping the normal pace of evolution.

But then are we going to achieve the great changes that we need? Can we realize them in our five-year programs or within one generation's time? The reply is that we can and do achieve many things with five-year plans, but many other things require much longer periods. Again the answer has been given by history. I start by quoting Mao's story about a foolish old man who wanted to dig up mountains and distribute water over wider areas. A wise old man said "How silly! It is quite impossible for you to dig up these two huge mountains". The foolish old man replied, "When I die, my sons will carry on. When they die, there will be my grand- sons, and then their sons and grandsons, and so on to infinity. High as they are, the

mountains cannot grow any higher, and with every bit we dig, they will be that much lower. Why can't we clear them away?" He then went on with his digging (35).

But this is not the only example from history. Any proper feasibility report can prove that no farmer can have such a house as he has on many mountains of the world and no medieval city could build a huge cathedral. But they both were built and we admire them today because humans were able to start processes and finish them step by step over a few generations.

This is my answer to all the pessimists who laugh or cry at broad concepts about a much better world: Let us have the proper concept on a global scale, by planning the dimensions and types of global spatial Zones. Let us conceive the overall system we need and elaborate on it with science and technology. If we do this, someday Anthropos will celebrate a life of much higher quality in his global city, or Ecurnenopolis (Fig. 2), which will cover 2,5% of the total land surface, surrounded by the global garden, or Ecumenokepos (Fig. 11), properly irrigated and supplied with an ideal global system of water or Ecumenohydor.

The conclusion is clear: we can definitely achieve our goals and we can reach the Global Ecological Balance (G.E.B.). We cannot yet say when, but once we set the goals and a plan of action it will become clear quite soon how and when we will reach our goals for an ideal balance.

2. The Twelve Zones at all Levels

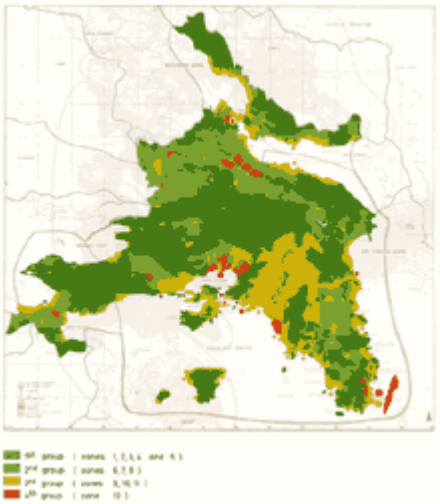

Fig. 12. Cluster of Zones as proposed for the Greater Athens Area

The whole proposal for the Twelve Zones made so far and especially all figures given about their dimensions are valid as a tentative proposal, but only on a global scale. The percentages for every Zone's territory ere not meant to be valid for every continent or nation, region etc. I will take the example of nations.

To be practical in e world where we pretend (not South Africa) that we are all equal, the divisions must be made by nations. If one European nation has already eliminated more than two thirds of its wildlife, as many have, it cannot insist, without paying in some way for its own overuse of natural resources, that Africa for example, should save every single part of wildlife. We cannot achieve our goals without justice. We need a proper and realistic distribution of resources and obligations in order to reach our balance among the Twelve Zones on a global basis.

If we forget this truth we may, apart from difficulties in the actual implementation of such proposals, run into difficulties in reaching an agreement on the basic principles also. We should not forget the discussions at the 1974 Bucharest Conference on population which proved

again how big a gap there is between speaking about basic problems in general and at different levels, scales and places. Nobody can or should, agree on a singles population policy, as every country is at a different phase of development and has necessarily different needs and goals. Thus for spatial areas and Zones we will have the same difficulties. Arranging the percentages on a global basis certainly does not mean that they are valid by continent, nation, region, city, community, etc.

As we cannot in this study give the answer for all levels and scales, we should clarify what these levels are. There are two practical ways to look at this problem. One way is to look at political boundaries. We must recognize that after the global scale we must move to the national one and then to its political and administrative subdivisions. This means a great scientific and organizational problem, as from the global seals we have to move to more than 150 national units and then to many tens of sub-units in some nations etc.

