Open PAGES Focus 4 Workshop "Towards a more accurate quantification of human-environment interactions in the past"

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Cover
Top: The Cistercian abbey of Villers-la-Ville in the southern part of the Dijle catchment, central Belgium, founded in the 12th century and abandoned after the French Revolution at the end of the 18th century.
Bottom: Quantification of carbon fluxes (Tg C) between the soil and atmosphere as a result of human-induced accelerated erosion during the last 6000 years for the Dijle catchment (Van Oost K. et al., 2012, PNAS 109: 19492-19497)

Human impacts on a peri-urban wetland in central Kenya

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Manguo wetland is located in Central Kenya at lat. 010 06' 19.6'' S and long. 36037' 58.44''E at an elevation of 2200 m asl. It occupies an area of 8.1ha and primarily depends on rainfall, surface runoff and underground seepage for its water supply. A study was carried out in August 2011-February 2012 to determine: Manguo vegetation composition and distribution, its soil/water chemical and physical properties, vegetation changes over time and major wetland uses and their impacts. The data sets obtained were:

a) Vegetation data (species sampled, number of individuals) to calculate species abundances, densities, frequencies, diversity, richness and sample similarity.
b) Soil and water data (pH, soil moisture and texture, nutrient levels) to determine the soil/water quality; determine if the soil properties influenced vegetation distribution and check if watershed land use had impacted wetland nutrient levels.
c) Pollen data was used to display vegetation changes over time (pollen diagram) and infer land use changes and climate impacts.

A total of 20 species from 8 orders and 12 families were sampled and the wetland was dominated by herbaceous vegetation particularly sedges. The vegetation abundance was higher during the wet period than the dry period with 6387 and 4272 individuals respectively. The diversity was higher in the wet period than the dry period with HI=1.05 and HI=0.64 in the wet and dry period respectively. However species richness was higher during the dry period at S=4.13 than the wet period at S=3.94. Plant species composition did not significantly change along soil moisture and nutrient gradients. The soils and water were determined to have adequate Ph and nutrient levels suitable for agriculture (main wetland use). The sediment core revealed the vegetation historical succession from high forest species abundance to open grassland at present. The main human uses/impacts identified were poor agricultural practises leading to soil erosion/siltation, overgrazing, garbage dumping and burning, digging of pits for sale of soil, bird eggs collection, uncontrolled water and sedge harvesting due to its unprotected status. The Manguo wetland core revealed a sharp decrease in trees and increased dominance of herbs which could be a result of anthropogenic induced vegetation changes. Significant forest clearance and site occupation occurred in the region in the recent past. This is assumed to be during the second half of the 19th century when there was a high influx of the Kikuyu who were cultivators. The dramatic decline of tree species indicates the influx of humans coupled with the appearance of the exotic species Eucalyptus and Pine and species cultivated for food e.g Zea mays, Amaranthaceae. Ecological information on Manguo wetland was unavailable and the study provided historical and ecological baseline information which can be used for the wetland conservation by Manguo wetland stakeholders.

Small river aggradation in different landscape zones or the Russian Plain: reasons and consequences

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Southern half of the Russian Plain is occupied by forest, forest-steppe and steppe landscape zones. Until the 17th century population density was low and area of cultivated lands was negligible. Area of arable lands increased considerably on the south of forest zone since the beginning of 18th century. Intensive tillage of the forest-steppe and the northern part of steppe zones began in the end of 18th century. Only in the end of 19th century lands of dry steppe zones were cultivated with increasing area of arable lands from 5 to 65% for only 20 years. Some parts of dry steppe in the south-east of Russian Plain and on south of Western Siberia were intensively cultivated only in the middle of 20th century after World War II. So in case of Russian Plain it is possible to evaluate the anthropogenic impact on landscape based on documentary evidence for region scale and in some case for local scale. Analysis of the spatial-temporal dynamics of stream net density (SND) for different landscape zones of the Russian Plain was undertaken using comparison of historical topographic maps for few time intervals since the end of 18th century. It was found that maximum SND decrease is observed at the northern parts of the steppe zone, where total SND in the middle of 20th century was 50-60% of those at the first quarter of the 19th century. It was confirmed that intensive small river aggradation was associated with period of intensive cultivation of basin area, which led to increasing of surface runoff and sediment transport from cultivated lands to the valley bottoms with proportional decreasing of underground runoff, feeding constant flow in the river channels during low water. The highest delivery of basin sediment to the river valley was coincided with periods of gully erosion intensification, which in turn were due to changes in land use (a sharp increase in arable land,