# STUDY OF THE IMPACTS OF CLIMATE CHANGE ON ECOSYSTEM SERVICES: ENVIRONMENTAL AND ECONOMIC ASPECTS

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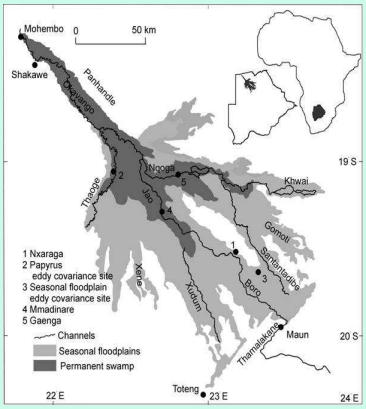
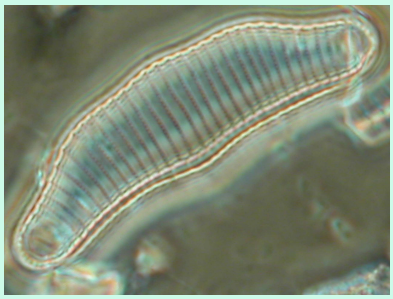
## Introduction

The Okavango Delta in North-Western Botswana is one of the world's largest inland wetland regions: it is created and maintained by the annual flooding of the Okavango river and it is the world's largest Ramsar site. This river basin faces several threats including the impacts of climate variability and change: these can be studied in a comprehensive framework taking into account both environmental and economic issues.

## Objective

The aim of this poster is to present a possible integrated approach to study the impacts of climate change on the ecosystem services provided by the Okavango Delta. A specific definition of the concept of Biodiversity Capital is proposed in order to underline the importance of biodiversity for human populations: "Biodiversity Capital is the quantity, quality and variability (at gene, species and ecosystem levels) of the biological resources providing Ecosystem Goods and Services to the human population(s) living in a given area and period". For example fishing in the Delta is wealthier the more fish populations are abundant (quantity), healthy (quality) and belong to a high number of species (diversity). Furthermore, if fishermen rely on healthy populations of a high number of species the ecosystem and fishing activities are more resilient to both environmental and anthropogenic shocks.

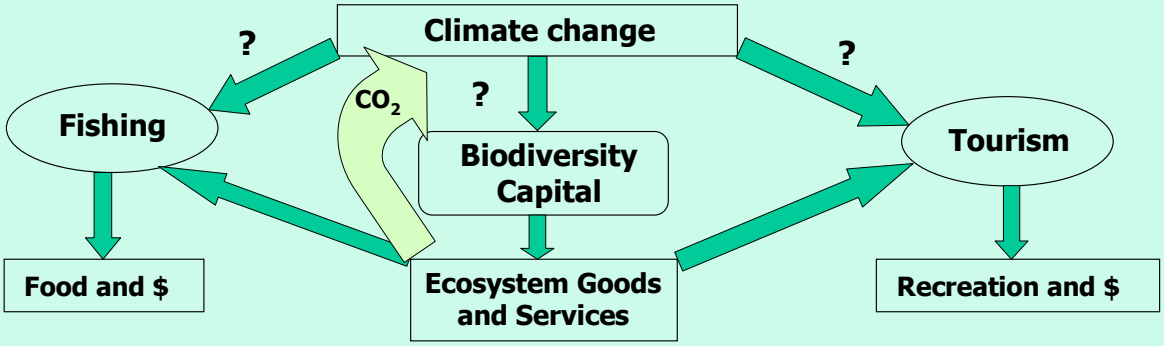


*From left to right: The Okavango Delta (permanent swamps in black, temporary swamps in grey); The diatom Eunotia pectinalis (var. undulata); Ribs, an operator of the DARWIN program with a tilapia.*

## Methodological approach

A useful technique to monitor ecosystem health is diatom analysis. Base line data on these siliceous algae and their ecological preferences are currently being compiled as part of a programme on aquatic biodiversity in the Delta, funded by the UK Darwin scheme. The research proposed will build on these findings by exploring different habitats and niches, thereby extending the knowledge of diatom biodiversity in the Okavango Delta. Algae play an important role in at least two important ecosystem services: they are the starting point of trophic networks ending with fish (provisioning service) and they absorb $CO_2$ thus contributing to carbon sequestration from the atmosphere (regulating service). From the environmental point of view the geographical analogue method can be used to study the impacts of drier conditions in presently wet areas, e.g. by monitoring diatoms in dry parts of the Delta, from the economic one scenarios can be elaborated starting from statistics on fishing and tourism. The final output could be the estimate of future trends given the predicted climate change impacts on these sectors (e.g.: drier conditions can reduce fish harvests but increase tourism on land).




Algal biodiversity constitutes an important part of the overall Biodiversity Capital of the Delta: its role in the wealth of different economic sectors is to be thoroughly investigated and possibly quantified, as well as the direct and indirect impacts of climate change on it and on fishing and tourism. The long-term monitoring of Biodiversity Capital, economic activities and climatic changes in the Delta, according to the scheme shown above, can provide consistent policy indications to design sound strategies for the sustainable management of its natural resources and their conservation along the time.

**References:** Ramberg, L., P. Hancock, M. Lindholm, T. Meyer, S. Ringrose, J. Sliva, J. Van As and C. Vander Post. 2006. Species diversity of the Okavango Delta, Botswana. Aquatic Sciences, 68, 310-337.

Websites: http://www2.geog.ucl.ac.uk/~mtodd/accord/index.htm; http://www.orc.ub.bw/biokavango/