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iale bulletin

International Association for Landscape Ecology

EDITORIAL

In this Issue you will find two comments on the article by Naveh which appeared in the IALE Bulletin of October 1984. We hope that these first reactions to an article in our Bulletin will be followed by many others, as in way the Bulletin will fulfill one of its functions: to stimulate discussion and interaction between IALE members.

We are also happy to present an introductory paper written by the secretaries of the IALE Working Group on Ecological Infrastructure. Hopefully, we will be able to report on activities in other Working Groups in the near future.

A large part of this Bulletin consists of the text of the Closing Lecture, held by the President of IALE, Prof. Zonneveld at the end of the Roskilde Seminar, October 1984. We believe his outlook is of interest to all IALE members.

W.B. Harms
S.M. Houten de Lange

IALE INFORMATION

EXECUTIVE COMMITTEE MEETING

On 10 April 1985 several members of the IALE Executive Committee held a short meeting at the Institute of Geography of the University of Münster (FRG), thanks to the hospitality of our Vice President, Prof. Schreiber.

The main issue during this meeting was the planned contribution of IALE to the 4th Congress of Ecology, to be held next year in Syracuse, USA. At the beginning of this year IALE was officially invited by INTECOL to organize a symposium on Landscape Ecology during the Congress. The original proposal to INTECOL, which was agreed upon during the Roskilde Seminar had to be redrafted because of the terms set by INTECOL. After some consultation with IALE members in several countries the Executive Committee finalized the programme for the symposium. This programme, which has already been submitted to INTECOL, is given below.

Another point of discussion in Münster was the desirability of setting up a journal for landscape ecology. The Executive Committee wonders if IALE members have ideas or suggestions on this matter.

SYMPOSIUM ON LANDSCAPE ECOLOGY

organized by
the International Accociation for Landscape Ecology
to be held during the 4th Congress of Ecology
at Syracuse, New York, August 1986.

1. Introduction by the President of IALE, Prof. I.S. Zonneveld, Chairman of the symposium.
2. R.T.T. Forman (USA): Shapes and flows in a landscape.
3. P.G. Risser (USA): Landscape pattern and the distribution of materials, nutrients, and energy.
4. H.G. Merriam (Canada): The study of ecological processes in farmland mosaics.
5. W.B. Harms & P.F.M. Opdam (NL): Ecological implications of landscape change in The Netherlands.
6. W. Haber (FRG): Using landscape ecology in planning and management.
7. M. Ruzicka (CSSR): Basic premises in landscape ecological planning.

NEXT IALE MEETING

During the VIIth International Symposium on Problems of Landscape Ecological Research in Bratislava, Czechoslovakia next October, an IALE meeting will be organized in which aspects discussed will include developments in the different IALE regions and the reports of the IALE Working Groups that were initiated in Roskilde last year. Therefore we would like all contact persons of Working Groups to submit a written report on what has happened to date or what is planned for the future to the Secretary-General, before October 1985.

INTERNATIONAL MEETING ON THE CULTURAL LANDSCAPE, NORWAY

In 1986 the Botanical Institute of the University of Bergen (formerly Bergen Museum) celebrates its centenary as a scientific institution. As part of this celebration the Botanical Institute is organising an international meeting consisting of a symposium and associated field excursion from June 29 to July 7 1986.

The general theme is the cultural landscape and its past, present, and future status.

The meeting will consider: 1) the reconstruction of the past cultural landscapes from pollen-analytical, archaeological, placename, and other historical data; 2) the present-day ecology of different cultural landscapes in the future. The meeting is organised by vegetational historians and ecologists in conjunction with

archaeologist and landscape architects.

The excursion (7 days; June 29-July 1, July 4-7) is designed to illustrate a transect through the major cultural landscapes in western Norway, from the outermost coastal region and offshore islands, through the fjord districts, into the mountain areas above the forets limit. It will visit areas of recent intensive ecological or palaeoecological investigations on the origin, development, and management of the major cultural landscapes. A wide range of vegetation types and associated floras will be visited and many different landforms and landscapes will be seen.

A symposium (2 days; July 2-3) will be held in Fjaerland during the excursion. It will consider cultural landscapes in broader geographical contexts. Ecologists, vegetation historians, and nature conservationists from all countries are invited to present lecture or posters on the general theme of the meeting,

Further details and a preliminary registration form can be obtained from

Botanical Institute

University of Bergen,
P.O. Box 12,
N-5014 Bergen
NORWAY

IALE WORKING GROUPS

NEW IALE WORKING GROUP

At the initiative of our contact person in Bulgaria, Prof. H. Marinov, a new Working Group "Ecology of the Danubian Catchment Area" has been started. IALE members interested in joining this Working Group are requested to write to:
Prof. H. Marinov,
Danubian Laboratory and Laboratory of Ecology
HIFE "D.A. Tsenov" - 5250, Svishtov, Bulgaria

IALE WORKING GROUP "ECOLOGICAL INFRASTRUCTURE"

Introductory notes at the start of the working group*)

During the IALE seminar in Roskilde a working group was initiated to focus on the significance of the so called "ecological infrastructure". This term is defined as the network of habitat islands and the interconnecting structures in the matrix of cultivated land. It is thought that these structures may function as habitats for plants and animals which otherwise can not persist in agricultural landscape, and also as corridors along which such organisms can move or disperse. Several papers during the seminar stressed these functions of small landscape elements in cultivated areas. The first aim of the working group is to serve as a platform for people working or interested in this field. They are invited to send name, address, a list of relevant publications and a brief description of relevant work to the secretaries, who will try to compose a newsletter once or twice a year.

In the following we shall try to describe

the research field which could be covered by the working group.

