Contribution of airborne LiDAR on the mapping of vulnerability to groundwater pollution
Example of the drinking water catchment of Trépail

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Introduction

Airborne LiDAR is a laser tool that allows the creation of a high resolution DTM of the relief under the forest. Its application concerns archaeology, geomorphology but also hydrogeology.

The objective of this study is to propose a method of mapping vulnerability to pollution adapted to the karst plateau under forest.

The EPIK approach, is created and tested for karstic environment. It's a multi-criteria spatial analysis based on superimposed and weighted indices allowing the zoning of the vulnerability to pollution.

This method is improved here with the lidar approach with the use of the Lidar tool which allows to better constrain each layer of spatial information.

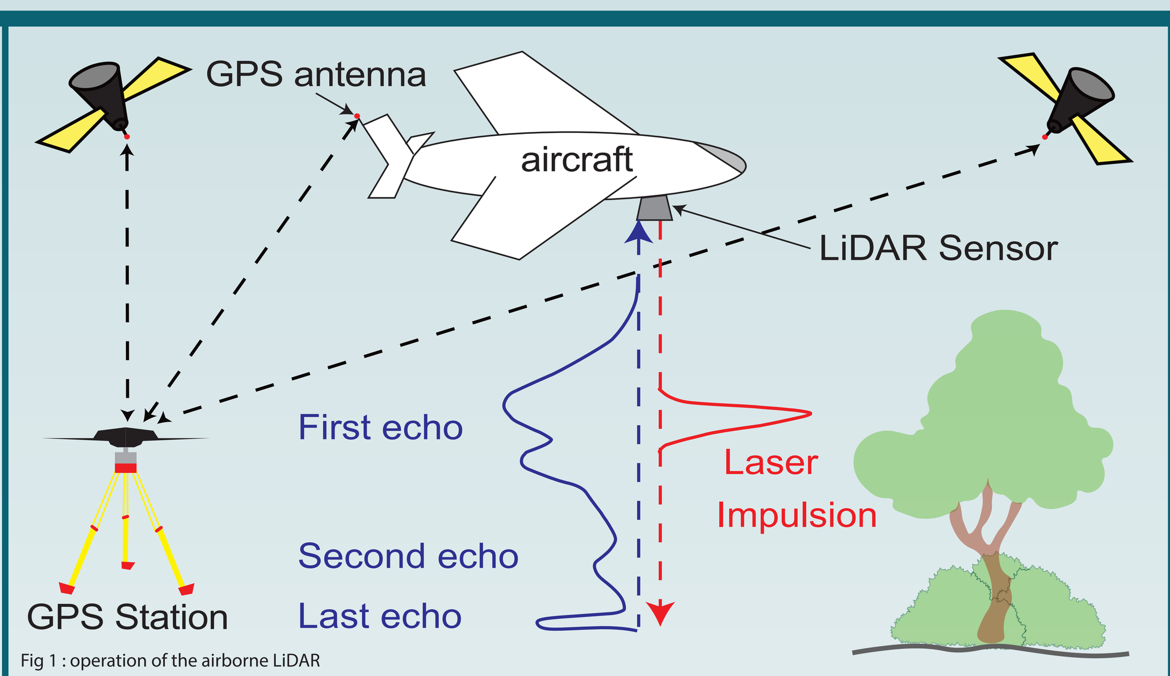


Fig 1 : operation of the airborne LiDAR

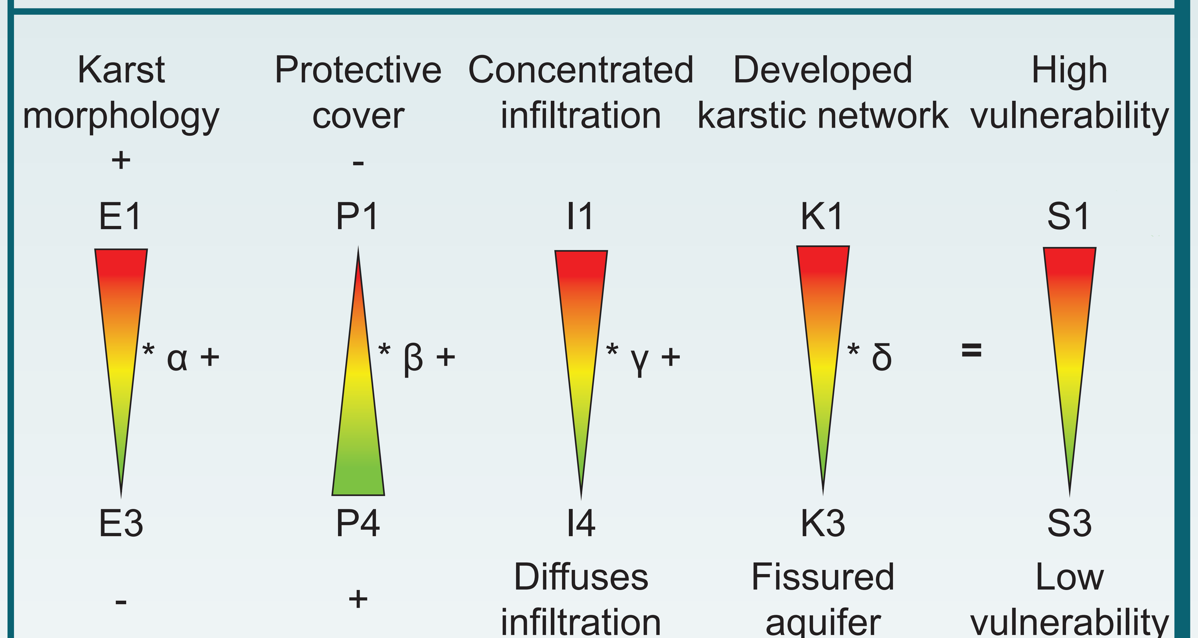


Fig 2 : EPIK method

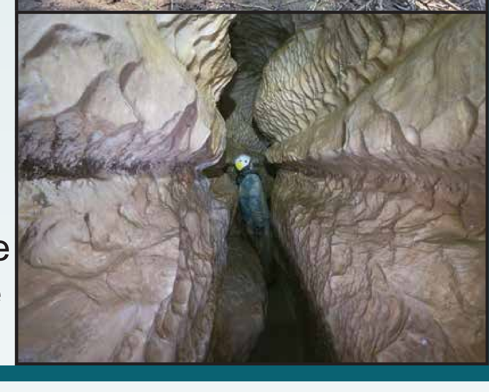
Study area

The spring of Trépail is located in the eastern part of the Montagne de Reims. It emerges on the front of the cuesta of Ile-de-France characterized by the triptic forest, vineyard and culture.

It is a karstic spring captured for the drinking water supply of the village.