Such an approach does not help at all towards a rational solution of our problems. The very fact that we miss a continental overview of the situation explains how weak such an approach is.

The second practical way to look at this problem is to rely on ekistic units which are based on geography, administration, etc. (see also section B2, Fig. 1)(36). As the nations are the units which take decisions for themselves and for the whole globe through the United Nations, the final practical solution is to use the ekistic scale for scientific work and to move to the national one for the decisions which are needed. In order to illustrate this systematic approach we will apply the ekistic scale.

There are fifteen ekistic levels beginning with the global Ecumenopolis, going down to the continental unit or eperopolis proceeding to megalopolis, metropolis, polis, neighborhood, house, room and Anthropos (37). Nations like the U.S.A., U.S.S.R. and China correspond to ekistic unit 13, whereas others like Singapore go down to ekistic unit 9 or J.O.

In dealing with the global ekistic unit 15 we must, for example, reach an agreement on the S.S.T.'s which threaten all nations even if they are not allowed to land in them, although they will fly only in the upper atmosphere. In dealing with continental ekistic units (No. 14) we have to look at climatic problems such as the expanding desert in Africa and face water systems on a continental basis. In this way, going down the scale, we have to face many eternal problems, such as lack of water, or contemporary ones such as increasing pollution in a certain big valley or in a certain bay. When we move down to ekistic units 12 and 11, that is at the megalopolitan scale, we have to face the misuse of land resources, the lack of coordinated

transportation and utilities systems, and many other related or unrelated problems. The same ekistic units may also comprise big national states, such as Nigeria, which begin to change rapidly in some of their parts (like Lagos), at a very high speed and badly need action in many ways.

The next ekistic units, 10 and 9, may well represent small urbanized states like Singapore, as already mentioned or small and mostly rural ones like Cyprus. Necessarily, because of organizational reasons, although the scales are smaller, we have to face every type of problem. Most of these ekistic units are metropolises which present mainly characteristic urban problems and the aggression against the countryside and all its values. It is at this level that people begin to ask themselves if they have not gone too far out, like in Los Angeles, and if the time has not come to create a mass-transit system to reduce total urban cost and pollution.

Fig. 13. Proposed areas for protection - Patmos island, Greece

In the lower levels of polis (ekistic units 8 and 7) that is the traditional town and neighborhood (ekistic units 6 and 5) we begin to face, other problems like the lack of natural green areas, pollution of many sorts including noise disturbance, the lack of social balances, etc.

Finally in the very small ekistic units from the house-group (ekistic unit 4) to house and room (ekistic units 3, 2) and to Anthropos himself (ekistic unit l) we really have many kinds of the problems already mentioned at higher levels as well as many other ones related to quantity and quality of architectural space, and to the human relations with their environment as seen from the biological, the physiological and the psychological points of view.

Here I want to state that this whole presentation is not at all theoretical and that personally and as an office (38) we have tried a systematic approach to this problem in many places of our globe. As an example of the Twelve Zones and four areas, 1 can mention Athens, Greece where the Zones and areas have been studied end proposed to the Government which has in principle accepted them (Fig. 12) and in a smaller scale the example of the island of Patmos which has many natural and cultural values to be saved (Fig. 13).

On the basis of the overall approach which has been presented as a system and the personal experience of fighting for forty years for the gradual development and application of a systematic approach in more than forty countries, I reach the following clear conclusion: We have 15 hierarchical levels in which we have several problems beginning at a certain level, where we must concentrate for their solution, but spreading at many more levels if not at all of them. We cannot therefore hope to solve any problem by limiting our action to the creation of the Twelve Zones at the global level only or at any other single one. When the United Nations are going to agree on