In a patchy environment, as is found in most agricultural landscapes, dispersal may be a critical process in population dynamics. Most dispersal is by juveniles or propagules moving from their place of origin (birth) to a place where they reproduce or could have reproduced (if they had survived and found a mate or had germinated and grown to maturity). Such movement is termed natural dispersal, referring explicitly to movements of pre-reproductive individuals. Movements of adult animals between subsequent reproduction sites are termed breeding dispersal. Dispersal only refers to unidirectional movements as opposed to bidirectional movements like, for example, migration between breeding sites and wintering places, or to frequently alternating movements between feeding areas and site of reproduction.

In agricultural landscape many species are confined to small habitat patches (ecotopes) with frequent disturbances, in which the small populations run relatively high risks of extinction. In these landscapes dispersal may be of primary importance to survival, since it may lead to colonization of unoccupied but favourable habitat patches, or to replenishment of vacant places in the population, which lowers the chance of extinction.

However, in patchy landscapes moving animals or plant propagules have to cross areas unsuitable for them to live in, in which they can not germinate or find enough food, or in which they are exposed to greater risks of mortality. For example, species of wooded habitats scattered in agricultural landscape may have to penetrate tracts of grasslands or arable land to reach the next suitable patch in which they may find a vacant place. Dispersal between small wooded ecotopes may therefore be influenced by the distance between patches and the type of interstitial habitat (matrix). Furthermore, dispersal may be facilitated by the presence of landscape elements connecting the ecotopes (hedges, hedgerows, lanes, riverine strips), which are a less hostile habitat than the fields for woodland species. Similarly, marshland may be connected by tracts of reed or marshy vegetation in ditches, like fragments of heathland in agricultural area are linked by sandy road-side verges. For other species, corridors may be formed in other ways, for example, by landscape channelization of wind patterns, by the geographic distribution of soil drainage types, or, for crop pests, by the landscape patterns of particular crops. Of course, apart from their function in dispersal and other movements, these connecting ecotopes may function as a habitat for various species.

The following aspects of dispersal have to be distinguished:

1. Species-specific dispersal abilities, depending on the size, velocity of moving and special features (like wings or facilities to become attached to moving animals or objects).
2. Intraspecific differences in dispersal, for example between sexes, age classes, individuals or between vari-

ous types of habitat.

3. Causes of dispersal: population density in relation to supply of essential resources. Individuals may disperse because population density increases beyond the carrying capacity of the habitat (space, food, sites for reproduction), or because the carrying capacity of the habitat changes (for example variation in food supply). Relationship of dispersal to population density of some species, such as Peromyscus, has been seriously questioned. Dispersal at different times by various types of individuals may be functionally different for the population. Some types of dispersal have been called non-adaptive. Both demographic and genetic functions must be considered. Both rates and selective values of dispersal will fluctuate in time.
4. Structural features of the landscape relevant to dispersal: Distance between habitat patches, hostility of interstitial habitat types, density and qualities of connecting elements. Ecological infrastructure may facilitate dispersal, but is not a necessary condition as long as time dispersal remains possible through the matrix of the landscape. The ultimate criteria of successful dispersal will be prevention of local demographic extinctions and prevention of genetic deterioration of populations that could lead to such local extinctions.

Of course, the occurrence of a population of a species in a certain habitat patch does not depend on the immigration rate solely. The viability of a population is mainly related to its size (and, by consequence, to the size of the habitat patch) and to several habitat factors (e.g. hydrology, soil type, structural diversity of vegetation, density of tree layer). Also, chorological relations with adjacent ecotopes (like influx of nutrients by groundwater or air currents, or transport of food by animals) may influence the population dynamics of organisms in the corridor or in the habitat patch.

From these considerations the following fields of research emerge.

1. Measuring rate of dispersal, its direction and distance and its temporal pattern, accounting for intra- and interspecific differences (generally in descriptive studies).
2. Identifying causes of variations in dispersal rates in particular populations. These studies may imply measurement of both population densities and environmental factors, and can be divided into longitudinal (monitoring) and tranversal (comparing populations or sites), approaches, either descriptive or experimental.
3. Relating landscape structure to dispersal parameters or to distribution of species in ecotopes with different degrees of connectivity. Often transversal, but also longitudinal methods; experimental design is possible.
4. Identifying the significance of dispersal to population dynamics and survival. Dispersal may function as a stabilizing process, it may be important with respect to recolonization of vacant habitats and survival in patchy habitats, and it may influence the genetic structure of populations.
5. Assessing the role of size of habitat

patches in population dynamics and community structure, i.e. with respect to changes in genotypes extinction chance etc.

Studies in these fields may focus on either the individual level (ethology), population level or community level. Which level must be chosen depends on the objective of the study. This is also true for the choice of species and landscape types.

Nature conservationists, landscape planners and population ecologists may have widely different objectives. For example, landscape planners are interested in the type of connecting elements, their dimensions and biological structure, and they also want to know the best size and shape for woodlots and what should be the distance between them. Nature conservationists may be primarily interested in rare species (but note that a hedgerow may mean connectivity for woodland species and, contrarily, a barrier for field species), whereas the ecologist just looks for a species suited for testing a prediction from a scientific theory. Our working group should cover the various types of research mentioned above, but it will be wise to ensure the applicability of results in landscape planning. For those applications, we should avoid too much detail, ask questions which are relevant for landscape management, nature conservation and development. It will be necessary to be explicit in choosing certain species as objects of study e.g. species which are important from the point of view of nature conservation or which give information about the functioning of communities. Studies of species groups or species communities should be encouraged whenever possible. Choice of species and species groups should be coordinated to avoid too much concentration on one species, and too little knowledge of the remaining ones in the community.

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*) Gray Merriam suggested several improvements of an earlier draft, for which we are grateful.

IALE WORKING GROUPS

IALE members interested in joining a working group should write directly to the contact person.

