Project title

Eutrophication and climate change in EU-LTER sites

Promoter: Mihai Adamescu/ University of Bucharest

1. Aim (for the LTER)

a. Develop time series of eutrophication parameters and use them in conjunction with climate datasets;

b. the project could be developed across eco-domains (from aquatic to terrestrial systems). It could be directed only towards lakes but this is depending on the number of aquatic sites involved.

2. Research questions and Hypothesis (500 words)

Climate change can affect temperature regimes in different ecosystems and cause important responses from the biotic communities.

The study of eutrophication is inherently linked with the temporal and spatial distribution of the biologically available inorganic forms of N, P, and Si in the aquatic environment. Nutrient cycling is a general characteristic of every natural ecosystem; what has altered over time (and with a quickening pace over the last 100–150 yr) is the quantity of nutrients being mobilized and moved (de Jong and de Oude 1988) due to the human impact.

As a consequence of the increasing nutrient input and acceleration of the nutrient cycling important structural and functional restructuring occurred in different ecosystems from terrestrial ones (forest grasslands) to aquatic (wetlands, lakes and even rivers). Responses included change in biomass of primary producers followed by changes in the species composition (decrease in lichens, increase in graminoids, and decline in typical species). In aquatic systems the responses of the planktonic communities (phytoplankton and zooplankton) are highly sensitive to environmental change (Hall & Burns 2002). Variations in the physical environment, water temperature, transparency and nutrient concentrations, may affect the structure of plankton communities by modifying different biological processes (survival, growth and reproduction rates) (Hall & Burns 2002), but also the structure and seasonal dynamics of these communities. Important changes occur also in the energy flux and matter cycling, in this way affecting entire ecosystems. In several studies (……..) it has been stressed that nutrient enrichment prevails over climatic forcing. Eutrophication and climate change implies a series of changes like: a) increasing frequency of algal blooms, b) increasing quantity of transferred energy to sediments therefore causing restructuration of the benthic communities, c) anoxia, mass fish killings, d) increase in cyanobacteria, e) increase of the vertical stratification of lakes.

Nevertheless only a very few studies have been focused on the direct relationship between climate change and trophy state of different ecosystems. Despite the efforts to reduce the nutrient entries in ecosystems the impact of climate change could have comparable effects with that of eutrophication on affected ecosystems (e.g., Schindler 2001). The implication could be even more stressful on the systems facing to cope with both eutrophication and climate change.

3. Spatial and temporal coverage

All types of habitats across Europe

At least 10-15 years of past data; if possible 50 years of data

4. Parameters used/needed* (if not only aquatic habitat are to be selected then the parameter group could be enlarged)

Parameter group (theme)	Selected parameter	Details about the parameter	Should be taken from existing data (yes/no)	Feasibility/constraints regarding existing data	Should be recorded in field (A5 work) (yes/no)	feasibility/ constraints regarding field sampling
1) Climate and physical variability	Monthly mean water temperature	Monthly mean values of as much as possible years	yes	No problems foreseen	no	
	Monthly mean air temperature	standard meteorological method; monthly values of as much as possible years	yes			
2) Biogeochemistry data	For terrestrial systems - Monthly soil nitrogen concentration	Relevant for grasslands, forests; annual sum of total inorganic nitrogen (sum of NH3 and NH4) from fertilizer or lifestock	yes		no	
	For aquatic ecosystems – Monthly water nitrogen concentration	Monthly concentration of nitrogen	yes		no	
	For aquatic ecosystems – Monthly Phosphorous concentration				no	
	Water N/P ratio	The ration N/P is very important in aquatic environment	yes		no	

3) Structure and function of the ecosystems, communities and populations	Type of lake	According to WFD			no	
	Phytoplankton community	Percent of each phytoplankton group (per station and month of observation; in case of forests the vegetation layer is important; the entire observation period should at least cover 10 years but more observations are very welcome	yes	No data are required concerning species list (only if this data exist and only if needed for explanation purposes)	yes	
4) Human population and economy	land use in the basin area	depending on land use type (forestry, grassland management) different categories, will be provided	yes	none	no	

5. METHODS USED

Trend identification; to be further specified

6. EXPECTED RESULTS

Observe the trend in different sites across European gradients of:

a) increasing frequency of algal blooms,

b) increasing quantity of transferred energy to sediments therefore causing restructuration of the benthic communities,

c) anoxia, mass fish killings,

d) increase in cyanobacteria,

e) increase of the vertical stratification of lakes.

7. REFERENCES