De la Nau Sinkhole

Fontaine de Verzy Cave



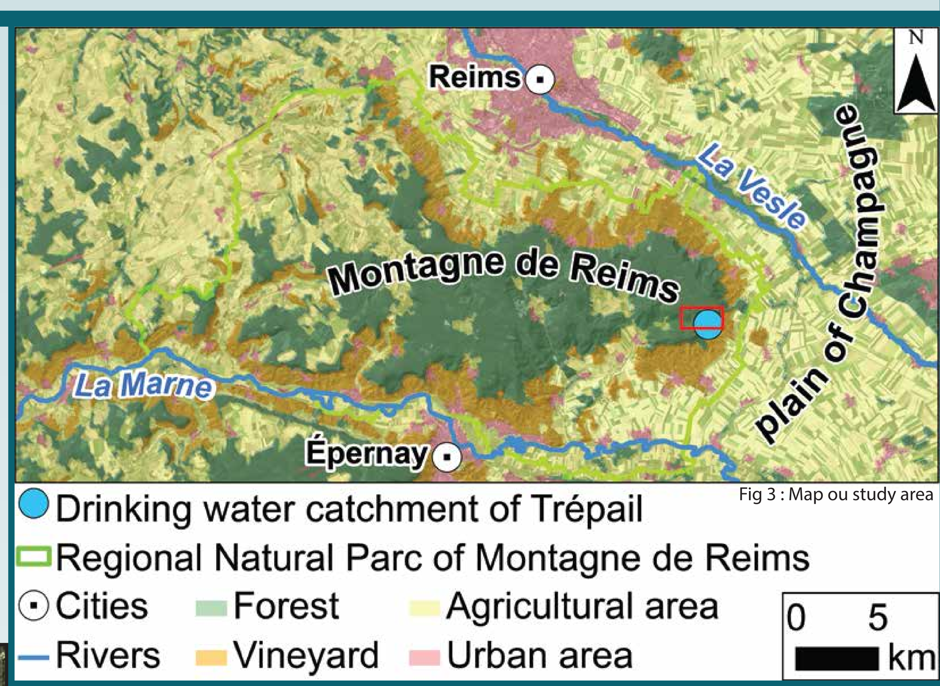


Fig 3 : Map ou study area

