Potential of environmental DNA for tracing land-use based sediment sources

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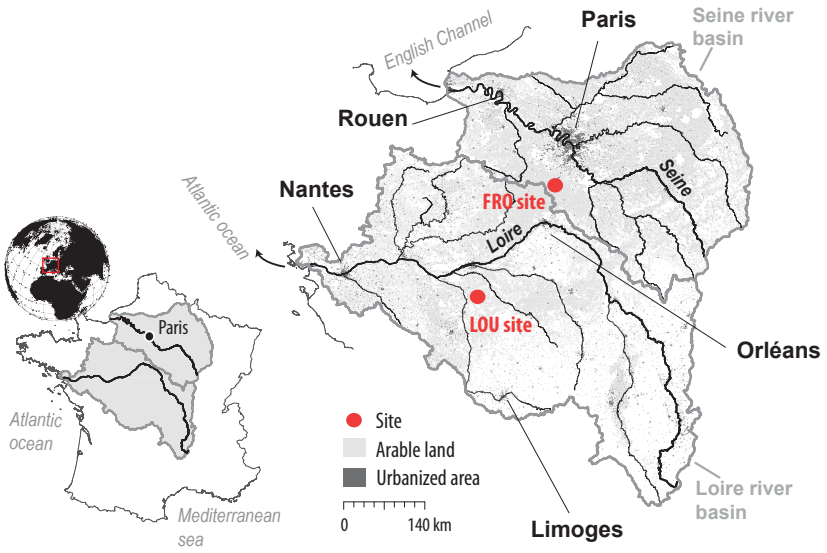

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Introduction.

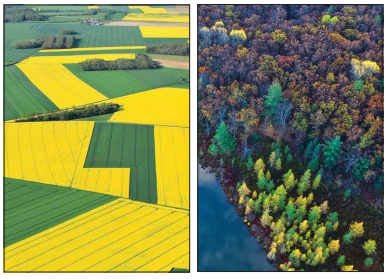
Environmental DNA (eDNA) is a complex mixture of genetic material extracted from environmental samples like soil, water or sediment in order to obtain reliable information on the past and current biological communities. In recent years, the eDNA technique was successfully applied to sediment accumulated in lakes for providing information on past land use and land cover changes in their drainage areas. Recently, the potential of eDNA for providing detailed information on the plant species found in sediment sources was investigated. This research highlights the powerful potential of this method for improving our ability to detect the vegetal communities causing erosion and sediment delivery. Nevertheless, some fundamental questions remain like for example the DNA memory effect in soils. **How long can the plant signature persist in soils? Are we recording the last species cultivated or a mixture of past plants in agricultural areas? These issues are of prime importance for examining the potential of eDNA as a new sediment tracer.**

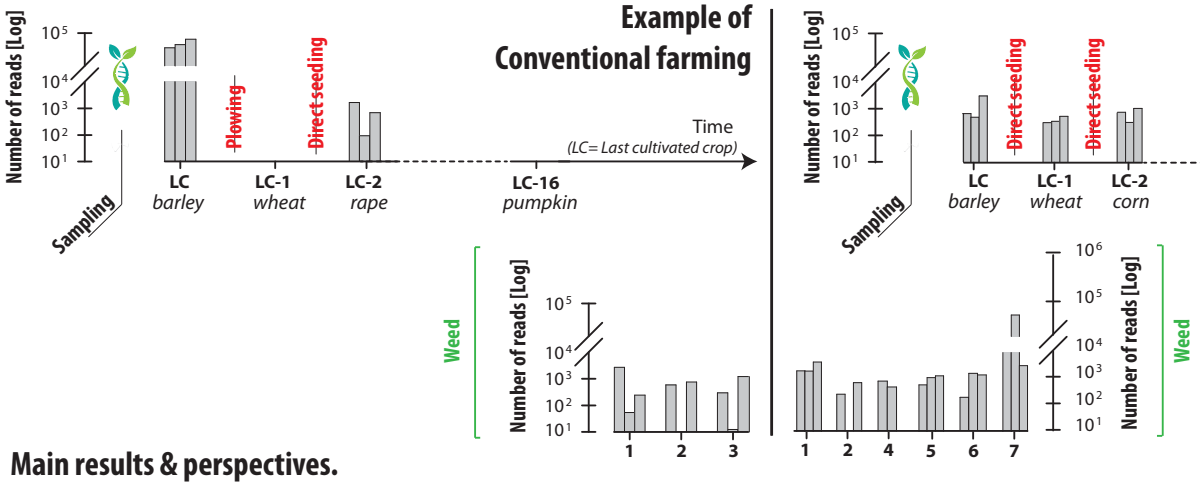
Sites & methods.

Two contrasted sites located in **intensively cultivated environments** in France were studied. In the first site, soil samples were collected (n=30) in plots for which the crop rotation history was **well documented since 1975.** In particular, crops cultivated only once during the rotation were used as potential **chronological markers**. The **impact of agricultural practices on eDNA preservation** was also investigated comparing soil signatures under conventional and conservation farming. In the second site, samples were collected (n=40) to compare the abundance of currently observed taxa versus detected taxa in cropland, grassland, woodland and river channel banks.

eDNA preservation and agricultural practices

eDNA preservation and land uses





1. bindweed - 2. ryegrass - 3. black nightshade - 4. knotweed - 5. healtyfoin - 6. Buttercup - 7.Non attributed

Main results & perspectives.

The results showed that the **last cultivated crop was detected in 100%** of the samples as the most abundant taxa under conventional farming and 75% under no-tillage. The **last cultivated species was the most abundant in 80%** of the studied plots. Interestingly, grapevine was detected in 46% of the cultivated plots of the second site, although this plant is no longer cultivated in this catchment. In addition, a **large variety of weeds were detected** in both sites in addition to the cultivated species. eDNA results provided by the current research illustrate the potential of this **method for identifying the recent (<7 years) land cover history of soils** which may allow to improve our understanding of sediment mobilization and transfer processes over short timescales.

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