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PAGES
PAST GLOBAL CHANGES

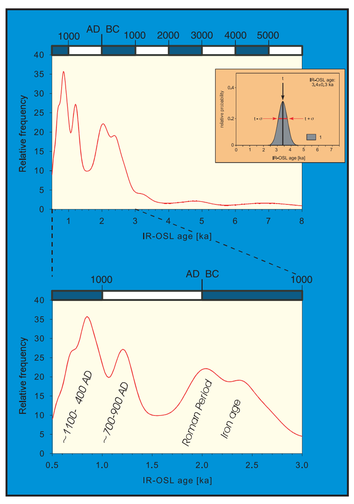
PAST ECOSYSTEM PROCESSES AND HUMAN-ENVIRONMENT INTERACTIONS

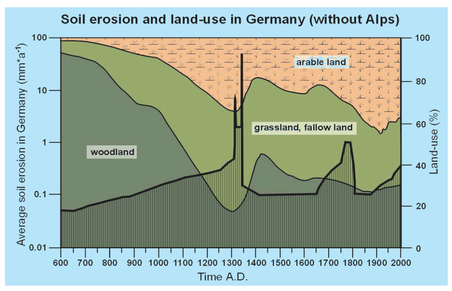
Goals: 1. To integrate past human-environment interactions at sub-continental scale with research and modeling based on present day ecosystems and watersheds.
2. To expand PAGES concern with ecological responses to global changes.

Land Use and Climate Impacts on Fluvial Systems During the Period of Agriculture (LUCIFS)

Aim: Understanding the variations in water and particulate fluxes through fluvial systems at various times since agriculture began on our planet.

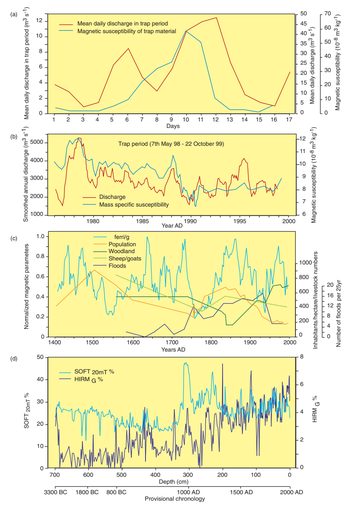
Human impact causes increased soil erosion





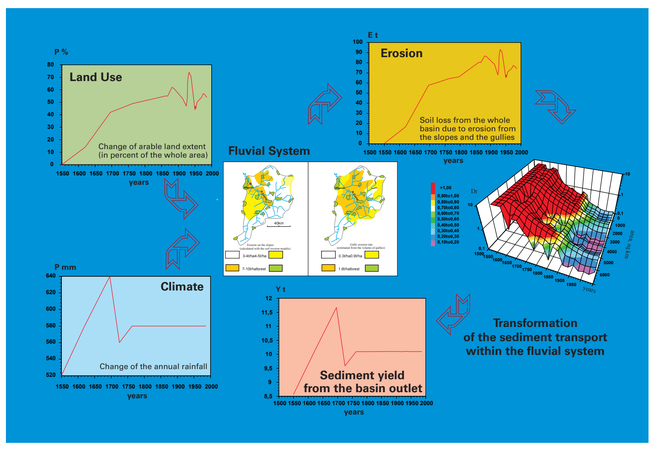
1. Frequency analysis of OSL-ages. OSL ages obtained on soil erosion derived sediments from several different sites in the loess hills of South Germany. 2. Soil erosion and land use in Germany during the last 1400 years (Land et al. 2000. PAGES News 8,3:11-13). **Phases of colluviation clearly coincide with phases of strong human impact.**

River discharge is strongly affected by seasonal changes in land use.



A) Magnetic susceptibility values of trapped sediment and monthly river discharge data. B) Magnetic susceptibility values of lake sediment and smoothed annual river discharge. C) Lake sediment flood proxy record. D) Long term trajectories of erosion over the past 5000 years. (Dearing 2000. PAGES News 8, 3:14-16). **A direct and positive link between the timing of peak values for annual discharge and the flood frequency is well within the errors of the sediment ages.**

The main factor controlling erosion is the area of arable land.