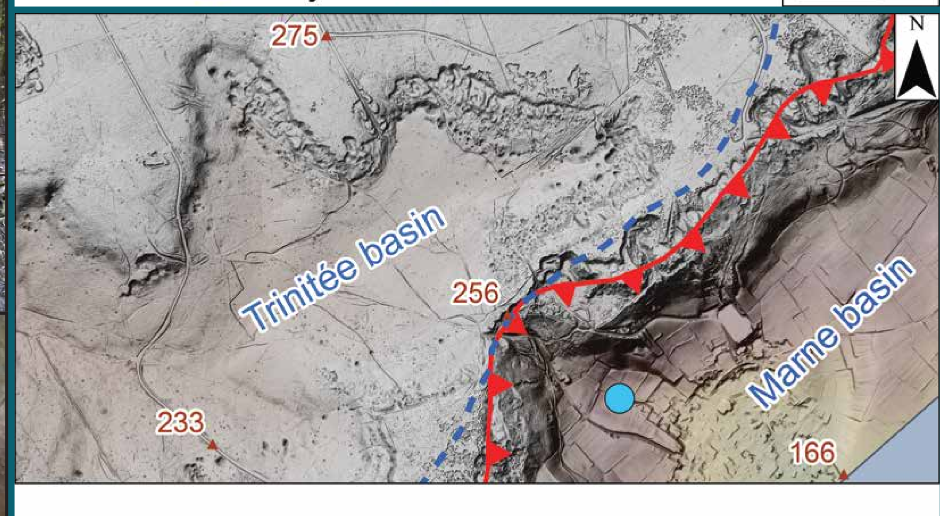


Fig 4 : Geomorphological context of the Trépail spring

