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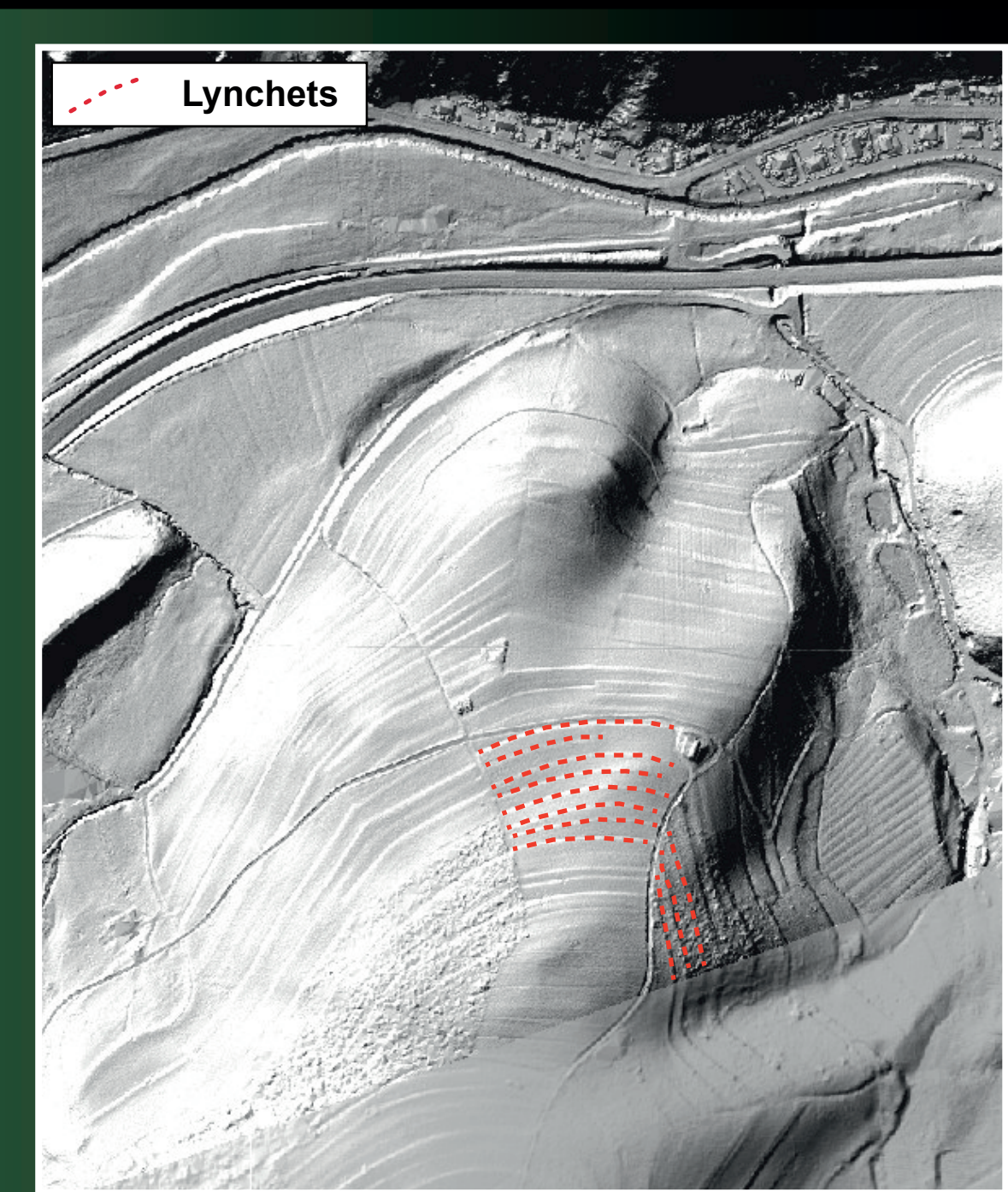
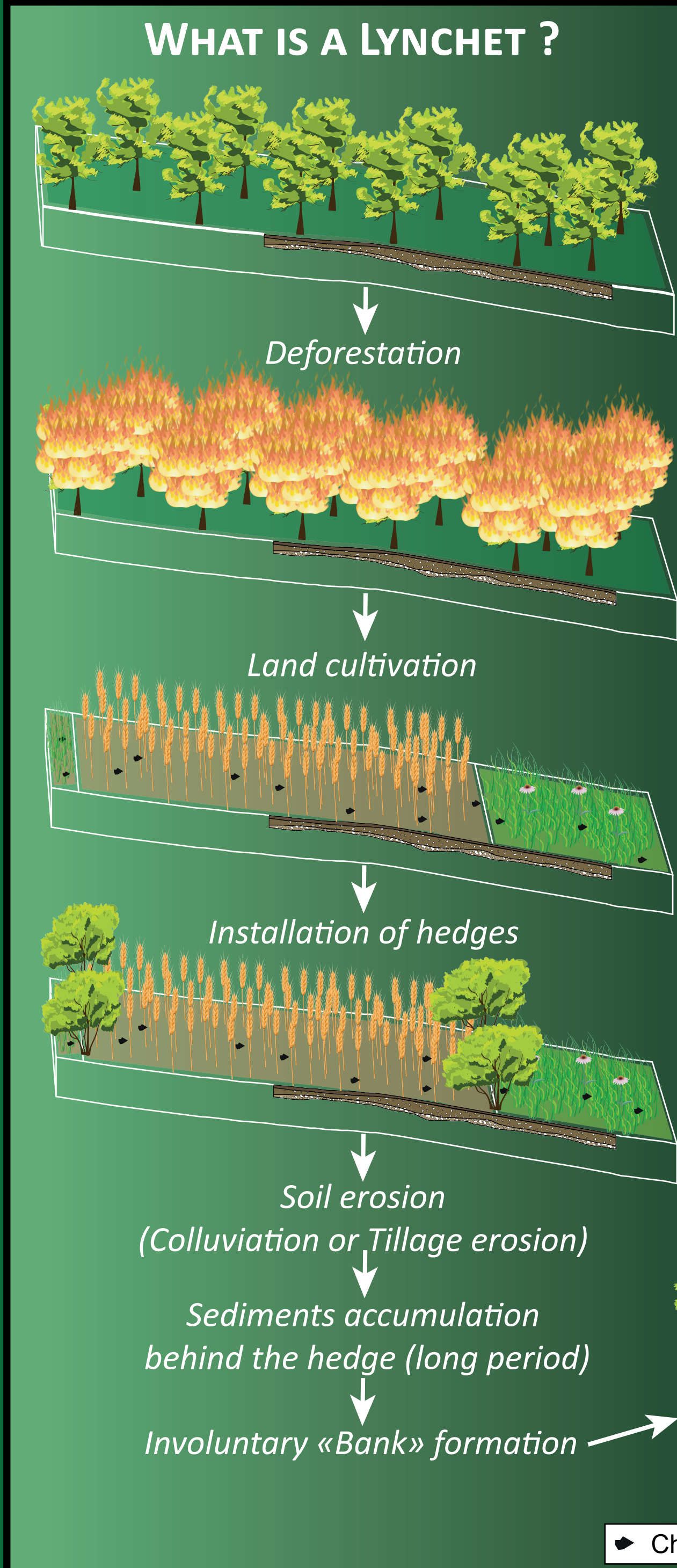
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