1. ECOLOGICAL INFRASTRUCTURE

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2. LANDSCAPE ECOLOGICAL ASPECTS OF AGRO-ECOSYSTEMS

   Preliminary contact person:

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3. ECOLOGY OF THE RHINE CATCHMENT AREA

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5. URBAN ECOLOGY

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FEATURES

CONCLUSIONS AND OUTLOOK OF THE 1^{e} IALE SEMINAR 1984, ROSKILDE

by I.S. Zonneveld, president of IALE

Dear audience,

This is a kind of end of a great happening. An end is a sort of boundary in time, in the fourth dimension. Boundaries, in general, can be abrupt or continuous, but crossing a boundary, in space or time, always means an end as well as a beginning, chronologically or chorologically, looking backwards to the old and ahead to the promised land, leaving the past behind and heading into the future.

And so Jesper Brandt gave me the order to guide you in passing this boundary. I have to request that we orient ourselves well. To see exactly where we are, we have to take out bearings on clear landmarks and set out our track into the future, the unknown (promised) land.

So let us stand still and look back at what we did. Just behind us is a large concentration of events, a cluster of bright and very bright ideas about landscape ecology concepts, about landscape ecology inventory and survey methods, about data analysis methods and about landscape evaluation. What are we going to do with that, what is the use of it at this moment, and how does it lead us further on our way?

I believe that there is a general consensus among us about landscape ecology concepts that land or landscape is a holistic concept, a system in fact that can be a subject of general systems theory. Nevertheless, three main perspectives on the landscape are common among us:

(1) The visual aspect with a strong "perception" element.
(2) The landscape as a chorological complex used in various survey tech-

niques as well as providing a main basis of relationship studies.

(3) The all-embracing holistic aspect on which the former two are also incorporated as partial aspects of interest.

As a first conclusion of this conference, I may remark that it appears that the difference between these three points of view may determine groups of interests which also coincide with aims and applications. Especially the differences between the second and the third are clear. One could almost speak in the terminology that was introduced in the Christian churches some decades ago between verticalists (or fundamentalists) and horizontalists, of which the "hedgerow people" are a special variant. This comparison is only superficial, however, because believers in each of these aspects of landscape ecology appear to have strong interests in application and not in contemplation.

Moreover, both groups of landscape ecologists emphasize the possibilities of research, each in their own way. One would sometimes think that two different scientific currents would be represented by them. This, however, is not true. We will see what they are, but first let us look to the visual aspect.

The visual perception aspect ("Landschafts Bild") is a special one, even treated in a special workshop. Care for the perception aspect of the landscape indeed requires special attention to the visual properties that may escape the attention of biologists and geographers studying other functions of land. Nevertheless, one may state that an organism, say a woman caring for her aesthetic aspect, should in the first place be healthy (as I have learned from the beauty shop literature). So holistic aspects are also evident here.

At this congress, Bartkowski stated clearly indeed that visual aspects have to be separated from the general meaning only as another side of it, which is correlated with the whole in a cause/effect relationship. The physiognomic aspect is especially important for men and animals. Scale and size (dimension) are decisive aspects in this visual influence.

It is clear that application is particularly important in landscape architecture, especially also in its aesthetic aspect. Here also, however, the ecosystem character plays a role in the horticultural, agricultural side of landscape architecture, when plantations have to be designed in relation to such non-aesthetic things as soils and ground water.

The second view on landscape, the chorological (by some Roskilde participants already called "hedgerow") view, received much attention at this conference. Especially our friends from the New World are concentrating on this subject. In my opinion, it is a wonderful field of research, opening new perspectives of landscape ecology study, that contributes to landscape ecology as such. I guess that most of this work, especially on the detailed "hedgerow" level, is done by biologists. During the discussions, my previous impression was strengthened that for

several of them landscape ecology is just biology in the landscape. As such, it is indeed useful and may also serve very practical purposes.

I do feel that the value of this type of research (that concentrates on fluxes in the predominantly horizontal plain), however, is much wider. It is a most welcome strengthening of the activities that must work. For me, the nice network models of Merriam are a fine illustration of what can be achieved and a promise for progress of our science in the future. This also holds especially for strengthening and verifying the hypothesis of wholeness of the subject of our study and for optimizing steady state and homeostasis theories. In the field, especially, we need more exact research. For all this we need to have an open eye on the work of others.

The beauty of an organization such as IALE and its regional supporting clubs is that people (geographers of all kinds, biologists of all kinds, engineers, social scholars and planners) are forming one forum where we listen to each other even when we do not understand certain details of the other's work. The binding element, the passage of connectivity, so to speak, is to try at one hand to contribute to solving practical problems, but on the other hand to help in developing the basic philosophy.

Let us now look to the third, the comprehensive and more fundamental holistic aspect which Zev Naveh has introduced to you in this congress in his own inimitable way. He wrote an article in our bulletin and even a whole book about it (Naveh and Liebermann, 1983). He states lead to a better understanding of the land as a whole. It has been proved that detailed as well as more global studies on the network of flux-paths through the heterogeneous system that we call land or landscape can supply quantitative data that contribute to fundamental knowledge to be used in our scientific land ecology that landscape ecology ought to be based on general systems theory, bio-cybernetics and on a transdisciplinary ecosystem concept in which man is included (ecosystemology). I cannot resist the temptation to also say something about it in this conclusion.

In the past half a century, starting with Smuts and later Von Bertalanffy, Laszlo, Miller and recently Jantsch and Fritjof-Capra, philosophers have been paving the way towards a new paradigm of systems thinking, leading us from the area of Descartes and Newton, the time of linear and mechanical action/reaction causality thinking, into a new way of systems thinking where the dominant awareness is that the whole is different from just the sum of its parts, and that this is not a metaphysical belief but something that can be objectively and partly quantitatively treated - a network in which not only the knots but also the way there are knitted and connected determine the strength and the character of the whole.

Systems theory is based on the observation that there are general rules for systems as such, never mind what the elements composing such systems are, whether the microcosmos or at macro

scale, biotic or abiotic. The holism of Smuts, worked out by later philosphers, states that nature, starting from the atoms and their elements, can be treated in a hierarchical set of open systems that are dependent on others but can be studied as a whole (holon). All systems (except the universe itself as a whole) are open systems having input and output, the latter being the means of dependence and factoral influence. Some of them (Smuts especially), however, show the tendency to jump quickly from organisms to the earth as a whole, with the human society in between.