Methodology

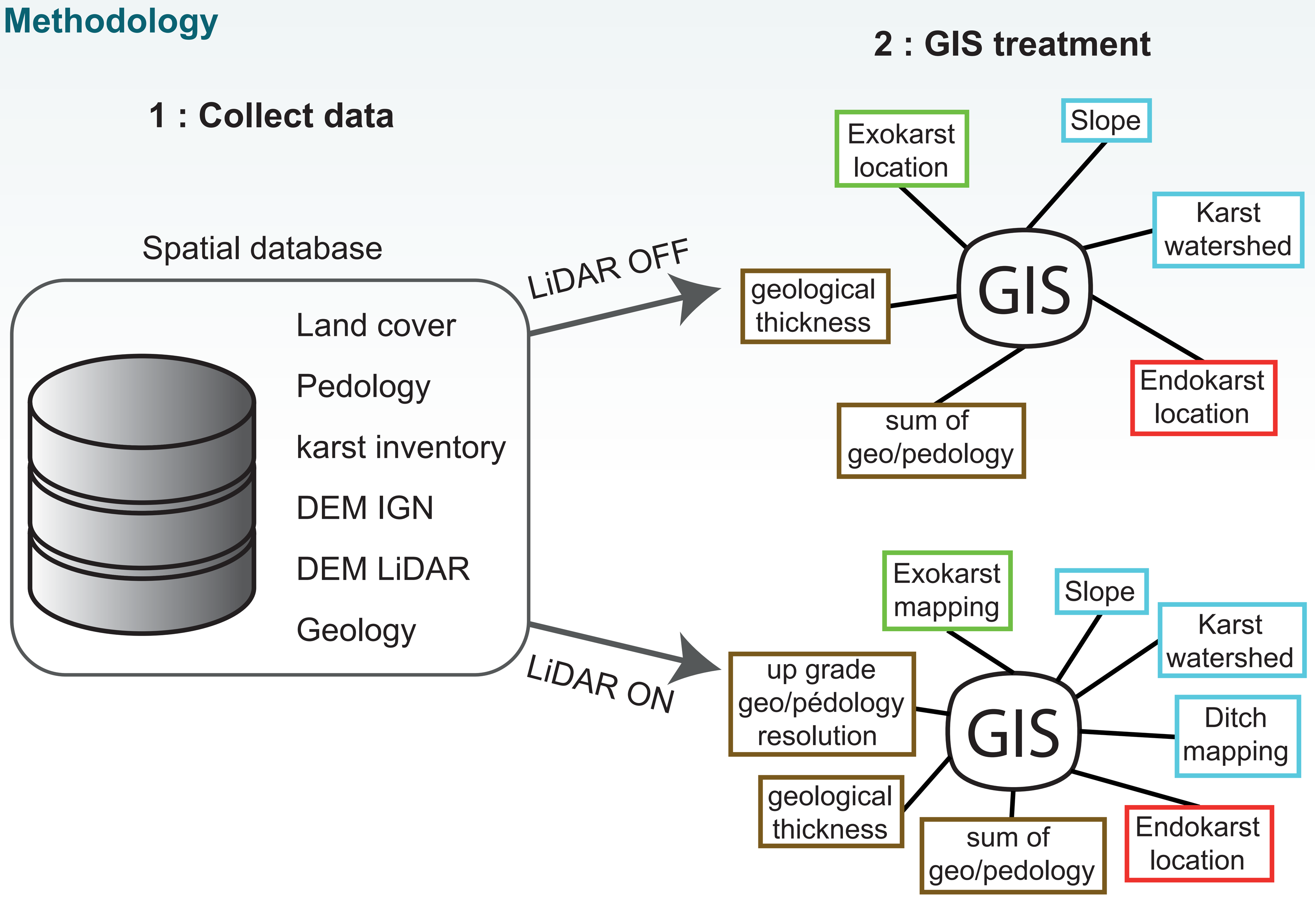
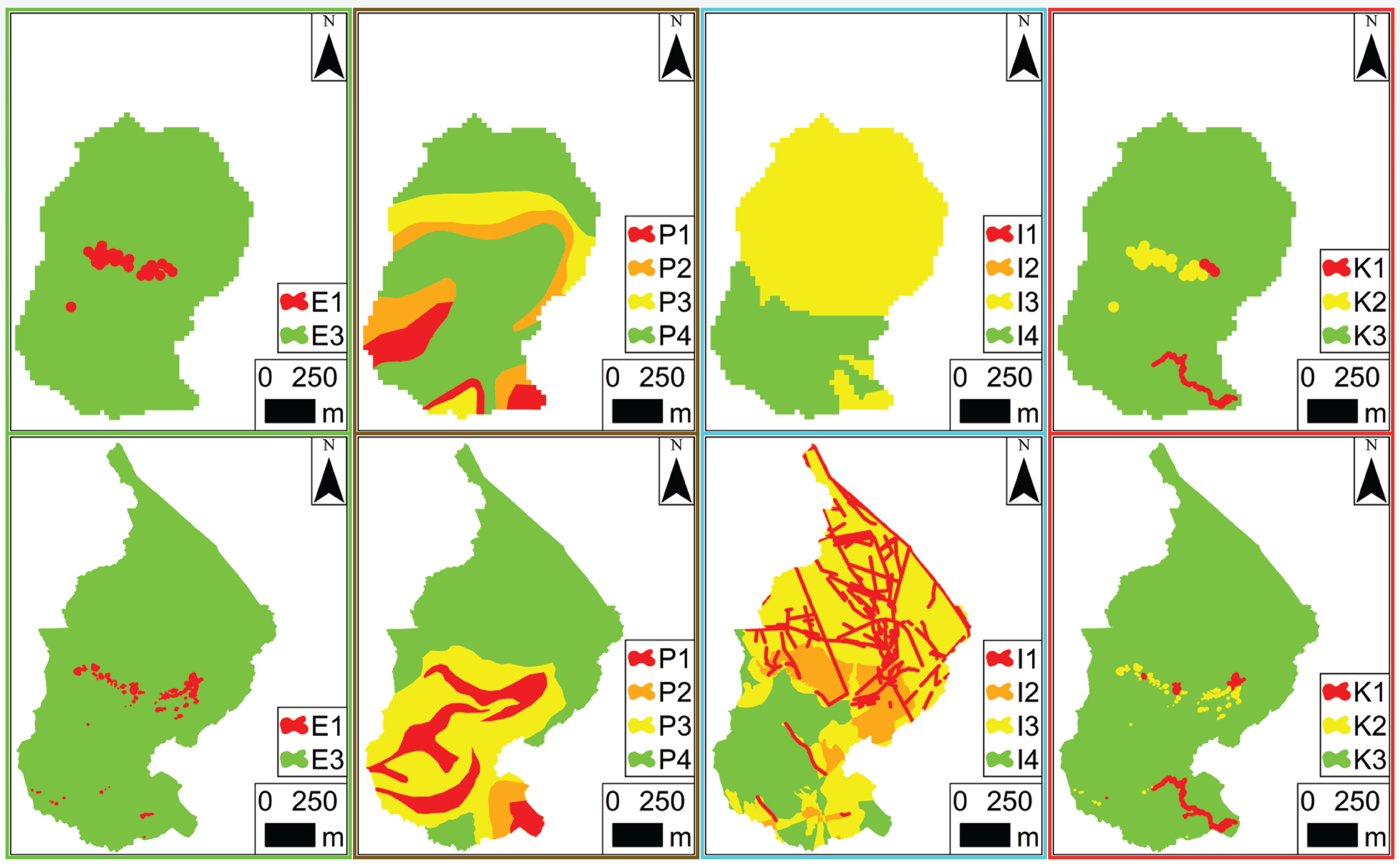