Global Ecological Balance (G.E.B.) at the global level this concept cannot be implemented if there is no provision on the rules by which these 12 zones are going to be agreed by continent, by nation and then inside every nation down to the room and its relation to humans. At every level we need other spatial balances. There is no logic in trying to reach the same percentages of the 12 zones for the capital city of a nation and its farming region. The solutions have to be very different, but together they must lead to the National Ecological Balance (N.E.B.) which again in order to be successful has to be a part of a broader one, of a Continental one (C.E.B.) and of the Global one (G.E.B.). Again we reach a basic conclusion: the Global Ecological Balance (G.E.B.) that we badly need depends on a multi-level system of balances that is very complex. This is the main reason why we do not yet dare to face it and the only answer at present is to establish the system for the creation of the Twelve Zones at all levels in a way satisfying the demands at every level. This is the basic need. A big question arises for the implementation of this system: if the majority decides on an Industrial Zone or big highway through a certain area and the minority living inside opposes it, who has the right for a decision? This means when there is a conflict between two levels about action, where does the power lie? In the larger unit which wants development, or in the smaller one which is affected and says "no"? The reply lies in a very complex model, and when we start applying it we will have made a very important step towards the implementation of the Global Ecological Balance.

3. Conservation and Development

The definition of the twelve types of Zones on a global basis first and at many levels gradually, sets the frame for the proper conservation and development policies. These policies and their programs have to define what we do, when and how in every place. Once we have set the ultimate goal for every place through the definition of the zones we will have the basic criteria to decide on all problems which have to be solved. Once we know that an Industrarea lies at a 15-mile distance from the Anthropareas and that this will not change in the foreseeable future, we have the facts on the basis of which we can give priority to face first the problem of air pollution which influences the atmosphere permanently (as far as we can judge); second, pollution which is very weak at 15 miles distance, even when the winds transmit it, and finally the problems of noise as they do not bother people at 15 miles distance and can be faced last.

On the other hand, when we deal with motor cars which pollute the atmosphere in many ways, we must give them priority as they move inside the Anthropareas and they will do so in the ultimate future. The motor cars must become machines which do not create any kind of environmental problems. An effort is already under way to

solve their chemical pollution. As noise pollution has not yet been faced by such action, we can describe the human demands in certain Zones and write the specifications for the noiseless machines that we need and, until they are produced, for the machines recording the noise of every car at every moment so that once a month we can receive the; report who disturbed the humans and how.

In a similar way we can face the pollution of the land surface by machines and decide that they must go underground or below the buildings inside the Anthropareas. They can remain on the surface (at least for the immediate future) inside the Industrareas and forever on the surface inside Wildlife Zone Five which is meant to help people to visit and enjoy Nature by using the proper machines on the proper roads.

By acting in the way already described, we can help towards the conservation of all values that have to be conserved and at the same time towards the development of all values of higher quality which we need and we can develop in an entopian (39) way even if our initial dreams are Utopian. Conservation of values of ecological importance and development of new ones in the line of ecology and ekistics are our two practical goals and the classification of the Twelve Zones helps us to see where we need one. science only or both. Zones One, Two, Three and Four need ecology only. In Zone Five ekistics enters in a small scale. This trend of ekistics continues to grow slightly in Zone Six, more in Zone Seven and much more in Zone Eight. The remaining three Zones of the Anthroparea need ecology and more and more ekistics and the Industrarea (Zone Twelve) has to be developed by ekistics, but under the full control of ecology.

4. A First Plan of Action

To be sure that we move from the setting of goals to actual implementation we have to end such an effort with a plan of action. As it is too early for a final plan, I propose a first plan of action that can be revised a year later and from then on follow a more detailed time schedule. This plan consists of the. following eight steps:

1. Symposion for an open discussion of the Global Ecological Balance (G.E.B.) among all types of experts concerned with ecology and ekistics in the broadest way. First half of 1975.

2. Collection of data and preparation of more detailed plans for several areas at different levels always with Twelve Zones to test their feasibility. October 1974 to October 1975 in A.C.E.(40).

3. Preparation and discussion of the third report of Global Ecological Balance (G.E.B.). The present one I consider as

the second one although I have issued several during the last two years(41) but in order to simplify the process I consider them all as one since the substance of their contents is the same. Symposion in October 1975.

4. Report for the United Nations Conference on Human Settlements to be held in June 1976 in Vancouver, Canada. To be published and submitted in March 1976 by a non-government organization such as the World Society for Ekistics or anyone else that will be interested in supporting it. This report should contain three parts, the Global Ecological Balance (G.E.B.) in its third report, a detailed plan of action and specific proposals on the agencies to deal with it.