Before landscape ecology as such came into being, the eco-system idea was proposed by the biologist Tansley. Troll introduced our present landscape ecology idea by joining concrete geographic thinking with abstract functional biological thinking. It is the task of this landscape ecology to work out the ecosystem character of concrete land units. This should be done at the academic level as well as in the practical field, the first being the basis of the second and the practical being in its turn the stimulant and energy source for developing the fundamental. Naveh stresses that the smallest land unit is the "ecotope" and that the relationship in and between ecotopes is the subject of such type of studies. So, we have to develop sound scientific means to do it.

General systems theory, as described by Von Bertalanffy, has a mathematical-mechanical side that provides a basis for mathematical modelling (about which we saw interesting examples in this conference, and I have something more to say about that later). But here, I want to emphasize the other, the conceptual, side of systems theory. This side represents holistic thinking of a qualitative sort. It is the firm basis of landscape ecology seen as a "state of mind": the power behind the awareness of the present generation about the limited resources, about the quality of life (especially also human life and its relationship to the environment), the interdependencies between man and nature, between social and natural aspects of man, in short, the awareness of the total eco-system of which we ourselves are just one of the elements.

This part of landscape ecology appeared to be considered on several occasions during this congress and especially in some workshops as a most important application of our science in development planning and management in developing countries.

It is interesting that this idea has a strong association with conservation, of counteraction to unlimited progress, even of a certain element of pessimism and fear for the future. Doomsday prophets are (mis)using it. New ideas are, as a rule, propagated and absorbed first of all by young people. And so we see a kind of contradiction in that real progressiveness (the youth who will improve the world) means a kind of conservatism, while only the "petrified" conservatists will want to progress with their optimistic growth-founded in a paradigm that once was enlighting the then not overpopulated, not yet polluted world, led by such geniuses as Descartes and Newton,

but now is obsolete.

The results of a too optimitistic belief in unlimited progress, in short-sighted handling, can be seen everywhere. And so in the very end, ecology, the science of the relationships in the eco-system, became a basis for political philosophy just as economics was long before, with all the inherent dangers to our ecologic sciences.

The main political currents differ mainly in the type of economic paradigm they profess. Opposing political leaders may search in the economic literature for different theories that suit their own clients best, and a political party that wants to gain the sympathy of the largest masses will select the theory that in the eyes of the masses is most sympathetic to them. Even econometric models for computing the employment rate and minimum wages, etc, are being manipulated, depending on the political belief of the responsible political economist. Despite this uncertainty, however, even possible misuse of this (it should be said not yet very hard) science, economics itself should be developed not only as a state of mind but as a real science in order to serve the welfare of mankind in an objective way.

So it is with ecology. Here also misuse already gave the term an invalid sound in certain circles. We need especially for our landscape ecology to develop as a science with sound hypotheses and clear and efficient ways of verifying and falsifying hypotheses. We need to develop landscape ecology to a real, generally accepted, sound science - and not only for the political aspects.

Let us look to the other side, the side of more exact quantitative knowledge gained by our science. This is needed as a basis for managing our world. This requires a scientific approach, academically as well as directly applicable.

Such scientific work is also done among that I called "more fundamental people". Land classification (typification - land evaluation in wide and narrow senses, using all techniques of observation, especially air and space borne ones - is an important example. Here the application is twofold:

(1) One can use the supposed topologic coherence between landscape attributes as a basis for mapping, with the physiognomic aspect as an entrance to the inner part.
(2) But at the same time, one emphasizes that only the whole can be the basis of land evaluation and not just loose parameters. So survey method and survey aim both are firmly based on the holon concept.

It is not always acknowledged in practice, however. Compilation of maps by just mechanically adding separate analyzed parameters (by computer) together may have the inherent danger of neglecting the holon character. If we are aware of this danger, however, it can be avoided. The landscape ecology state of mind can help us avoid a too mechanistic method. This holds not only for classification, but also for evaluation and planning. Various aspects about the latter were

well accentuated at this congress.

The most important thing here, I think, is the game of questions and answers. The great act of planning is to ask the proper questions at each phase when determining data requirements. Too often, studies made by pure scientists require cumbersome translations to provide the information that planners need. If the questions are put clearly in the first place, the outcome of research can at least be modelled so that planners can use it. "Bram", one of our planners, even wanted to arrange our conference in that way.

An important remark that I heard during coffee (how important are these connectivity sessions!) from more than one of our vice-presidents is that landscape ecology does not only have to answer questions of planners. That indeed is a main task, but in addition landscape ecologists should develop their own science(s) so that it becomes a firm basis for application*, even inducing planners into a direction they would not have been thinking of before.

The original theme of the conference was to see what methods, what tools, we have available for survey classification, data analyses, synthesis and planning. Well, you must judge yourself whether we have succeeded. Among our main tools we find AEROSPACE SURVEYS (remote sensing) as have been proposed by various speakers, varying from old fashioned aerial photographs to the most sophiticated new satellite recordings. This could indeed be expected. Was it not Carl Troll who invented the term "landscape ecology" by looking - originally as a biology student who deserted to become a geographer - to airphotos, rediscovering the "total Character einer Erdgegend" from Von Humbolt?

Fine examples have been demonstrated of how remote sensing of various kinds helps us in analyzing and surveying the landscape. Does remote sensing belong to landscape ecology, giving it the status of a new paradigm? No, it is a set of techniques and methods used by many people, but I think we may state that landscape ecology science(s) makes most optimal use of it, and more than many other sciences.