Fig 5 : EPIK methods with and without LiDAR

3 : Production of EPIK parameters



Result

The resolution of vulnerability maps to groundwater pollution is improved by the use of lidar.

It also allows the creation of new layers that would not exist without LiDAR (more spatial information) and to improve the understanding of water flow.

This makes the epik method operational at the cadastral parcel scale, and therefore operational from a regulatory point of view.

Thus, the Lidar allows an approach of the surface of feeding more coherent with the reality of the ground by including the impact of the ditches, by modifying the surface of the AAC and by detecting new zones of vulnerability.

Fig 6 : Mapping of vulnerabitility of water pollution with EPIK method (without LiDAR)

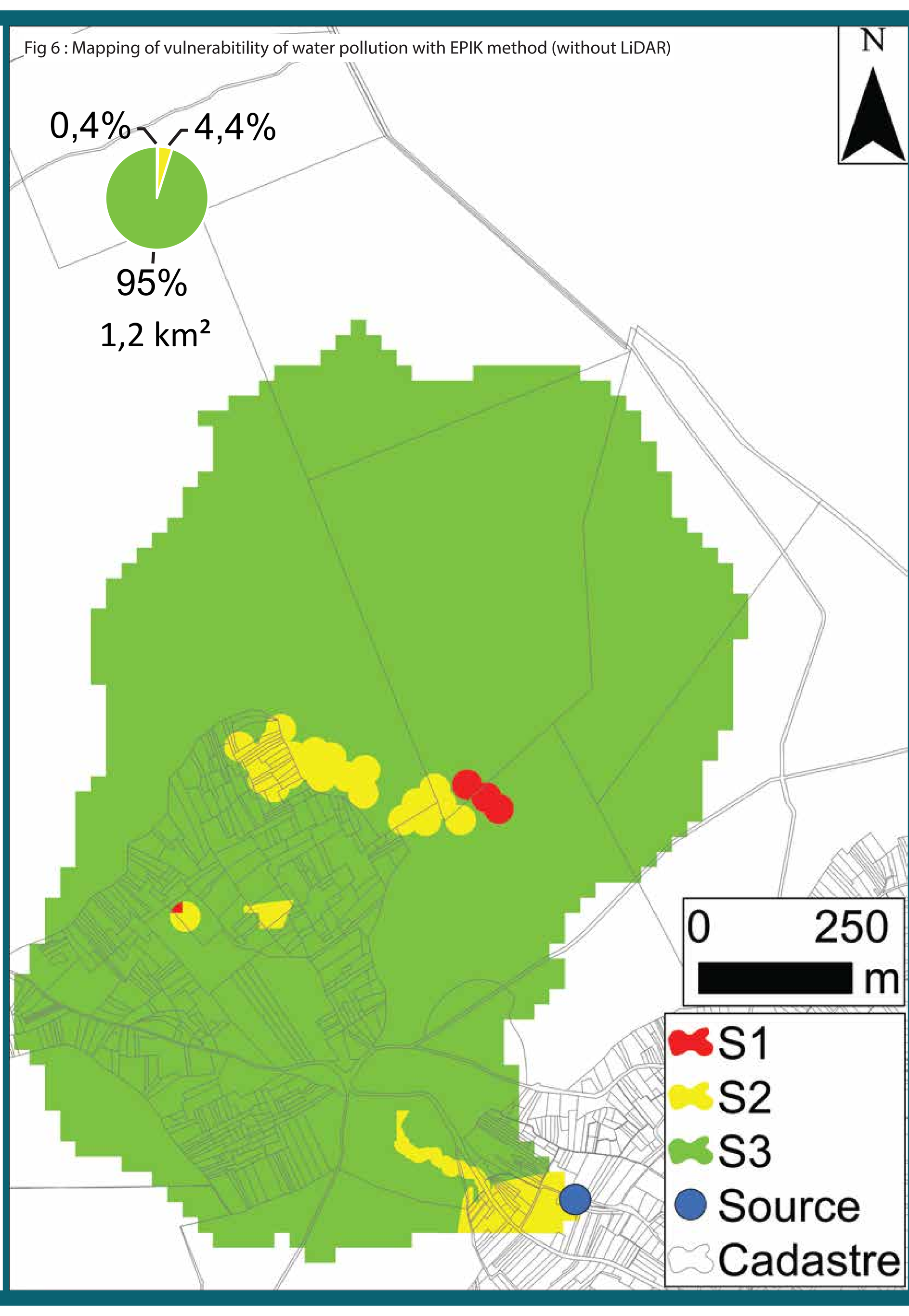


Fig 7 : Mapping of vulnerabitility of water pollution with EPIK method (with LiDAR)