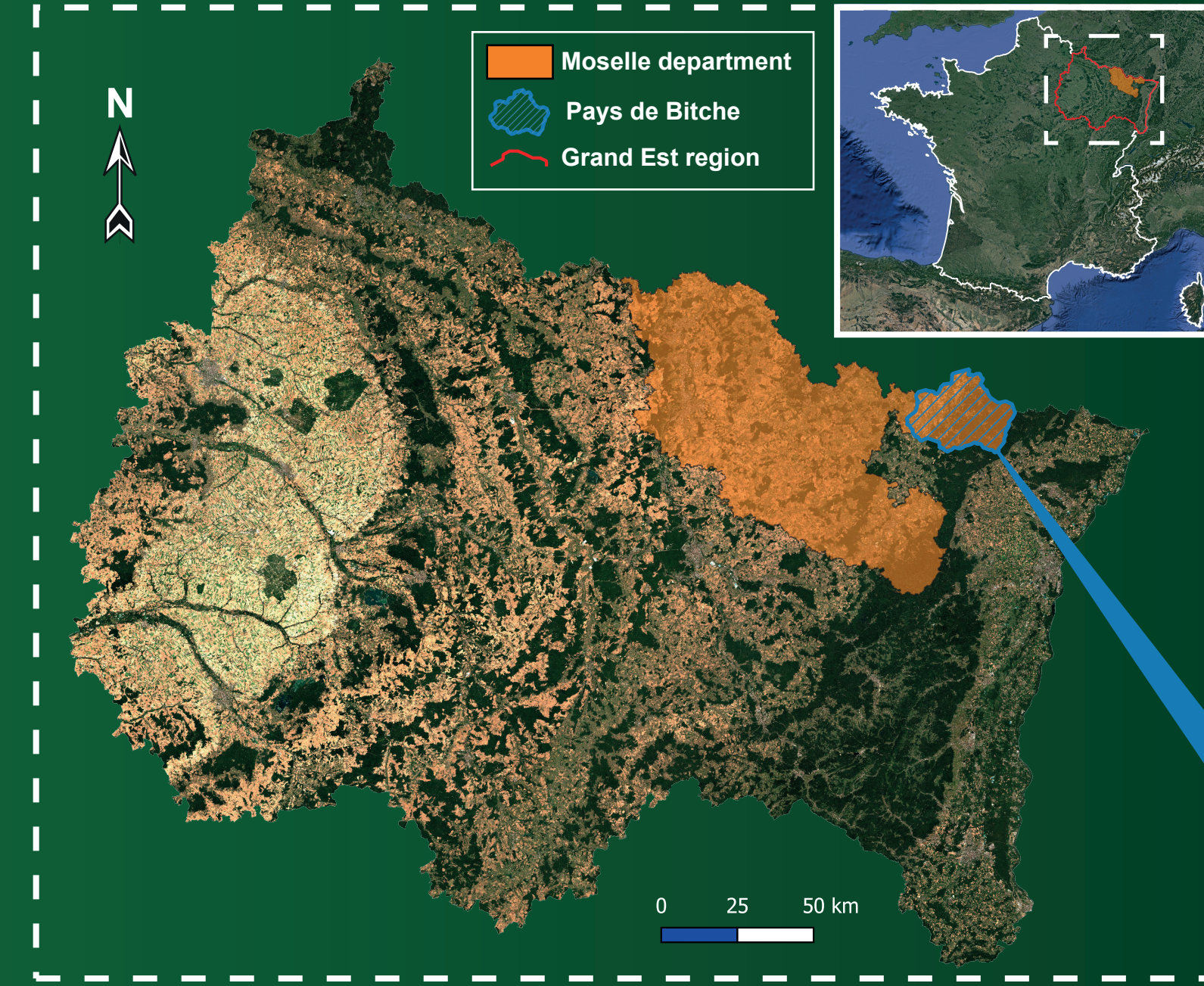
HISTORY OF AGRARIAN LANDSCAPES IN PAYS DE BITCHE SINCE ANTIQUITY : GEOGRAPHICAL AND PALEO-ECOLOGICAL APPROACHES.

