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Geo - Biosphere Observatoria: some remarks on monitoring with special emphasis on wetlands.

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ABSTRACT

Global changes are affecting our ecosystems very drastically during the last decades and are likely to do it in the near future. In order to predict the evolution of the ecosystems it is necessary to understand the underlying abiotic and biotic processes. The creation of geo-biosphere observatoria in different ecosystems could greatly improve this knowledge. It is argued that both the influencing factors (global changes) and the effects should be monitored. In this paper we are concerned with the latter. When monitoring the effects one has to realize that global changes will affect ecosystems in many different ways depending on local conditions so global changes are split up in regional changes. Many different ecosystems should be included in the programme and studies should be on two levels. First as many different parameters as possible must be measured in a few sites and secondly a few parameters should be measured over a wide area. This approach is briefly illustrated with our studies in wetlands, especially the "Delta area" of SW-Netherlands and "The Elankaart" a nature reserve in Belgium and the studies of waterfowl over the whole Western Palearctic region.

INTRODUCTION

Ecosystems and organisms have continuously been adapting to environmental changes. The last decades however the influence of men on the environment was so profound and quick that the question rises whether our ecosystems, from which we are ultimately dependent, can any longer adapt quickly enough. There are several examples in which it is shown they can not (e.g. desertification of the Sahel) so it is of extreme importance to understand the functioning of our ecosystems and to measure their pulsation over a long time. This knowledge can ultimately be used to forecast the effects of environmental changes on our ecosystems and predict global changes in the environment.

ICSU planned recently a new major transdisciplinary research programme the "International Geosphere-Biosphere Programme - A study of Global Change". As global changes in the atmosphere, waterquality (eutrofication) and soilcomposition are integrated into the ecosystems it is not surprising a working group on Geo-Biosphere Observatories was established. In this paper I make some remarks on these observatories and describe some of our studies in wetlands which are relevant to this programme.

GEO-BIOSPHERE OBSERVATORIA: SOME CONSIDERATIONS.

First of all we want to stress that atmospheric changes cover easily large areas and can quite quickly influence the whole earth but all biological processes are very much restricted to regional changes. Acid rain is a very global change in the atmosphere but its effect on ecosystems is very much dependent on the soilcomposition, speciescomposition (pine wood versus deciduous wood) and complexity of the ecosystem. So necessarily the scope must be narrowed from global changes to regional changes when studying ecosystems although the disturbing influence can be global (eutrofication, acid rain etc.) but obviously some results can be generalized. This means a clear distinction must be made between monitoring the factors (global changes) and monitoring the effects on several ecosystems. In the rest of this paper we are mainly concerned with the latter. To be able to understand the influence of global changes on the environment we believe two approaches should be followed. First a network of observatories or monitoring programmes in many different ecosystems in many different places should be established since the effects of global changes, such as atmospheric ones, are likely to be very diverse, depending on local conditions. In these observatories several parameters both abiotic and biotic should be measured in time. Next to these measurements it is however crucial to study many different aspect of the functioning of the ecosystem or the interrelations between the components of the system. As many parameters as possible should be measured in a few sites but a few parameters should be followed in many sites. This brings us to our second approach. As changes in several ecosystems are not necessarily independent of one another one should have some studies concerning a few parameters (e.g. some migrating species or some general features of landuse as in ecological mappings) but covering a large geographical area. This is important either to test the extrapolation of results obtained or to explain some of the patterns observed in the few sites studied in greater detail.

WETLANDS

Wetlands, although covering only a small part of the earth, are very important as water reservoirs and are biologically very rich. Many wetlands are natural as rivers, estuaries, lakes and marshes, some seminatural as wet grasslands and many man made lakes (e.g. gravelpits). They are however very sensitive to changes and rectification of rivers, reclamation, pollution, acidification, drainage and eutrofication are only some of the factors changing wetlands and their ecological functioning.

At our laboratory we are studying since several years some aspects of wetland ecology as outlined above. On a few sites detailed ecological surveys are carried out and the overall distribution of waterfowl is studied. Here we will shortly outline these research projects as they are related to the bio-geosphere observatoria.

THE "DELTA AREA".