The landscape approach uses the visual land aspect in interpretation, and so is a most valuable tool for soil and vegetation surveys. It is an example of how landscape ecology thinking is of value in analyzing land attributes. On the other hand, landscape ecological studies, done to study the landscape system as a whole, cannot be carried out optimally without the view from above, whether from a kite, an ultralight airplane, an ordinary aircraft or a satellite. We hardly need to stimulate developments here, because technicians are forcing the means upon. We, on our part, have to select, to guide and to beware of "remote science fiction": unrealistic technological fan-

* Applied and pure science are not as different as many people think. The difference is mainly that if a pure scientist makes mistakes, it only induces others to critize and write a new book, and so science goes on. An applied scientist who makes mistakes, however, will be sacked.

tasies, impractical, expensive techiques and contraptions that replace good traditional methods that may get lost without useful alternatives.

Similar developments occur in the second main modern field of methods presented: GEO INFORMATION SYSTEMS. Here also technology is flooding the market with automated cartography instruments suitable for created computerized data bases for storing land data, with emphasis on the chorological aspect. The same as in remote sensing holds here: landscape ecologists should select, but here also guide and help in design. Storing and retrieving land data is the basis of our scientific activity, the pure fundamental as well as the applied one. In addition to storage and retrieval, we also want processing in the form of correlation calculations, up to model formulation. At this congress, we have seen examples of how to proceed in this direction (Haber, et al.).
Many of the other methods presented here for data collection, survey analysis, processing, integration and evaluation are using computers, as could be expected. We saw at this congress two ways of approaching the problems: deriving details from the whole, but also building wholes from separate surveyed and analyzed data, using the computer as an integrator, somtimes by simple additions, or as a more sophisticated tool to create cybernetic models.

This may be an appropriate place to make some remarks on the computer age problems as discussed during sessions and workshops. Let me state that I think that no student can be educated anymore who has not learned to handle the computer. What pencil and paper were for my generation, the computer is for the present one. At the same time, I would like to emphasize - with some exaggeration (which is my second nature) - that the computer should not be more than that pencil and paper of my generation, especially in the present state of landscape ecology. Sophisticated cybernetic landscape models generated by a computer relate certainly not more to the reality of a simple landscape than a model description of a kite to a real jumbo jet.

The so-called "artificial intelligence", the "thinking" computer programs, can function only with the data and logic circuits that are put into them about things we already know. Even for the simplest classification of land attribute features (vegetation, soil) by cluster analysis combined with ordering (such as polyfactoring, principle component, etc.) techniques, there are no ideal programs except interactive ones using the human brain at the same time.

Despite the dreams of computer scientists who believe in a real artificial intelligence, the human mind must interfere and computer programs must become as interactive as an old-fashioned sheet of paper and pencil. The kind of parameters we use already require this. Haber also demonstrated this clearly with his models.

I am sticking my neck out now (I, who want to be considered as a betha-scientist) when I say that holistic thinking in hierarchical systems will in the

foreseeable and probable infinite future not be possible if we do not trust the partly subconscious activity of our minds. No, I do not say intuition, feeling, imagination, fantasy, illusion. All these words are contaminated. What we do have is a great store of acquired and received knowledge that through infrequent use filters down to the far recesses of our minds - down near the subconscious level. That knowledge is the result of input from a variety of sources (including attending IALE congresses) and can be recalled and incorporated in "models" far more complex than anything a computer can generate. Much of what is called intuition may in fact be generated in this manner. Anyhow, it is an important tool of science, as modern cerebral science seems to acknowledge. I believe that systematic thinking has for the main part to rely on that partly subconscious program to manipulate the super computer system of our brains. And there we are in the centre of the present computer age problems. I observe that some students (of course not the best ones) behave as if computers can think for them. They use programs they have not invented themselves, of which they know not exactly how they work and, worse, believe that the result is the truth. Instead of wrestling with the material (as Jacob with the angel)* which is the only way to feel the conscious and especially the subconscious memory, they work purely mechanically, trusting that the computer programmer has thought for them. Again, forgive me; my second nature of exaggeration forced me to this statement. But the danger exists.

This means that the modern landscape ecology student should not be just a computer user; he should know very well how to handle these inanimate objects as a piece of paper and a pencil, working interactively with his or her brains during the process of analyzing, synthesizing and planning the landscape.

We have heard in this congress that a program can never be developed that can even vaguely resemble a model of a landscape (ecotope or so). But partial systems are already successfully modelled and (if used with care) can be applied in science and practice. These partial system models are nutritious "concentrated food" for our associative thinking in our conscious and subconscious minds. This conference has given examples of such activity in the use of analysis, synthesis, evaluation of land resources and planning.

Models are hypotheses and hypotheses are the basic building blocks of science - but is landscape ecology a science? - Let us briefly look at that subject. Is landscape ecology in the form it appears in this congress a real science and not just an interesting philosophy, uniting loosely a series of other disciplines? Jacqueline Cramer and co-workers at the Amsterdam University recently made a study of it from the viewpoint of science dynamics, a research discipline combining epistomology (which traditionally studies the internal structure of sciences) and science sociology, that is the study of

* That illustration is especially for Zev Naveh. (Gen. 32: 22-32)

the social and institutional context of the development of new sciences.

It appears that there is not a consensus among science philosophers on the question of what a new discipline, a new science is. Some people say that one needs a true shift in theoretical considerations, a change in paradigms (Kuhn, 1970, cit. Cramer, et al.).

Others (Mulkay, 1975, cit. Cramer et al.) consider science as having a dynamic social structure, showing continuous minor shifts in the network of researchers, dealing with different problems and so reclaiming continuously new fields of research. If such a gradual shift has gone so far that a new centre in the total network has been created, with its own specific methods of research and problem assessment, one speaks of a new specialization.

The conclusions of the Amsterdam Science Research Group are that, at least in The Netherlands, there indeed is a social network of scientists with sufficient contact and orientation on specific problems giving impulse to institutionalisation of landscape ecology as a separate science. One hesitates to talk about a new paradigm in Kuhn's sense, however, and it is for this group still an open question whether there has been created a new centre in the scientist network where own specific methods are being developed and own problems' assessed in Mulkay' sense. There is clearly a tendency in that direction, however, and they state that it would be good for landscape ecology if that tendency continues.