Keller Benjamin¹; Robin Vincent²; Herrault Pierre-Alexis¹; Schwartz Dominique¹ and Ertlen Damien¹



Digital Elevation Model (DEM) view of lynchets system landscape near Lièpvre (Haut-Rhin).

WHY STUDY LYNCHETS ?
 - The *lynchet* forms in hedge landscapes since the ancient times. The charcoals stored in the bank helps us to define the woodlands composition before clearing of the forest or the composition of the hedge itself. It also allows us to date agrarian forms, thus helping us defining the cycles of cultivation, hedge and landscape history.



PAYS DE BITCHE STUDY LOCATION
 - The study site is located in Grand Est region (France) in the east north of Moselle department (57). Pays de Bitche is composed of 47 municipalities (355 ha). This territory is located partly in the Regional Natural Park of the Northern Vosges (PNRVN).

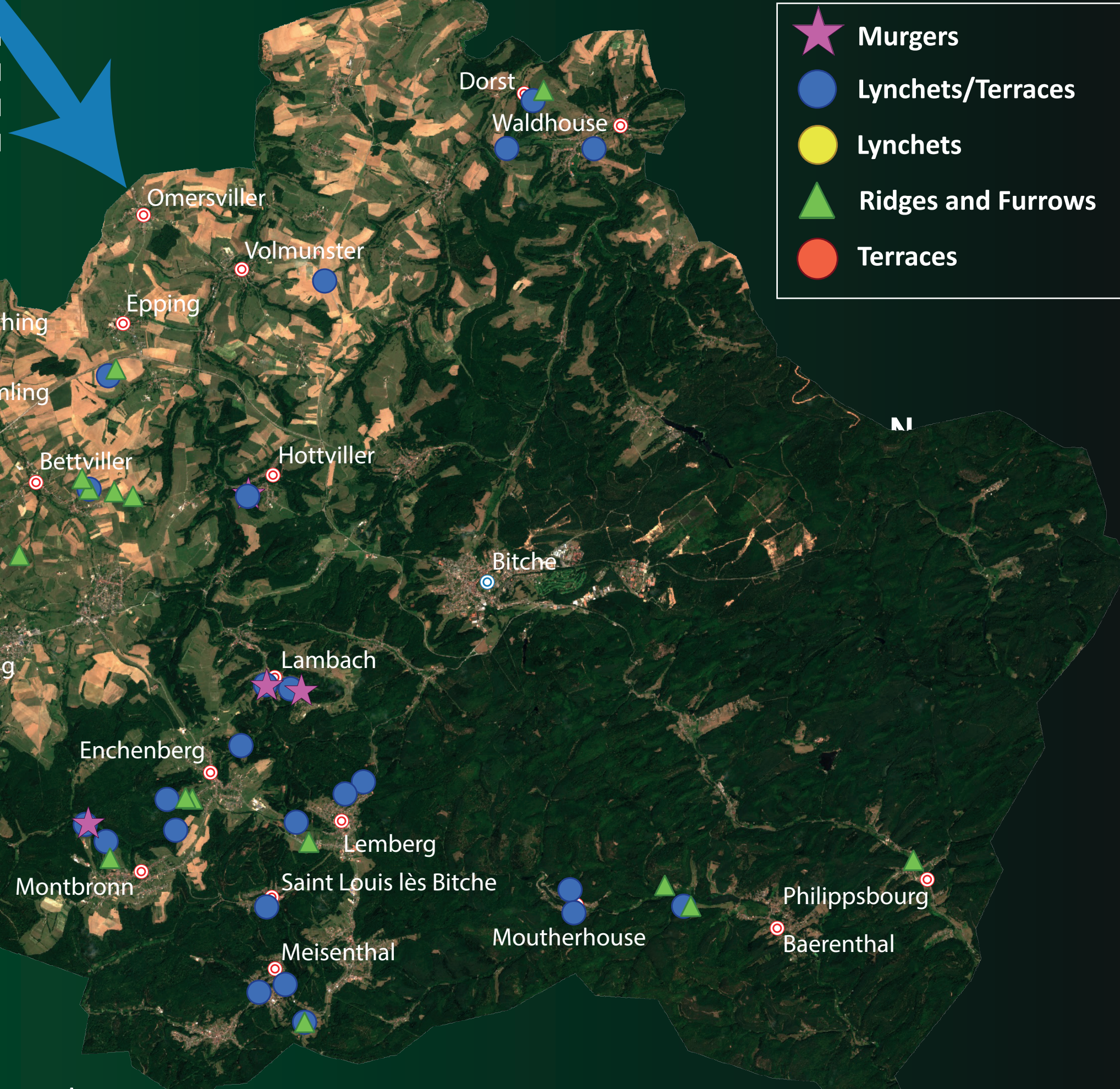
PAYS DE BITCHE STUDY CONTEXT
 The landscape can be divided to 3 parts because of human exploitation probably influenced by geological contrast in this area :
 - The open landscape at the west is the result of the agriculture persistence, dominated by limestone.
 - The landscape at the center is the result of agricultural abandoned, dominated two geological formation (limestone and sandstone)
 - The closed landscape at the east, dominated by the sandstone and forest.

PAYS DE BITCHE AGRARIAN FORMS
 - 20 municipalities have been prospected, including 7 in the "open landscape", 10 in the "in the central part" and 3 in the "closed landscape".
 - 72 agrarian forms have been identified.
 - 2 sites have been selected to be analysed (in Achen and Obergaillbach)

