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## Enhancing the detection of buried anthropogenic features through a cloud-computing Python procedure

Filippo Brandolini<sup>1</sup>, Guillem Domingo-Ribas<sup>1</sup>, Andrea Zerboni<sup>2</sup>, and Sam Turner<sup>1</sup>

<sup>1</sup>Newcastle University, School of History, Classics and Archaeology, McCord Centre for Landscape, Newcastle upon Tyne, United Kingdom of Great Britain – England, Scotland, Wales ([filippo.brandolini@newcastle.ac.uk](mailto:filippo.brandolini@newcastle.ac.uk))

<sup>2</sup>Università degli Studi di Milano - Dipartimento di Scienze della Terra "A. Desio", Via L. Mangiagalli 34, I-20133 Milano, Italy

The necessity of sustainable development for landscapes has emerged as an important theme in recent decades. Moreover, past landscape reconstruction enables a better understanding of human resilience to climatic and environmental changes in different periods and locations, and illustrates examples of sustainable development in the past. Free and open-source (FOSS) datasets of satellite imagery offer considerable opportunities for landscape heritage stakeholders both for recording and monitoring activities. In this research, a completely FOSS-cloud procedure to enhance the detection of palaeo-landscape features is presented. Sentinel - 2 satellite imagery has been retrieved in the Google Earth Engine dataset collection and analysed through a Python script code realized in Google Colaboratory. A multi-temporal approach has been adopted to investigate the potential of satellite imagery to detect buried features along with Spectral Index (i.e., RGB, False Short Wave Infrared Colour and Bare Soil Index) and Spectral Decomposition analysis (i.e., Hue, Saturation and Value, Tasselled Cap Transformation and Principal Component Analysis). This procedure has been tested in the Po Plain (Northern Italy), chosen because it is characterized by human-landscape interaction since the Mid-Holocene. Thanks to its complex settlement and land-management history, the Po Plain represents an ideal laboratory to assess the potentiality of satellite imagery to enhance riverscapes' palaeo-features. The outputs obtained can be visualized directly in the Google Colaboratory browser or downloaded via Google Drive for further graphical applications or spatial analysis. The buried features detected have been checked through the available geomorphological and archaeological literature; published case studies interpreting the occurrence of buried features served as a benchmark to validate the script code developed. This research represents one of the first applications of the GEE Python API in landscape studies. The main advantages of this procedure consist of: i) being FOSS, all the software used here are open-licensed; ii) working in cloud, no powerful hardware is necessary to run the script code; iii) high adaptability, changing the ROI is possible to calculate SI and SD outputs for any area of the world; iv) very basic coding skills are required to adapt the code to a ROI with different environmental characteristics. The development of FOSS-cloud procedures could support the identification, conservation and management of cultural and natural heritage anywhere around the world. In remote areas or where local heritage is threatened as a result of political instability, climate change or other factors, FOSS-cloud protocols can facilitate the application of new scientific methods and enable the dissemination of and access to scientific information.

