



Two millennia of forest history deduced from closed depressions in the Lorraine plain (North-eastern, France)

David ETIENNE (1,2), Pascale RUFFALDI (1), Frederic RITZ (3), Jean Luc DUPOUEY (4), and Etienne DAMBRINE (2)

(1) Laboratoire Chrono-environnement, Université de Franche-Comté, UMR 6249, Besançon, France (etienne@nancy.inra.fr), (pascale.ruffaldi@univ-fcomte.fr), (2) Laboratoire de Biogéochimie des Ecosystèmes Forestiers, INRA, Nancy, France (dambrine@nancy.inra.fr), (3) Office National des Forêts, Nancy, France (frederic.ritz@onf.fr), (4) Laboratoire d'Ecologie et Ecophysiologie Forestières, INRA, Nancy, France (dupouey@nancy.inra.fr)

Recent archaeological surveys and ecological investigations in large “ancient” forests have shown that these areas had been often cultivated during the Roman or Medieval periods, and that this former land use is still deeply influencing present soil properties and plant biodiversity. This new perspective has boosted the research for sediment archives describing the state of forests across the archaeological and historical periods, especially in low altitude forest.

Closed depressions (CD) or small hollows (over 30 000 CDs) are found in many silty plains of North-Western Europe (north-eastern France, Luxemburg and Belgium). They are defined as small (100 to 400 m²) closed wetlands, mostly supplied by rainwater. Their origin is debated. Recent coring campaigns in CDs of Lorraine (north-eastern France), 3 to 5 meters thick sediment cores were retrieved. It opened the way for palynological and pedological reconstruction of former landscapes.

Here we present a sediment analysis of four peaty CDs (Assenoncourt, Römersberg, Sarrebourg and St Jean), located in different low altitude beech (*Fagus*) and oak (*Quercus*) forests, on silty clay soils, 50km from Nancy. As the oldest available map (Naudins, dated from 1728 to 1739) indicated forest boundaries similar to the present ones, these forests were considered as ancient forests.

The sedimentation begins during the second Iron Age or Roman period. By this time, pollen analyses show an open landscape (70% of Non Arboreal Pollen), composed mostly by grassland (*Plantago major/media*, Poaceae and Asteraceae) and cropland (*Cerealia*-type, *Centaurea cyanus*).

Around the 5th century AD, coinciding with the collapse of the Roman Empire, the pollen sequences describe rapid afforestation by *Betula* and *Corylus*, and later *Carpinus* forest.

From the 8th century AD, *Carpinus* decreases in favour of *Quercus* which may reflect an anthropogenic clearing. From the 10th to the 14th century AD, croplands expand again with cultivation of hemp (*Cannabis*-type) and rye (*Secale*-type).

From the 15th to the 19th century AD, pollen diagrams are similar at three sites and differ from the fourth. At Assenoncourt, St Jean and Römersberg, the contribution of *Quercus*, *Carpinus* and *Fagus* remains almost constant: 40%, 10% and 10%. This pattern may be related to short rotation forestry management applied in order to provide fuel wood to the local salt industry. At the fourth site (Sarrebourg), pollen assemblage varies with successive *Quercus* and *Carpinus* phases, following a natural sylvicultural evolution. Finally, the present-day forest extension took place during the 19th century with the replacement of wood by coal in the salt industry and the recent collapse of this salt industry during the 20th century.

This study confirms, in the context of low altitude forests with heavy soils, what had been observed on shallow calcareous soils of the Lorraine plateau. Most of our state forests, that were thought to be “very ancient” or “immemorial” forest, have been managed for agriculture in the deep past. Because agriculture lands were often limed, fertilized, and eroded, this former agriculture use may to a large extent explain present soil properties and, as a consequence, present biodiversity.