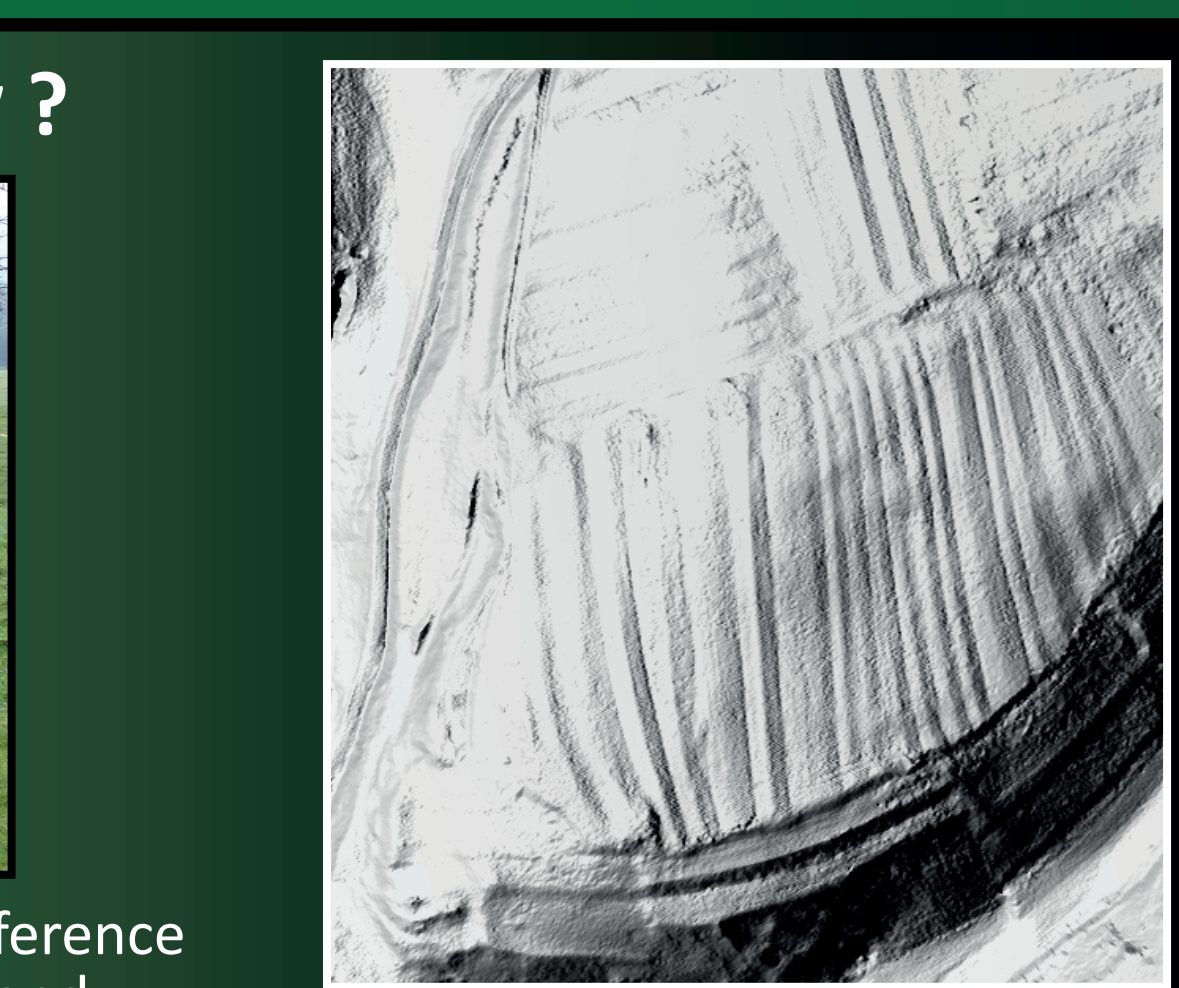
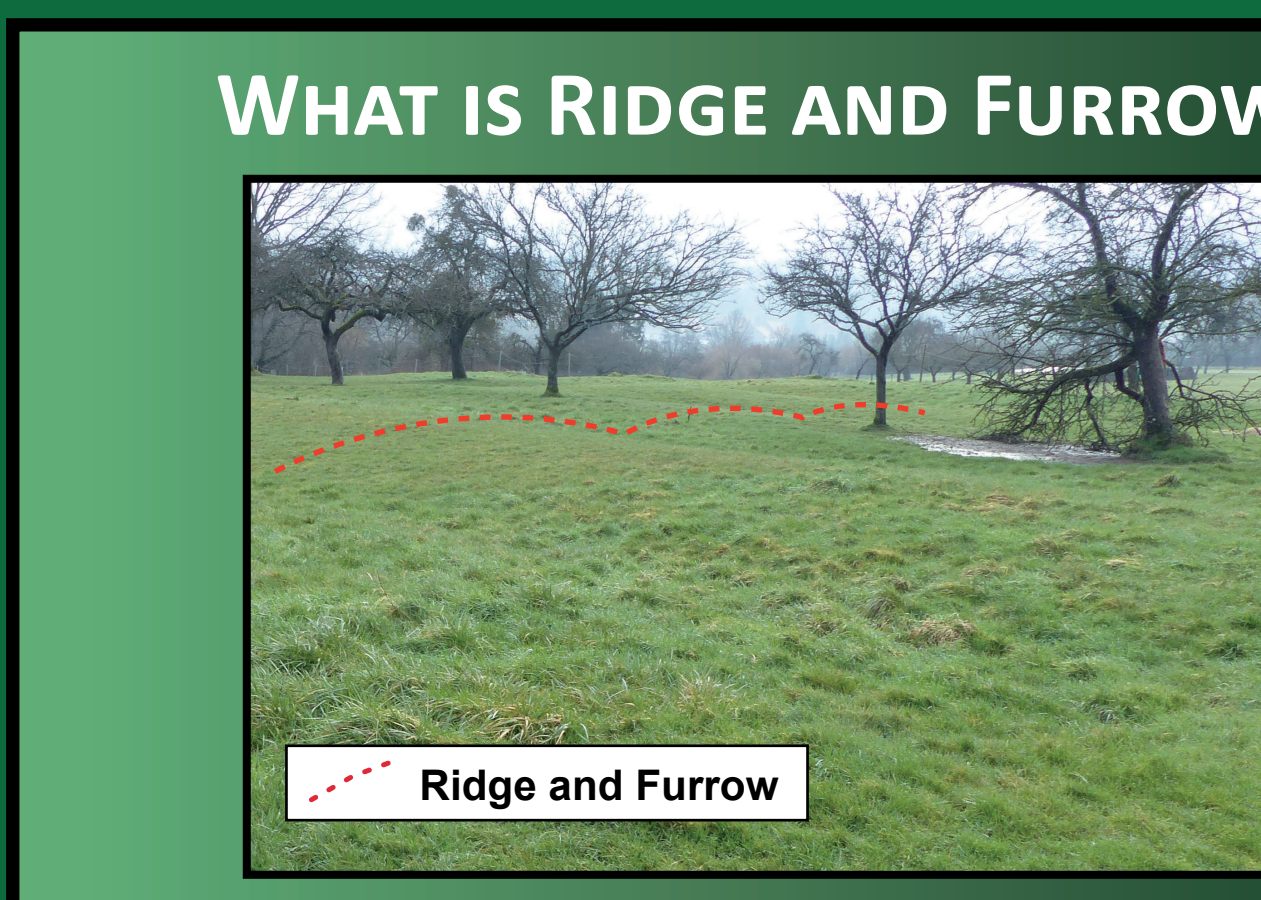
OBBERGAILBACH STUDY LOCATION
 - Obergaillbach is part of Regional Natural Park of the Northern Vosges.