During the 1970s, the newly formed group of landscape ecology-minded people in Holland was not interested in sharp delineations from other disciplines. Especially the contact, the science-sociological network between the biotic and abiotic scientists, the physical planners and the policy makers was the aim. The "state of mind" idea was dominant. The demand for more research and by that for research funding, however, is leading to sharper definitions. The simple fact is that the systems paradigm, which since Smuts, Von Bertalanffy and others gradually is infiltrating the minds of physical and biological scientists, has not yet fully altered the somewhat more traditional thinking of science administrators, private ones as well as governmental, such as ministers of education and their staffs. So too often, requests for funds can be done only through the narrow Cartesian and Newtonian shaped channels in which science became artificially subdivided when universities forgot that science had to be universal. I have been told that this is the case not only in The Netherlands. There, however, the reaction is that at present trials are being made to create special channels for funding the more multidisciplinary research projects initiated by landscape ecologists.

There is a chance, however, that by this the original tolerance about subjects and also the wide science-social network (the wide field of cooperation between physical, and biological, human geographic and physical sciences, planning and policy making) might be reduced in the future. For instance, if the minister or his of-

ficials have to decide whether a certain amount of money is to be spent in physical geography, or in agronomy or biology of some sort, he logially will ask the question "what is the difference", and he or she will use mechanistic criteria to judge whether a study of, say, the vegetation in a certain area of Nigeria or Holland or elsewhere in relation to the environment belongs to the traditional biological (plant geographical) sciences or to the newly created landscape ecologic one. Vegetation scientists, landscape ecology minded but very much in need of funds, will then avoid using the term "landscape ecology" when they are trying to get money from a channel that traditionally supplied money for vegetation research, despite the fact that their study might be of considerable importance for the development of landscape ecology as a science.

At the other side, any request coming into the newly created landscape ecology funding channel will be scrutinized sharply to see of it could belong to the more traditional sciences. The result of all this could be that the funds for the latter may tend to promote even more monodisciplinary research than they do already, and that then the more system scientific multidisciplinary projects will accumulate near the newly created landscape ecology channels that (because the funds will remain in the most favourable case equally divided over all channels) may soon be congested. The result would then be that the propagation of the new paradigm of landscape ecology, based on general systems theory, bio-cybernetics and ecosystemology, as proposed by Naveh and Liebermann as being the aim of landscape ecologists, may be hampered or even counteracted. If that were to occur, the promulgation of landscape ecology as just a "state of mind" rather that a new specialization would have to be prefered.

One thing, however, is sure. We very much need sound fundamental and applied scientific landscape ecology research. What it will be called and how science administrators will have to be convinced - or even manipulated - is a most important question, but nevertheless one of second order and one that may have to be solved in different ways in the different countries we come from.

This is the reason that we have created the IALE, a science social network of people with a common aim, that is, irrespective of the name and local policies, to promote and carry out landscape ecology research and apply it for the benefit of society. So the question whether the material we assembled and discussed this week will convince the Amsterdam group of science dynamics philosophers about the validity of landscape ecology as a science is intertesting but, whatever the answer may be, our type of research - studying the landscape in a multidisciplinary, integrated way - should continue and increase.

What is <u>the future</u>? Well the material prospects are good! Acid rain is pouring down and creating jobs for many ecologists all over Europe, and Americans show "hope" that they too will be involved in this landscape ecology employment stimulance. Well, I just want to say that any government which is wise should

stimulate landscape ecology and not only for acid rain problems. Everywhere, from the pover-developed to the developing countries, the impact of man has consequences that demand integrated, systemic study. What do we see? Within one year, two vice-president of IALE obtained important, concrete awards. Richard Forman became the first professor landscape ecology in the New World and at one of the most prestigious universities in the United States: Harvard. In the Old World, another vice president, Milan Ruziska got a multiplication of his staff because his government became wise and realized how important his work so far was, and made his institute into one of the largest institutions of applied science in his area. (So become a vice-president of IALE if you want to have success).

But let me be serious. There are three main fields in which we have to be active. The first and main thing we have to do (without releasing all our other research and planning activities, in fact preferably through all these activities) is to let our holistic view, our state of mind on the world ecosystems, penetrate continuously to the world leaders, the political ones, the administrators, the cultural ones, the religious ones, and the scientists. This does not mean that I urge you to walk in demonstrations; you may if you wish. Most important is to be a recognized and trusted scientist, contributing to the development of applied and pure science. In my opinion, applied scientists should by their study not hesitate to look for fundamental aspects that may also be of use elsewhere, up to the world level, and then publish about it. The best scientific theories envolve from practice, especially in a study of a system of which we are ourselves a part.

The detailed subjects within this field for our daily work will be dictated by practice:

(a) Land development in the developing countries mainly for increased food production.
(b) Restoration of degraded land in the over-developed countries, focussed on ecologic infrastructure.

A limited number of us may be involved in worldwide activities such as M.A.B. projects sponsered by UN bodies. We could even think that IALE, as such, could play a role here if wanted.

The second main field of attention for the coming years is methodology. Constant updating and development of new methods is essential for every science. This conference was a fine example of how to promote it. Landscape ecology needs specific tools, including some that can be borrowed and adapted from geographers and cartographers. Unavoidably, this costs a lot of time that I myself sometimes feel is unproductive. Especially when you are emotionally involved in the ecologic degeneration around you, you want to do something direct about it. But instead you have to "waste" your time in trying to find something useful in the deluge of, for example, remote science fiction literature about remote sensing proposals that have flooded our desks for the last decade.

Nevertheless, among a lot of nonsense,

there appeared to be most powerful tools that are very valuable, although many still have to be adapted to specific landscape ecology needs. Most attention should be paid to means of sequential observation. For the first time in history, we have a means for studying the fourth dimension for scientific interest and especially also for "watching and warning" - monitoring.