The so called "Delta area" in SW-Netherlands, comprising the estuaries of the rivers Rijn, Maas and Schelde, changed quite dramatically in the last decade due to coastal engineering works (Duursma et al., 1982). Because of the extreme importance of these estuaries for fisheries and as feeding grounds for birds many different aspects (fysico-chemical, hydrodynamic, botanical (micro- and macrophytobenthos, phytoplankton), zoological (zooplankton, fish, benthos, birds)) of the ecosystem and their interrelations are studied (see Duursma et al., 1982). We are studying the spatial and temporal patterns of the distribution of macrozoobenthos and birds in the Oosterschelde and Westerschelde in relation to environmental changes (see Meire and Kuijken, 1984a,b; Meire 1987). In the Oosterschelde it are mainly changes in the hydrodynamical regime of the estuary, in the Westerschelde mainly changes due to pollution and eutrophication. In this studies we are able to determine the effect of environmental changes on the food supply of birds and how this in turn affects the birds. By now we are developing some predictive models describing this part of the ecosystem.

"THE BLANKAART".

"The Blankaart" is a shallow lake surrounded by a marsh. It is situated in the valley of the river Yzer and is surrounded by about 2000 hectares of low laying wet grasslands. Both botanical and ornithological the area is very important (Desender, 1982; Heirman, 1987) as well as for its auto-purifying capacity of flooding water. Drainage and eutrophication are however quickly changing the whole ecosystem. Data on waterquality exist already since the beginning of this century and data on fauna (especially birds) and flora are available since many years. Recently a project started in which all components of the ecosystem are monitored and some interrelations especially between birds and their food supply and between vegetation and water level and quality are studied. A paleolimnological study of Chironomids could also clearly demonstrate the changes in the lake during the last two or three hundred years.

WATERFOWL COUNTS

Waterfowl (mainly waders, ducks and geese) are widespread but restricted to wetlands. On their migration between the breeding and wintering grounds they may use a chain of wetlands in which they stay for longer or shorter time either to refuel (build up energy reserves for migration), to moult or to winter. They are either herbivores (all goose species and several ducks), piscivores (grebes, cormorants etc.) or feeding on benthic invertebrates (some ducks, waders). As such they can have an important role in wetland ecosystems. Obviously their occurrence at one site depends on the conditions experienced at other sites. To get a better idea about numbers, their distribution and the factors causing possible changes, the International Waterfowl Research Bureau (Slimbridge, UK) organizes yearly a waterfowl census in the Western Palearctic region. Belgian cooperates in this network since 1967. Six counts are organized (once a month from October until March) in Belgium since 1977 (Kuijken et al., 1985). By monitoring not only the birds but also their habitat,

foraging behaviour and population dynamics this dataset allows us to interpret changes in numbers and distribution especially in relation to global changes. One of the changes affecting these birds are climatic changes. The winter distribution is largely affected by weather conditions and global changes in climate can profoundly influence these birds either on the breeding or the wintering grounds. Of most arctic breeding species the success of the breeding season depends largely on the time the tundra is snowfree. Surviving the winter depends partly on the drought conditions in Africa (Cave, 1983) or the possibility to cross the extending desert of the Sahara. In the European wintering areas eutrophication and especially waterlevel management influence waterfowl populations.

The data on numbers, distribution and feeding ecology of waterfowl in the Western Palearctic region is unique especially since whole populations are studied and changes can be related to global and regional changes. However many gaps in our knowledge still exists. So it is of extreme importance that more data from The Mediterranean, the Middle East and Africa become available. Further it is of extreme importance that next to these general surveys several wetland ecosystems are monitored in detail to describe the ecological relations which influence these birds. On the other hand these data allows us to interpret the changes in bird numbers in a given area not only in relation to local situations but also in relation to global changes in the population.

CONCLUSIONS

As the pressure on our ecosystems from drastic environmental changes is so big it is essential to get more insight in their functioning. Therefore a network of Geo-biosphere observatoria in which several parameters are studied is likely to increase very much our knowledge and will enable us to build predictive models. Obviously the choice of the sites will depend on many factors but we strongly believe most ecosystems should be represented. As the success of this programme depend greatly on the duration of the studies the most crucial point will be the availability of the necessary finances.

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