MBW STUDY CONTEXT
 - Obergaillbach site (MBW) is located under forest in a gentle slope (9%) with an altitude of 352m.

MBW LANDSCAPE CONTEXT
 - Lynchets have been conserved. Perhaps, some of this forms have been destroyed or disappeared because of reappalling, erosion...
 - According to maps, aerial photograph, forest office datas... MBW site has been under forest since 18e century.
 - 4 km from MBW site there is a Gallo-Roman site (European Archaeological Park Bliesbruck-Reinheim)
 - According to maps and aerial photograph, MBW site has been cultivated since the 19e century.

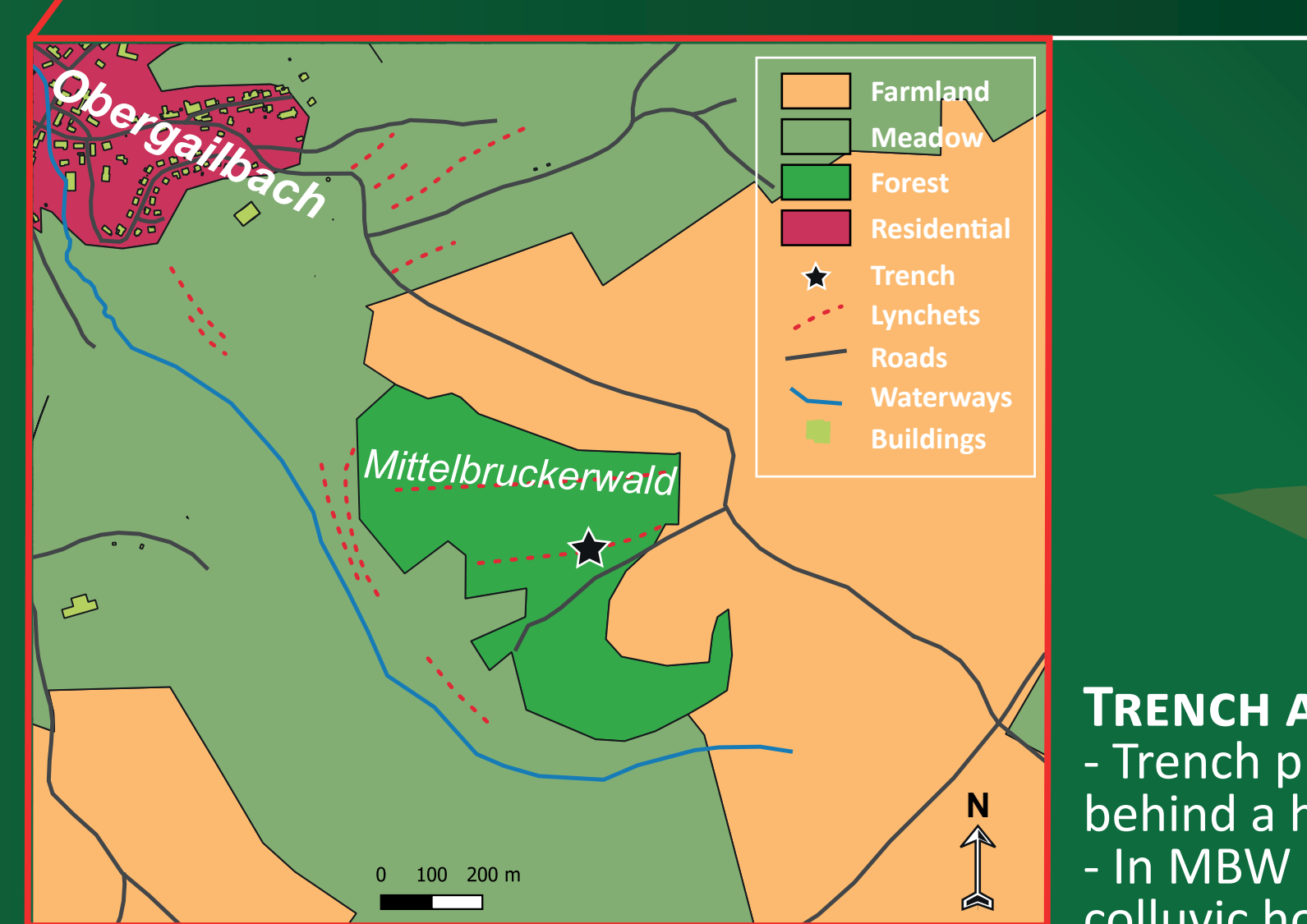
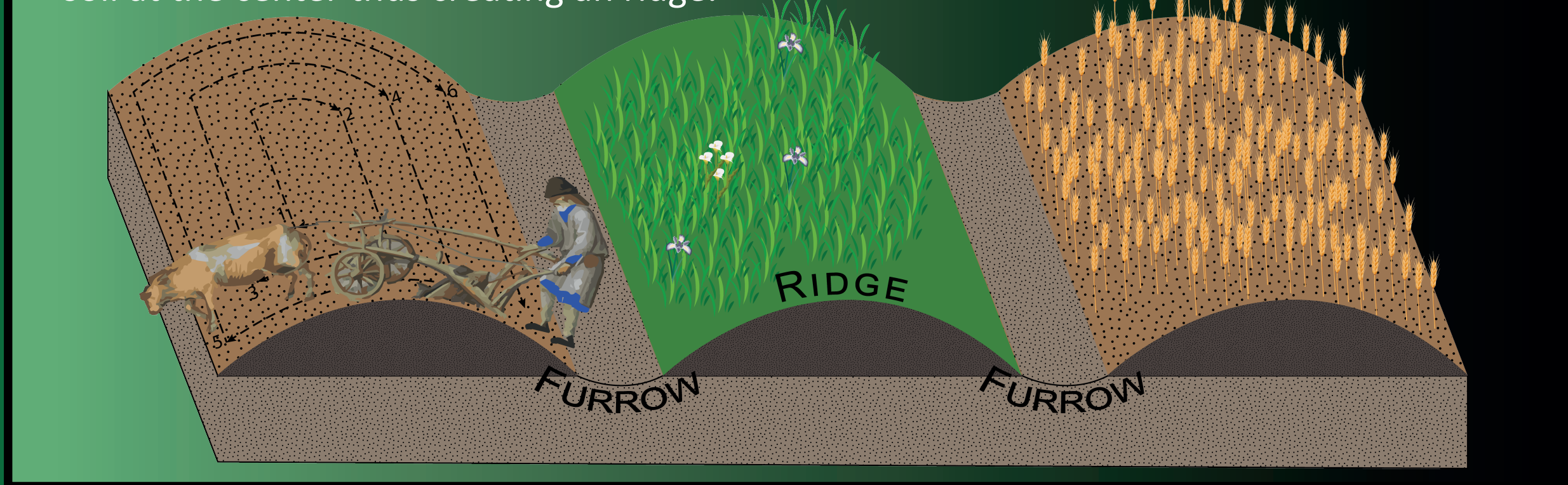