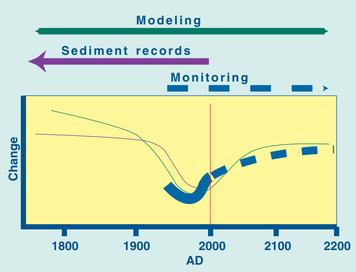


Land use and climatic change cause erosion of the Zusha River channel net, altering sediment yield. (Sidorchuk 2000. PAGES News 8, 3: 19). **Sediment delivery to rivers is controlled by erosion of cultivated land. Sediment movement in the river is controlled by rainfall and runoff.**

Human Impact on Lake Ecosystems (LIMPACS)

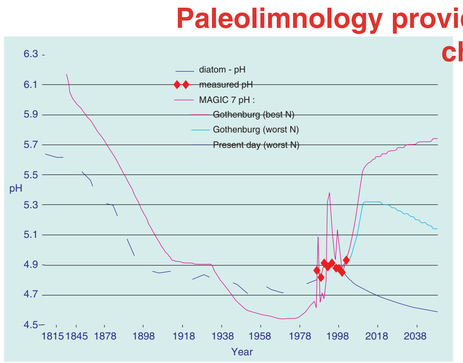
Aims: Understanding how lakes function on different time-scales in response to both natural forces and human impacts.
Predicting how lake ecosystems will change in the future as stresses are altered.

Modeling is needed to develop a system-level understanding of lakes



Limnological change: The role of sediment records, models and monitoring (Battarbee 2000. PAGES News 8, 3: 20).

Paleolimnology provides unique insights into ecosystem change relevant to contemporary debates on lake functioning and human impact

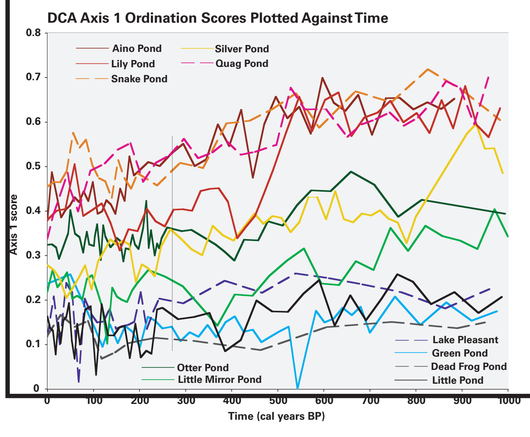


Combined plot of inferred, monitored and modeled pH for the Round Loch of Glenhead from 1820-2050 (Battarbee 2000. PAGES News 8, 3: 20-21).

Human Impact on Terrestrial Ecosystems (HITE)

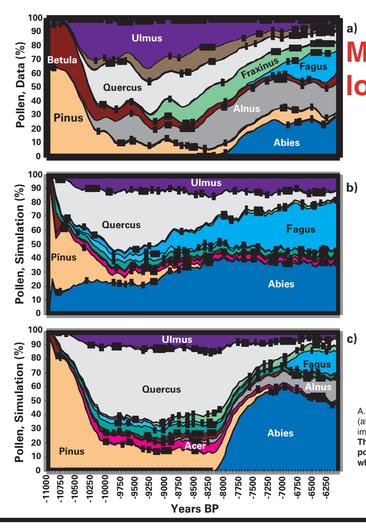
Aim: Understanding terrestrial ecosystem change through time; thereby improving the security and enhancing the value of terrestrial ecosystems for the future.

Historical and paleoecological investigations confirm that homogeneity is only centuries old and largely a product of human disturbance



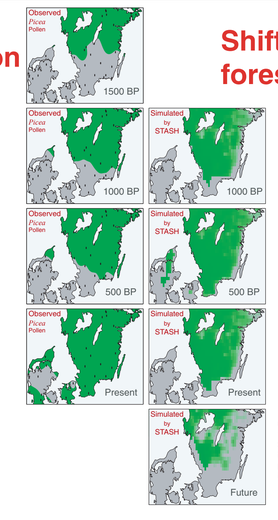
Long-term changes in forest composition in central New England USA, depicted through DCA scores for 11 pollen diagrams from small lakes (Fuller et al. 1998). **Separating human and environment drivers of forest changes requires a millennial perspective.**

Models are best calibrated based on long records of biotic changes.



A. Pollen frequencies in the early Holocene for Lake Soppensee, Switzerland (after Lotter 1989). B and C: Simulation results with climatic input data or immigration dates for *Abies* and *Fagus* (Bugmann 2000. PAGES News 8, 3: 26-28). **The simulation revealed broad agreement between simulated and measured pollen frequencies when immigration of two species was delayed to the point where they appeared in the pollen record.**

Shift from deciduous to coniferous forest are driven by climate change and land-use interactions



Observed and simulated *Picea* distributions during the last 1500 years in Southern Scandinavia (Bradshaw et al. 2000. PAGES News 8, 3: 29-30). **Future predictions suggest that the range will retreat northwards, and outlying populations will be out of equilibrium with climate under threat.**

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