The fashion of today is computerized geo-information systems (G.I.S.). It started for me at a land evaluation congress in Australia in 1968 with a speech by the Canadian Tomlinson (who is still going strong) and now, all of a sudden, everyone is trying to use it - and no doubt we should. This congress showed how necessary it is to share ideas because in the discussion it appeared that several people were trying to invent the wheel again independently. A working group has been formed for this matter and we look forward to the results.

In addition to these two large fields of technology, other tools must also be sharpened. This congress was the one in which attention flourished for the study of the chorological fluxes, after a beginning in Veldhoven. Special tools to measure and model these fluxes must be developed and refined.

Connectivity is a concept demanding attention. Methodology in this field is developing. A working group has been created to stimulate that and should go to work, not only in the hedgerows.

The third main field of interest is connectivity between people. As I mentioned when talking about science dynamics studies, the quarantee of the quality of science is not in the first place tools, aims and subjects. The most crucial element is a network of scientists, people who know each other. The usual means of connection is literature, but reading is a cultural and so a bit innatural means of connectivity, although necessary. Real contact between scientists is a much more active means of connectivity. I have seen too many highly intelligent people, very well able to read, who are isolated and suffer from deficiencies in scientific - and especially in landscape ecologic - thinking. I think this holds for many of our colleagues who start now to create cores of landscape ecology thinking in the developing countries. The care of our network, making it efficient through organizing oral and written contacts, is an important task for the future.

Another area where connectivity between scientists is needed is at the international level, where political boundaries separate areas that landscape ecologically depend upon each other, and so create isolation in science. It is my form belief that working groups combining scientists and planners (as IALE so wonderfully unites) might be helpful for pure scientific contact, and also as preparation for better understanding.

A coastal working group was created. Probably in the future, working groups concerned with a river that passes through many countries - or along other landscape ecological corridors where

fluxes should go unhampered - may be worthwhile.

This, Mister Chairman, is what I could think up, with the help of many of you, as a conclusion to this fine congress and as a view of the future.

Thank You!

LETTERS TO THE EDITOR

THE USE OF THE TERM ECOTOPE

In his contribution to IALE Bulletin (Vol 2 No. 1, Oct. 1984), Prof. Z. Naveh proposes that "The introduction of the landscape-ecotope as a practical operational tool for ecological research and management is probably the most important contribution of landscape ecology to ecology as a whole". The "ecotope". as suggested by Naveh, is the elementary "landscape cell". I would like to comment that this usage is rather unfortunate; in their 1973 milestone paper ("Niche, habitat and ecotope". the American Naturalist 197, 321-338), R.H. Whittaker, S.A. Levin and R.B. Root selected the term ecotope for representing "the species relation to the full range of environmental and biotic variables affecting it", hence the ecotope constitutes "the ultimate evolutionary context of a species". For decades ecology has suffered from the repeated introduction of unnecessary, duplicate, and vaguely defined jargon. Proponents of landscape ecology should be more carefull about the selection and adoption of terminology for their newly emerging discipline.

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ON THE DIVERGENCE BETWEEN THEORETICAL AND EMPIRICAL STREAMS OF LANDSCAPE ECOLOGICAL RESEARCH

In the IALE bulletin of October 1984 Naveh (1984) has presented some thoughts on various trends in landscape ecology, on the challenges presented to us, and on ways to meet these challenges. I would like to examine some theoretical and empirical developments and indicate what their merits may be in relation to the double challenge that faces landscape ecology, viz. to create a synthetic discipline and to create tools for ecological management. But first a bit of rearguard action on the persistent notions of holism and Gestalt is necessary.

Naveh has pointed out that a holistic philosophy is one of the unique features of landscape ecology. That is undoubtedly correct, but I think one ought to be wary about holism as a philosophical basis for landscape ecology.

The concept of holism goes back at least on the work of the 19th century German geographer Carl Ritter (1833). In his works one finds the concept of "das Ganze" ("Wholeness") of all earthly spheres. This idea is apparently used to indicate some all-embracing and all-pervading coherence of everything that exists and happens (Veen, 1976). No doubt, the popularity of the concept is explained by the wave of reaction against the analytical way of thinking of rationalism which had - by that time - revolutionized scien-

tific thinking. Now I agree whole-heartedly that it is a good thing when people realize that the earth is an incredibly complex, coherent system, which cannot be exploited unthinkly, and be expected to maintain its life-bearing functions without any change at all. If that is what holism is about, then it is all right with me. But one would certainly prefer to borrow the phrase of "connectedness" from the theme of the coming 4th Congress of Ecology and use it in a general, philosophical sense instead of "wholeness". For this preference there is a sound epistemological reason. A "wholeness" or "totality" on the true holistic sense is by definition more than the sum of all components. It is even more than this sum plus the sum of all interactions between all components: a "whole" is, therefore, not a system. But what it actually is cannot be defined: a "whole" is by definition beyond definition. It is, therefore, beyond scientific research (Poppers, 1961; Hard 1973; Ven, 1976). Because "wholes" in the strict holistic sense are undefined, they cannot possibly contribute to the theory of any discipline, synthetic (as defined by Neef, 1982), integrative or otherwise. Also it is hard to see how one could profit from this holistic thinking when engaged in real problems of landscape management.