- ★ Murgers
- Lynchets/Terraces
- Lynchets
- ▲ Ridges and Furrows
- Terraces

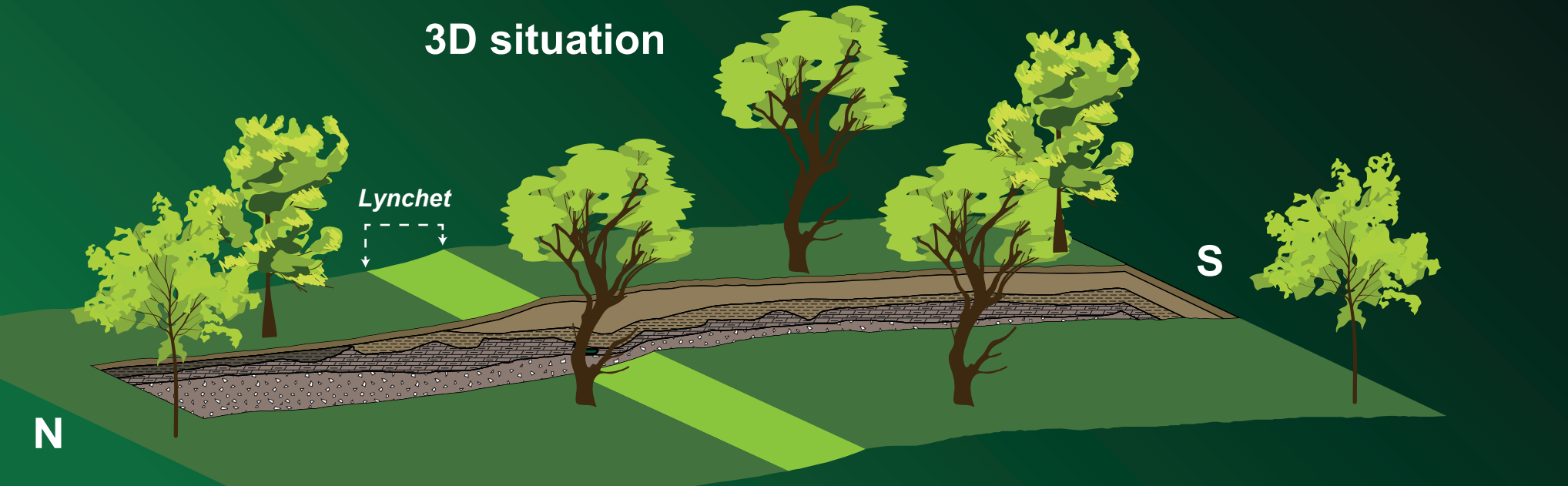


Digital Elevation Model (DEM) view of Ridge and Furrow system landscape near Reipertswiller (Moselle).

