

CLANIMAE

Climatic and Anthropogenic Impacts on African Ecosystems

DURATION OF THE PROJECT

Phase 1: 01/01/2007 – 31/01/2009
Phase 2: 01/02/2009 – 31/01/2011

BUDGET

752.698 €

KEYWORDS

Climate history, tropical Africa, lake-sediment records, human impact, deforestation, water quality

CONTEXT

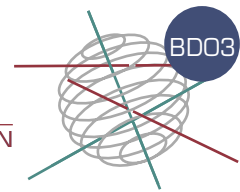
The magnitude and geographic reach of human impact on Earth's biosphere has increased rapidly over the last 100 years, in particular in equatorial East Africa where rates of population growth and the intensification of agriculture are among the highest in the world, and where developing economies strongly depend on water and other goods and services provided by natural ecosystems. Economic development with conservation of biodiversity and ecosystem functioning requires spatially and temporally explicit knowledge of the timing and relative magnitude of ancient and modern human impact on terrestrial and aquatic ecosystems to 1) evaluate the current health of ecosystems and their resilience to anthropogenic impact, 2) model the range of their possible responses to future climate change, and from these 3) develop locally optimal strategies for land and water-resource management.

PROJECT DESCRIPTION

Global studies of historical land use have focused on large-scale landscape modifications that can potentially affect global climate via their effects on surface albedo, aerosols, and the carbon cycle. These studies concluded that the impact of pre-colonial cultures on natural ecosystems in East Africa was limited, due to very low mean population density (~3% of today's population in 1700 AD). This contrasts with the common paradigms in archaeology that human ancestors impacted the East African landscape from Palaeolithic times onwards, and that the onset of significant anthropogenic deforestation must be situated at least 2500 years ago, following the introduction of iron metallurgy by Bantu immigrants. CLANIMAE responds to the urgent need of a correct long-term perspective to today's climate-environment-human interactions in tropical East Africa, by simultaneous high-reso-

lution reconstruction of both past climatic variability and the history of vegetation and water-quality changes through multi-disciplinary analyses of dated lake-sediment records. The climate reconstructions will integrate information on biological, geochemical and sedimentological proxy indicators of past changes in the water balance of study lakes. Several relevant data sets are already available, while others will be provided, at no cost to this project, by in-house doctoral thesis projects or foreign collaborators in complementary research initiatives. Reconstruction of past terrestrial vegetation dynamics will be executed within this project and based on analyses of fossil plant pollen and phytoliths in sediment records from lakes situated along the climatological gradient from (sub)humid western Uganda to semi-arid eastern Kenya. The evolution of water quality through time will be reconstructed using paleoecological analyses of fossil diatoms and aquatic macrophytes, following calibration of diatom and macrophyte species distribution against lake trophic status and turbidity in the modern-day regional lake gradient. Special attention will be given to the validation of silicon isotopes in diatom opal as proxy indicator for past diatom productivity, and to the stratigraphy of fossil fungal spores associated with the excrements of large domestic animals as indicators of lake use by indigenous pastoralists. Specific research activities funded by the Belgian federal science policy include the reconstruction of past vegetation dynamics and pastoralist activity through analyses of fossil pollen and fungal spores (UGent-Limnology, coördinator); silicon-isotope geochemistry and the monitoring of modern lake ecosystems (RMCA-Tervuren, partner 2); aquatic macrophyte paleoecology (FUSA-Gembloux, partner 3); and diatom paleoecology (National Botanic Garden-Meuse, partner 4), the two latter methods as indicators of past water quality. Pollen data on vegetation history will partly be provided through a sub-contract of UGent with expert palynologists in Kenya (Dr. S. M. Rucina, NMK Nairobi) en Uganda (Dr. I. Ssemmanda, U.Kampala). Phytolith data on the past





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occurrence of domesticated banana in Uganda will be obtained through an informal collaboration agreement with Dr. J. Lejju (U.Mbarara). A co-financed collaboration with the York Institute for Tropical Ecosystem Dynamics (UK; partner 5) contributes expertise on the long-term dynamics of African terrestrial ecosystems and on the archaeology of East Africa. Other long-standing collaboration agreements with international partners will provide complementary data and materials that further contribute to the regional-scale assessment of past climatic and anthropogenic impacts on African ecosystems.

An essential characteristic of the integrated paleoecological research method of this project is that it will address the question of past climate-environment-human relationships at the time scale at which the relevant processes have actually occurred. This will allow us to 1) separate the influences of natural climate variability and human activity on East African terrestrial ecosystems, 2) determine the exact timing and relative magnitude of indigenous (pre-20th century) anthropogenic land clearance compared to recent landscape alteration, and 3) determine the severity of lake water-quality losses due to siltation and excess nutrient input directly linked to deforestation and agriculture, compared to those associated with natural long-term hydrological change.

CONTACT INFORMATION

Coordinator

Dirk Verschuren
Ghent University
Limnology Unit, Department of Biology
K. L. Ledeganckstraat 35
B-9000 Gent
Tel:+32 (0)9 264.52.62
Fax:+32 (0)9 264.53.43
dirk.verschuren@UGent.be

Promoters

Luc André
Royal Museum for Central Africa
Biogeochemistry and aquatic geochemistry Unit
Mineralogy and Petrography
Leuvensesteenweg 13
B-3080 Tervuren
Tel:+32 (0)2 769.54.59
Fax:+32 (0)2 769.54.32
luc.andre@africamuseum.be

Laurent Bock
Faculté universitaire des Sciences agronomiques de Gembloux
Laboratoire d'Ecologie
Unité Sol-Ecologie-Territoire
Passage des Déportés 2
B-5030 Gembloux
Tel:+32 (0)81 62 25 38
Fax:+32 (0) 81 61 48 17
geopedologie@fsagx.ac.be

Christine Cocquyt
National Botanic Garden of Belgium
Section Cryptogamie
Domein van Bouchout
B-1860 Meise
Tel:+32 (0)2 260.09.41
Fax :+32 (0)2 260.09.45
c.cocquyt@telenet.be

Robert A. Marchant
The University of York
York Institute for Tropical Ecosystem Dynamics (KITE)
Environment Department, Heslington
York, YO10 5DD, UK
Tel:+44-1904 434061
Fax:+44-1904-432998
rm524@york.ac.uk

Follow-up Committee

For the complete and most up-to-date composition of the Follow-up Committee, please consult our Federal Research Actions Database (FEDRA) by visiting <http://www.belspo.be/fedra> or <http://www.belspo.be/ssd>

