LEAP

Learning from the past: The impact of abrupt climate changes on society and environment in Belgium

DURATION
1/09/2022 – 1/12/2025

BUDGET
998 036 €

PROJECT DESCRIPTION

Context

Climate change is causing significant impacts on people and the environment worldwide. The effects are also visible in Belgium, such as the recurring heat waves in 2022 or the devastating floods in Wallonia during the summer of 2021. However, this is not the first time we have faced abrupt climate changes. Our ancestors also experienced rapid climate changes with a temperature decrease of 1-2°C. However, due to the short duration of these events (lasting only 100 to 200 years) and the absence of written sources, it is challenging to assess their impact on society and the environment. By improving our understanding of these past events and their effects on ecosystems and human populations at a regional level, we can better address the challenges we face today in Belgium.

General objectives

The overall objective of the LEAP project is to increase societal resilience against climate change through documenting past rapid climate changes (RCCs) with high resolution and assessing the environmental impact and societal responses to these RCCs at a regional level. For this project, three RCCs around 9.3, 4.2 and 3.2 ka cal BP have been selected for which preliminary data suggests an impact on past populations in the territory corresponding to modern-day Belgium. Moreover, these RCCs occurred under environmental boundary conditions similar to those of the present day and are therefore likely to provide analogues for future predictions.

Studying how climate affected the environment and populations in pre- and early-complex societies helps us understand human resilience and addresses current and future climate changes. This includes extreme weather events like droughts, floods and forest fires, as well as population movements and adaptations. The detection and evaluation of the resulting anthropogenic and ecological changes requires a multi-proxy approach with high-precision dating. Our project focuses on documenting and reconstructing (a) past and present regional climate change (palaeoclimate), (b) ecological dynamics (palaeoenvironment), and (c) changes in demography and mobility (palaeomobility) in the Meuse basin (Belgium) during the selected climate shifts.

Methodology

To reach the general aim, we study Belgian cave deposits, peat bogs, and human remains in and around the Belgian Meuse basin.

Figure representing the Belgian contexts investigated in this project: (left) example of speleothems in the Caves of Han, (middle) the peat deposits in the Hautes Fagnes, (right) human remains

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- **Cave deposits for palaeoclimatic data**

We study cave deposits (speleothems) to reconstruct temperature shifts, rainfall, and sedimentation during these abrupt climate changes in Belgium. For this, we perform sedimentological observations, oxygen and carbon stable isotope measurements and trace element analysis, and combine this with U/Th dating. To better visualise the current climate change compared to the past investigated ones in terms of rapidity and intensity of change, we put the past speleothem records in perspective to recent ones of the last 100 years. The investigated speleothems are incorporated in the RBINS speleothem collection.

- **Peat bogs for palaeoenvironmental data**

We investigate peat bogs from the Hautes Fagnes (Eastern Belgium) to determine past vegetation dynamics and wildfires, and to provide information on the resilience of our ecosystem to rapid climate changes. We reconstruct vegetation dynamics based on the analysis of fossil pollen and spores from peat bogs. The analysis of microscopic charcoal fragments from the same peat deposits provides information on the occurrence of wildfires. Possible correlation between vegetation dynamics and climate changes will be based on high-resolution radiocarbon dating.

- **Human remains for palaeomobility and – demography data**

We date and analyse human remains from the Belgian Meuse basin to understand how these past rapid climate changes affected the mobility dynamics and the population density of local communities. We accomplish this by statistical modelling of available and new radiocarbon dates (SCPD, Kernel density analysis) and of raw counts of archaeological sites (settlements and burial contexts) in the Belgian Meuse basin to evaluate past population fluctuations. We also perform isotopic analyses (O, S, and Sr isotopes) on human remains, dated before, during, and after the abrupt climate changes, to trace possible episodes of human mobility or variations in landscape use promoted by climatic deterioration or improvement.

Potential impact and valorisation

Integrating all this data will offer valuable insights into how climate change affected us in the past, and allow us to put today's climate change in historic perspective (speed, magnitude etc.). We will further provide climatologists and policymakers with high-resolution data and knowledge on past climatic changes, along with their environmental and societal impacts. This contributes to the development of accurate regional climate scenarios for the future in Belgium, enhances awareness, and supports informed decision-making for addressing extreme and worsening weather events such as droughts, floods and forest fires.

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LINKS

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