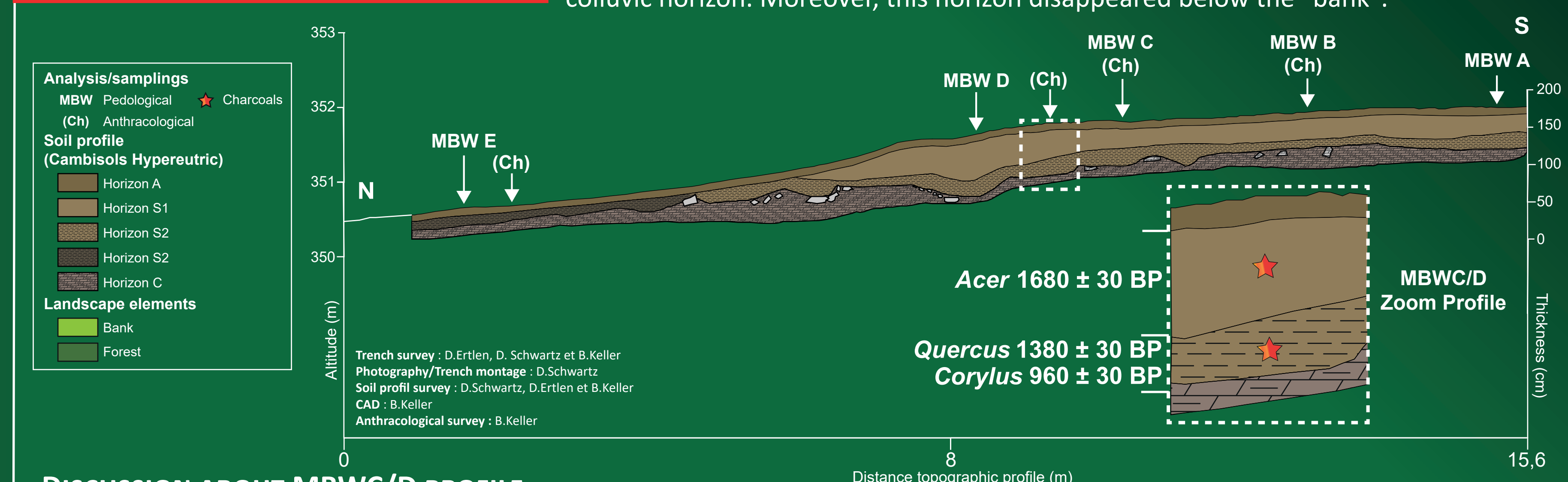
WHAT IS RIDGE AND FURROW ?
 It is a succession of *ridge* and *furrow*, with difference of elevation that can reach almost one meter and whose frame allows to reconstitute the former organization of parcels. This agrarian forms is the result to utilization of mouldboard plough stationary (≈10e-siècle) and the plowing technique known as "ados". This technique consists of plowing starting from the middle of the field between two plot boundaries, then turning around the first plowing favoring the accumulation of soil at the center thus creating a ridge.



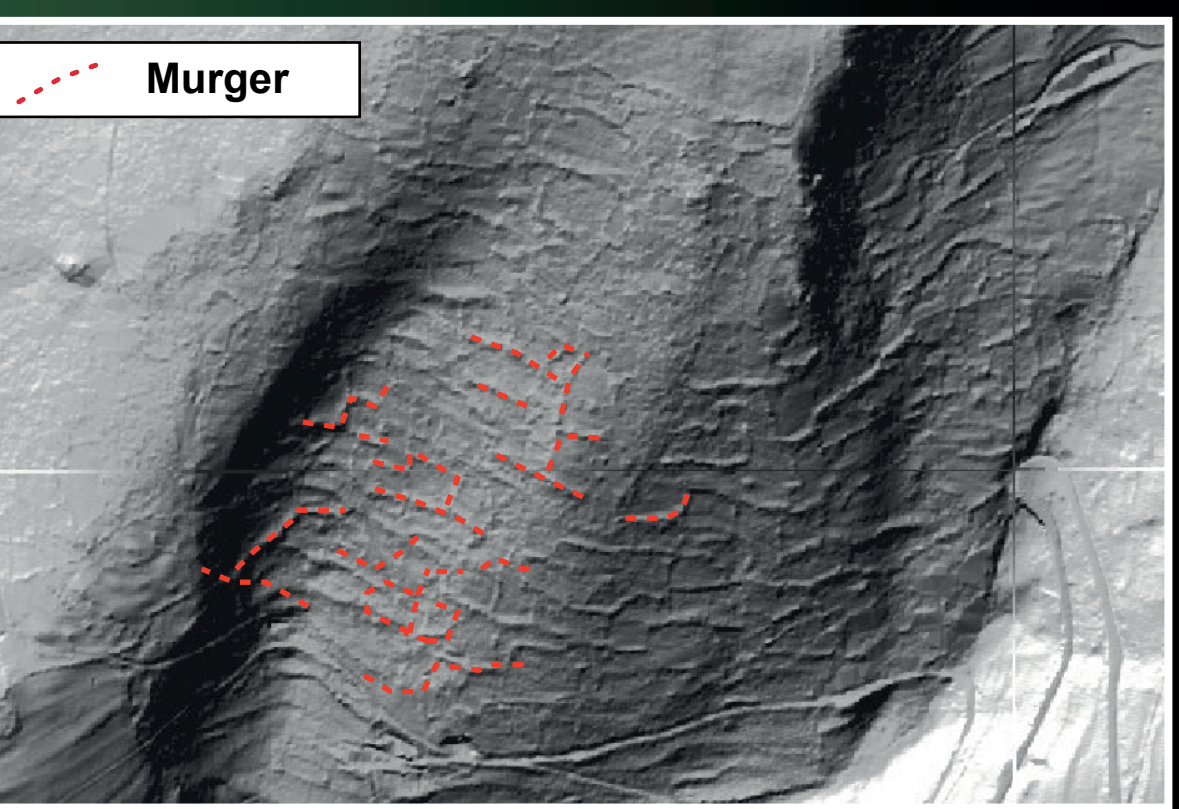
Soil profile (MBW) of the trench realized in the municipality of Obergaillbach at a place called Mittelbruckerwald