A "Gestalt" is not a "whole" in the objective sense but it is the spontaneous perception and recognition of an "obvious" unit. One finds this concept explicitly or implicitly in landscape descriptions of way back, e.g. in the work of Vidal de la Blanche (1903). The concept is nicely illustrated by Gradman's observation on the Black Forest in Germany (dating from 1931, as cited by Büdel, 1977): "Der Schwarzwald ist eine so charactervolle Landschaft dass er von jeher als Einheit aufgefasst wurde" (The Black forest is a landscape so full of character that it has forever been considered as unity").
A person perceiving a Gestalt can investigate what factual combination of phenomena gives rise to the perception. In the case of a major landscape region such as the Black Forest, it will turn out that this Gestalt is distinct by virtue of the associated geological and geomorphological constitution, the pattern of vegetation and land use and so on. The integrative power of the concept of Gestalt works on a rather primitive level and its function in integrative or synthetic landscape ecology is a modest one. It is a starting point, but not necessarily the only one, for delineating major landscape regions or the constituent landscape units. The perceived Gestalt as such does not provide information on internal and external functioning of the corresponding, polythematic, regional or local entity. Therefore it is in itself not directly useful as a tool in research oriented towards landscape management.

It should be admitted that the concepts of Whole and Gestalt do not only contribute little to the development of theory for landscape ecology as integrative discipline but also do very little to further the applicability of landscape ecological knowledge. At best, these concepts have played a role during - what Neef (1982) has called - the stage of structural research in landscape ecology.

Neef has rightly indicated that "administrative and planning authorities made only small use of the knowledge ... (provided by structural studies of landscape pattern - AV) ... for the information about structural features ... did not correspond with the needs of these institutions" (Neef, 1982). What the institutions did need was an answer to the question "what will happen, if .." which (still following Neef) led to the present stage of dynamical research, i.e. the study of landscape processes. I believe that the concepts of "wholes" and "Gestalt" are connected to a large extent to the stage of structural research. If the present theoretically inclined researchers cling too strongly to these notions, they will only alienate the present empirically inclined workers from landscape ecological theory. This would be a pity since the progress of any discipline is fuelled by the interplay of theory and practice. Separate development of theory and practice is something we can ill afford.

Some of the diverging trends in landscape ecology, as mentioned by Naveh (1984), may be explained partly on the basis of the different directions that are followed in the search for central concepts which would serve as alternatives for the older ones that have been found lacking scientitic and practical fertility. The following tentative identification of some of these approaches is perhaps not too audacious, since various authors have put forward similar suggestions.

There is one approach in which suitable theoretical concepts, taken from general systems theory, information and communication theory and cybernetics, are shown to produce valuable results when applied to the study of landscape. There is not only the pioneer study by Van Leeuwen (1966), but for example also the work of Phipps (1982) and Kwakernaak (1982), who have developed ideas of the French school of theoretical ecology. The universal character, general applicability and sharply defined meaning of the concepts used in this approach make it seem likely that these concepts will contribute heavily to the development of a synthetic theory for landscape ecology.

One may perhaps distinguish at least two empirical approaches, which are generaly quite separated from this theoretical development. One of these approaches stays within the boundaries of the concept of a landscape as a kilometers-wide area where a cluster of interacting stands or ecosystems is repeated in similar form (Forman, 1982). Interaction within this type of area is the focus of empirical ecological investigation. To some extent this approach equals plant and animal ecology at the level of landscape. At this integration level a set of new concepts has been developed (Forman, 1982), which contribute not only to the theory of landscape as a real transactional system, but also to the applicability of landscape science in landscape management.

One other empirical approach does not stay within the boundaries of a landscape as defined above. In this approach a landscape is viewed as a system of interactions (within and between landscape

components), controlled as it is by conditions imposed by one or more system placed hierarchically above the sphere of the landscape interaction system itself. Such independent control systems are for example the atmospheric circulation, the hydrological cycle, mega-geomorphological and large scale biological processes and especially land use. (Van de Maarel en Dauvellier, 1978; Vink, 1983; Vos, Harms en Stortelder, 1982; etc.) The idea behind this approach is that the phenomena at landscape level cannot be understood by "only" analyzing the processes originating within the landscape itself. This way of thinking is building a picture of global connectedness in a very real sense. Also, chorological problems can be tackled by looking at the position of landscape and landscape components relative to the action of the control systems. Environmental deterioration frequently comes about through human interference with some of the control systems and is reflected in landscape quality. In those cases many landscape management problems can probably not be solved properly by measures taken on the landscape level alone.

Naveh (1984) has indicated that landscape ecology might act as a catalyst for integration and fusion of the diverging divisions within ecology. This certainly is a valuable goal. On the other hand, we see devisions in landscape ecology itself as well.

This is not disturbing. In fact, the various divisions all have valuable contributions to make. I definitely agree that IALE can and should play a role in promoting the exchange of ideas and results, and by doing so build the bridges Naveh speaks of. What I would like to put forward here is that perhaps a better feedback mechanism between practice and theory is what landscape ecology needs most.

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7-12 Oct. 1985	Polish-German Bilateral Conference Halle-Poznan on theme "Geosystems of towns" Enq.: Prof. T. Bartkowski. Inst. of Physical Geography, A. Mickiewiez University, Dolna Wilda 34 61552 POZNAN, Poland.
May/June 1986	International Training Course in Landscape Ecology.
(3 weeks)	Enq.: Academy of Sciences of the German Democratic Republik. Institute of Geography and Geoecology (IGG) Georgi-Dimitroff-Platz 1. DDR - 7010 Leipzig.
29 June/ 7 July 1986	International meeting on The Cultural Landscape - Past, Present and Future. Enq.: University of Bergen p.o. Box 12 N-5014 Bergen Norway.
10-16 Aug. 1986	4th Congress of the International Association for Ecologists. SYRACUSE, NY USA. Enq.: prof. F.B. Golley, Institute of Ecology, Univ. of Georgia, Athens, GA 30602 USA.
21-26 Oct. 1985	VIIth International symposium on the problem of landscape ecological research. Enq.: Dr. Milan Ružička, Institute of experimental biology and ecology, Obrancov mieru no. 3, 81434 Bratislava CSSR.
15-17 Jan. 1986	Landscape Ecology Symposium: The Role of Landscape Heterogeneity in the Spread of Disturbance. Enq.: Dr. Monica Goigel Turner Institute of Ecology University of Georgia Athens, Georgia 30602 USA

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