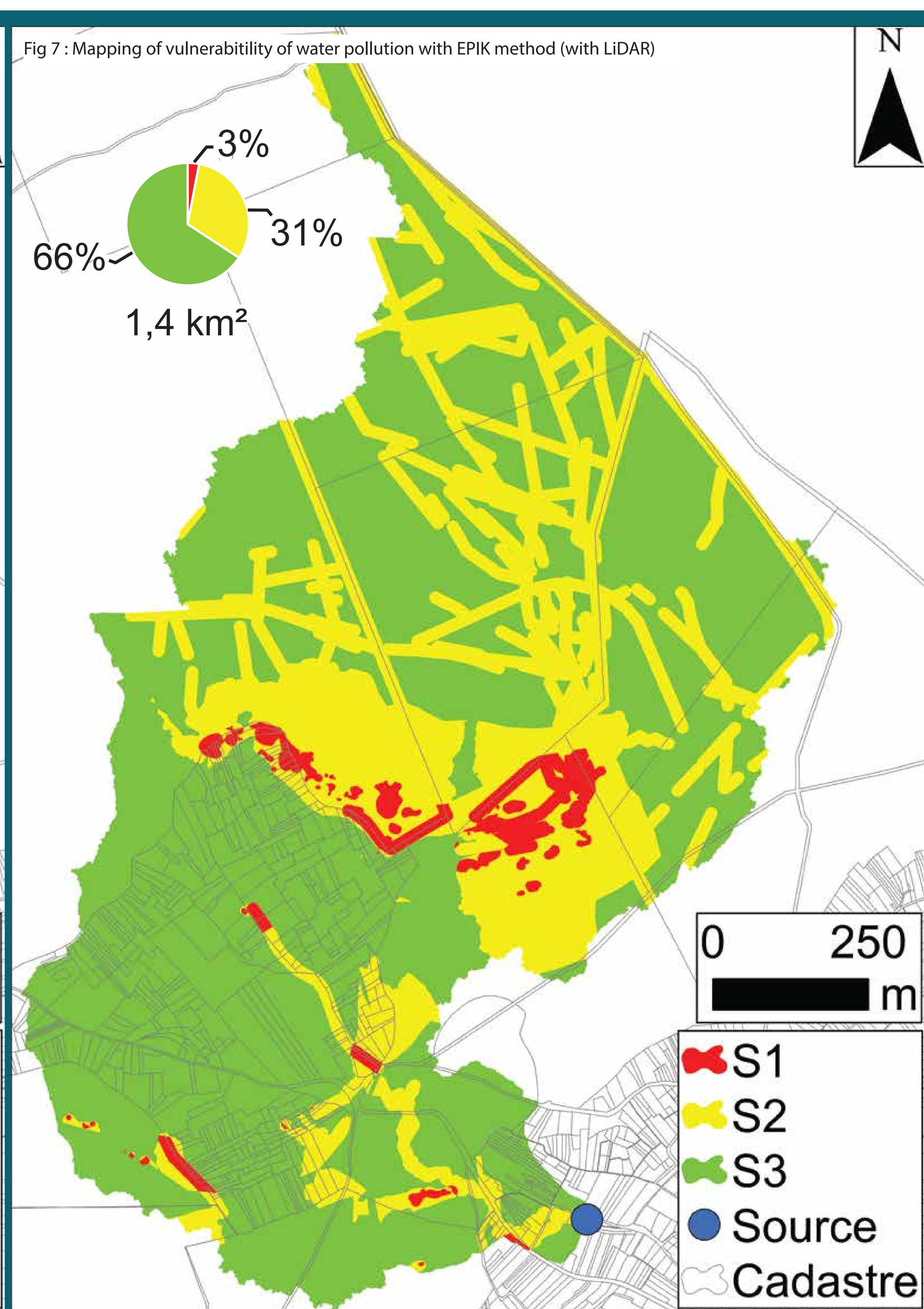
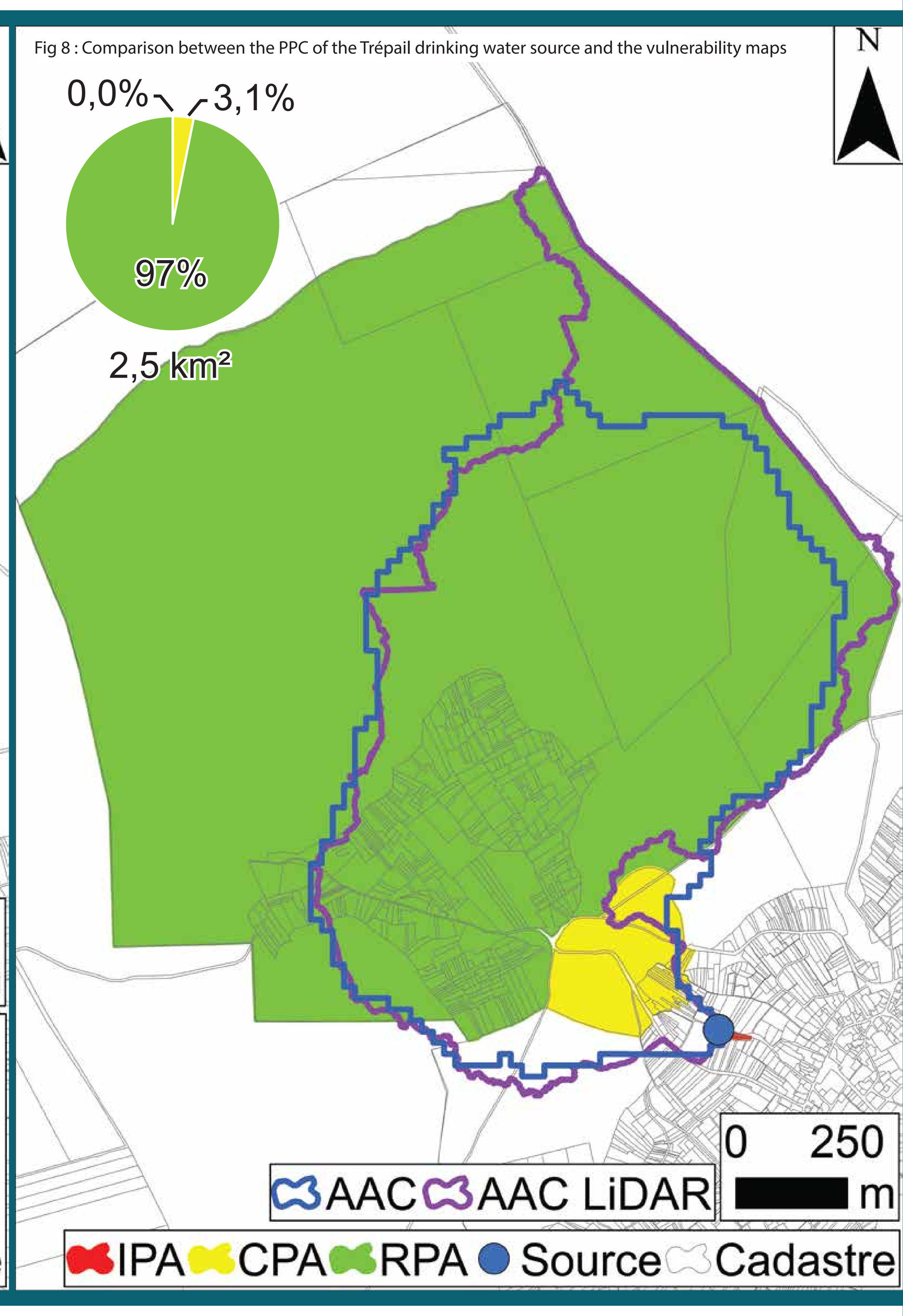


Fig 8 : Comparison between the PPC of the Trépail drinking water source and the vulnerability maps



Conclusion

The LiDAR data allowed to map a karstic border located on the slopes of the Montagne de Reims within the topographic watershed but also in the adjacent watersheds (hydrographic capture). Moreover, the LiDAR resolution allows to propose a vulnerability mapping at the parcel scale. As such, it can be applied to land development projects to achieve zero pollution in water.

Finally, the topographic survey by airborne LiDAR carried out by IGN, at the scale of France, whose data will be publicly available in 2026, seems to be of great interest for the creation and updating of PPCs and AACs, especially in karstic contexts.

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