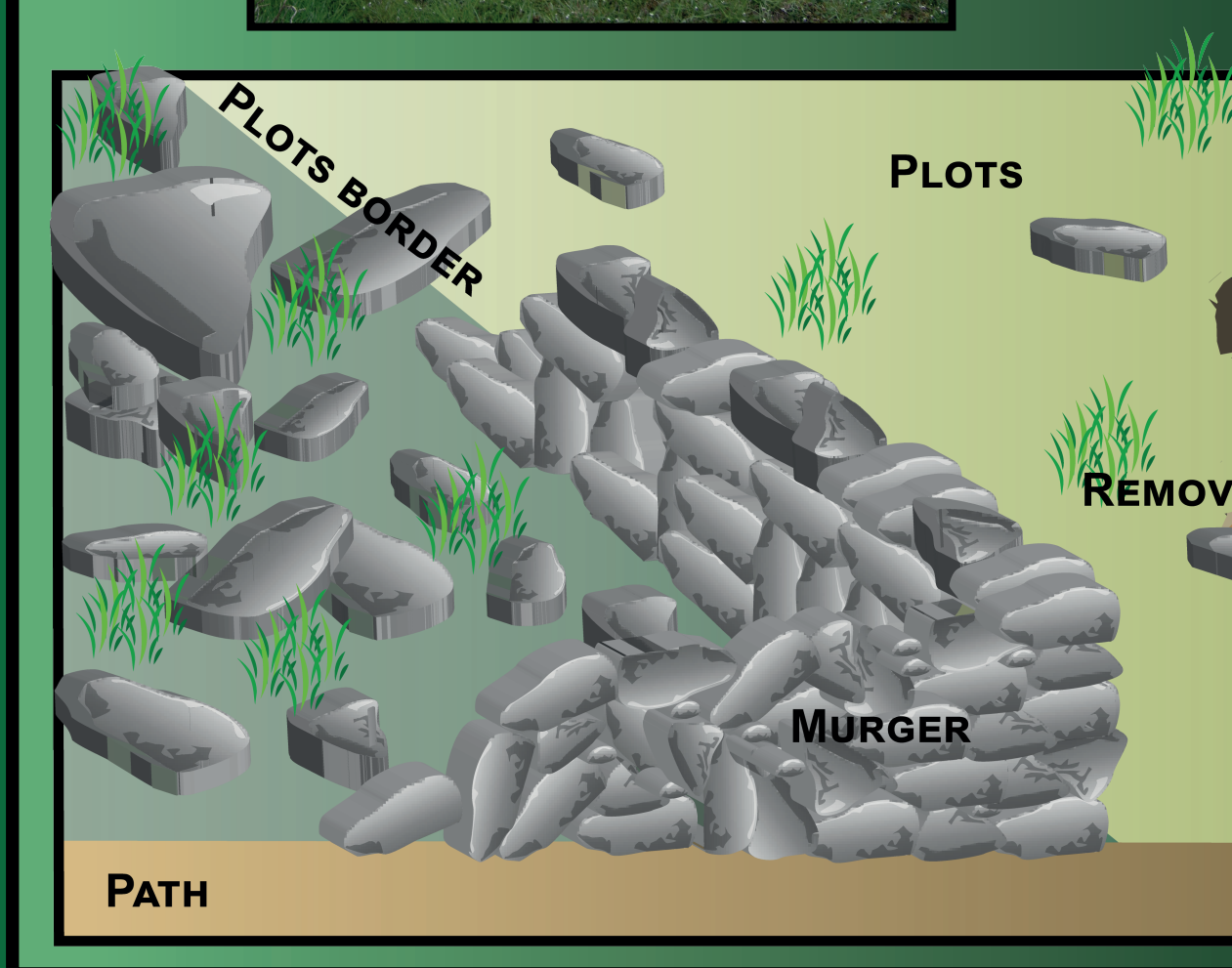
TRENCH ANALYSE
 - Trench profile shows raising of the soil horizon (S). Proof of sediments accumulation behind a hedge. This "bank" is not a voluntary construction like a terrace.
 - In MBW profile there is two S horizon. The S1 horizon is more loamy and probably a colluvic horizon. Moreover, this horizon disappeared below the "bank".



DISCUSSION ABOUT MBWC/D PROFILE
 - *Acer* (1680± 30 BP) could correspond to the first cultivation in this area at the end of the Roman empire, probably due to the Gallo-roman site presence.
 - *Quercus* (1380 ± 30 BP) correspond to probably a new deforestation. A polynic study do to Moselle department shows a landscape dominated by forest (mostly *Quercus*) during the High Middle Ages, nevertheless there is a raising of cereal values almost at the same period [Ruffaldi et al., 2007].
 - *Corylus* (960 ± 30 BP) correspond to an opening of landscape during the central Middle Age, the same study confirm a high anthropisation during the late Middle Age [Ruffaldi et al., 2007].
 - The total Anthracomass (ATM) and species nombre are higher in the S horizon. The species are mostly heliophilous.



Digital Elevation Model (DEM) view of Murger system landscape near Soultzeren (Haut-Rhin).



The "*Murgers*" are the results of removing stones of the plots and stacking stones on the plots border. Removing stones, in order to make the cultivation of the lands possible, is used since antiquity in the middle east. Some of this "walls" can reach 2 meters height. A *murger* can be superimposed on a Lynchet that can indicate two different phases of land use.

DISCUSSION
 In France some of lynchets have been dated during :
 - The Iron Age (2710±200BP) and the High Middle Age (1370±100BP) in Habsheim (Haut-Rhin) by OSL datation [Froehlicher, 2016].
 - The Central Middle Age (around 900 AD) and with a new deforestation during the Renaissance (between 1650 and 1760 AD) in Goldbach and Altenbach (Haut-Rhin) by pedoanthracology study [Schwartz et al., 2017].
 - The Central Middle Age (1120 AD) in Massif Central [Bernard-Allée et Valadas, 1992] Some of this dates correspond of periods determined to MBW allowing a better comprehension of landscapes temporal trajectory in the large scale.
 - Dated more charcoals and on several soil profiles for a better comprehension of the landscape dynamique. Combine other pedological analyses (Near Infrared Spectrometry, micromorphological analyse, organic matter datation...). To study the links between the occurrence of lynchets and the historical development of the territory.

CONCLUSION
 This agrarian landscape are worth to study because there an heritage as a shape structuring the landscape and as paleoenvironmental archives. This allow us to better understand agrarian history and thus human dynamics and their consequences on the temporal trajectories of the Bitchois territory.

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