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► To cite this version:

Anthony Foucher, Olivier Evrard, Olivier Cerdan, Irène Lefevre, Clément Chabert, et al.. Reconstructing soil erosion rates and sediment sources during the Anthropocene in ponds and lakes draining contrasted cultivated catchments (Loire River, France). AGU Fall Meeting 2018, Dec 2018, Washington D.C., United States. cea-02674466

HAL Id: cea-02674466

<https://cea.hal.science/cea-02674466>

Submitted on 31 May 2020

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Reconstructing soil erosion rates and sediment sources during the Anthropocene in ponds and lakes draining contrasted cultivated catchments (Loire River, France)

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Soil erosion is hypothesized to have strongly accelerated after WWII in response to changes in land use and landscape patterns across Europe. However, there is a lack of data on this process in cultivated – flat – environments of Northwestern Europe where very few records are available to quantify these changes in soil erosion rates during the last several decades.

The Loire River basin (117,500 km²), in France, provides a good example of cultivated environments that have been exposed to extensive land use changes after 1945. To quantify the impact of these changes on soil erosion rates, 10 ponds and lakes draining contrasted cultivated environments (dominance of cropland, vineyards, forests or grassland) were selected for sediment coring. Several cores were collected depending on the pond morphology, and the sediment profiles were characterized (magnetic susceptibility, CT-scan, spectrophotometry, particle size, XRF elemental geochemistry, C/N ratio, Rock-Eval pyrolysis, palynofacies) and dated using fallout radionuclides (Cs-137, excess Pb-210) analyzed by gamma spectrometry. Based on these results, the Mass Accumulation Rates and the corresponding soil erosion rates were calculated for the pre- and post-1945 periods.

The results show strong variations in soil erosion rates depending on the local changes in land use and landscape (documented by agricultural statistics and aerial/remote sensing imagery). The impact of the occurrence of extreme weather events (e.g. storms) was also recorded in some of the sediment cores. In the future, sediment tracing techniques will be applied on these cores to quantify the occurrence of potential changes in sediment sources during this period. The calculated soil erosion rates will also be compared to the outputs of a soil erosion model in order to identify the main factors (climate vs. human impact) controlling these changes and to propose effective measures to combat soil erosion and reservoir/river siltation in this region.