5. The United Nations declaration on Global Ecological Balance (G.E.B.) and the approved plan of action in June 1976. This plan of action should contain by now the methods for financing it. One way is from the resources from the oceans, as it is reasonable to expect a United Nations decision on the owner- ship of these resources by then.

6. Creation or nomination of the agency in charge of the Global Ecological Balance (G.E.B.). One probable name is the United Nations Ecological Agency or U.N.E.A.

7. Selection of some areas as experimental ones for the Global Ecological Balance (G.E.B.). Also in June 1976.

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9. Gradual implementation of the United Nations' plan of action. Beginning January 1, 1977.

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38. Doxiadis Associates International, Consultants on Development and Ekistics, Strat. Syridesmou 24, Athens 136, Greece was founded by C.A. Doxiadis in 1951 in Athens, Greece. With a staff of about 700, the firm conducts planning and development activities in forty countries on different continents. Activities have included the planning and development of new cities and the renewal of existing urban centers, the development of university and industrial complexes, and the study and planning of multi-national regions. Doxiadis Associates International has several affiliated companies and regional offices in Brazil, Germany, Iran, Jordan, Nigeria, Pakistan, Saudi Arabia, Spain and Zambia. Doxiadis Associates Inc., 1058 Th. Jefferson Street, N.W., Washington D.C. 20007, U.S.A. affiliated with Doxiadis Associates International, is a U.S. corporation providing design, planning and development services on projects ranging in size from single buildings to entire urban regions. DA Inc. was founded in 1959 by C.A. Doxiadis who is Chairman of the Board of Directors and Chief Executive Officer.

39. See note 10

40. ACE - The Athens Technological Organization started ekistic research and educational programs in 1953, and established the Athens Center of Ekistics in 1963, to foster a concerted program of research, education, documentation, and international cooperation in all major fields related to the development of human settlements.

41. C.A. Doxiadis, "Water and Human Environment", Water for Peace, Vol. 1, International Conference on Water for Peace, Washington D.C., May 23-31, U.S. Government Printing Office, 'Washington D.C. 20402, pp. 33-60.

C.A. Doxiadis, "Global Action for Man's Water Resources", paper delivered to the First World Congress on Water Resources on "Water for the Human Environment", organized by the International Water Resources Association, Chicago, Illinois, September 24-28, 1973.
C.A. Doxiadis, "Marriage Between Nature and City", INTERNATIONAL WILDLIFE, January-February' 1974, pp. 4-11.

National Physical Plan and Program for Greece: The study was assigned in November 1972 and its purpose has been to provide proposals for the distribution of population and the economic and social activities in the national context up to the year 2000. These proposals were to be based on the regional possibilities and constraints that should be identified.

The study proceeded first to an analysis of the existing situation in all these sectors of activity that could influence the planning proposals, Work was headed towards finding the best viable solution to all these problems. By use of a standard method developed by Doxiadis Associates, a great number of alternative solutions was created out of which only a few were proposed for a policy decision. In a later stage, these proposals were evaluated on the basis of twenty-five criteria in order to find the one which should he selected as the more preferable one.

The solution selected will be studied in detail and the final National Physical Plan will divide the space of the country in the land use categories. The program will refer to the measures that will be necessary for attaining the desired distribution of the population and the desired land use structure

Physical Plan for the Region of the Greek Capital: The purpose of the study has been the elaboration and proposition of the desirable and feasible distribution of economic and social activities in the Greater Athens Region for the year 2000. This distribution should be realized through a set of the most important development programs.

The study proceeded according to the following steps:
a. Identification of explicit and implicit programs.

b. Elaboration of alternative regional plans.

c. Selection of the best alternative.

d. Detailed elaboration of the selected alternative and proposals of the necessary programs in ten-year steps

The contract for this study was signed in November 1972.
"The Human Settlements Research Project", report of the Athens Center of Ekistics prepared for the IFIAS Workshop which took place in Athens, Greece, May 13-17, 1974.

"Action for Human Settlemants", Delos Symposion (Delos Eleven) organized by the World Society for Ekistics at the Athens Center of Ekistics, Athens, Greece, July 8-13, 1974.