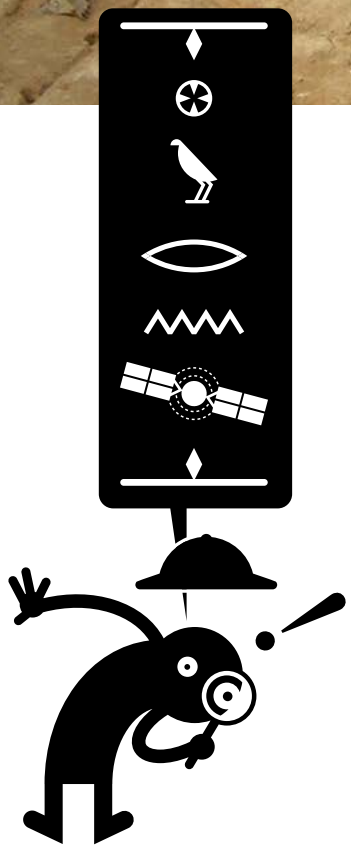
SEEING THE PAST THANKS TO TECHNIQUES OF THE FUTURE



Seldom used in the domain of archaeology up until now, remote sensing is not only poised as an interesting technique to find out more about sites and therefore better preserve them, but also as a means to discover remains from the past undetected through more traditional methods.

While agricultural management and land planning have already assimilated the use of remote sensing into their practices, it is a more recent approach in the domain of archaeology. Traditionally, information gathering is essentially based on countless surveys, patiently and laboriously carried out, with the help of maps and aerial photos which provide an overview. But now, satellite instruments offer spatial and spectral resolutions that are continuously improving. Research teams are therefore endeavouring to explore the added value they could offer through precision, speed and the extent of their observations.

THREATENED PYRAMIDS

The APLADYN project focuses on the Nile valley and the pyramids of Giza, the archaeological site par excellence. Just like other large fluvial systems, the Nile is the axis of a mythical fertile valley, which was the cradle for the emergence and expansion of three thousand years of Egyptian civilisation. For the researcher, as for ordinary mortals, the cultural and natural heritage it harbours is priceless. A better understanding of the sites' dynamics, and the links woven between man and his environment, certainly provides the keys to studying the past. For instance, by determining where the old channels and the river bed passed, we can more accurately pinpoint the areas probably occupied by humans in ancient times.

Detailed observation of the landscape also provides the keys to the future, by defining the threats that weigh on these unique sites. New methods integrating remote sensing data have not only revealed the rapid growth of urbanisation in Cairo, but also the migration of the sand dunes which are advancing at an average of four metres a year. By comparing the Landsat images of the past 40 years, the scientific team has shown that this clear progression of the dunes still doesn't compensate for the continued expansion of farmland in the fertile plain into the desert. Remote sensing has therefore helped to quantify both the risk of the formation of sand dunes and anthropic pressure. Thanks to the methods developed, it is now possible to

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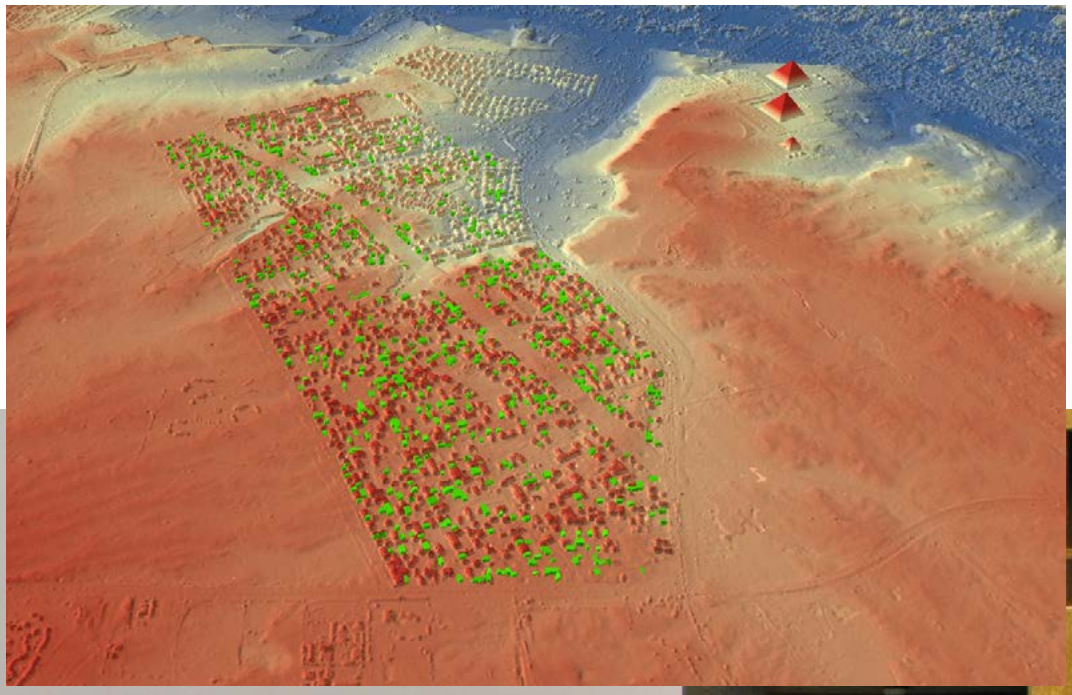
estimate the progression of these phenomena by extrapolating future changes based on past evolutions. Such models are essential for local managers so that they can take the necessary protective measures.

THE HUNT FOR ARCHAEOLOGICAL TREASURE

Automatically identifying an area with a high archaeological potential, anywhere in the world, is, of course, one of the researchers' objectives. Human activity in the distant past has left traces in the composition of the soil, and this can be conveyed through modifications in the plant cover. Succeeding in characterising these traces is an exciting challenge, explored by the ANAGHLIA project.

Since archaeological wealth is closely linked to the contours of the landscape, it is important to obtain a detailed topography of the site being studied. This is why researchers integrate the LiDAR data into their methods: this airborne active system sweeps surfaces with its laser signal, even through clouds or vegetation. The return signal is intercepted and provides information on the position and altitude of thousands of points of contact on the ground, thus providing the (micro)topographical context necessary for the analysis and interpretation of the spectral signals.

Furthermore, the considerable amount of information provided by the hyperspectral data helps to reveal some of the ground's geophysical



A digital elevation model can be created by comparing two sets of high resolution stereoscopic images, clearly showing and quantifying the degradation of the Gizeh plateau by new housing developments.
The buildings erected between 2009 and 2011 in the area called "Pyramid Gardens" (Hada`iq al-Ahram), located southwest of the archaeological site, appear in green.

properties indicating that the site was probably occupied in the past: the presence of charcoal particles, tiny fragments of terracotta or an unusually high quantity of organic matter are just some of the elements sought after. By combining the two sources of information in an innovative manner, the researchers better understand how existing remains are distributed on the surface, and how elements of the landscape can expose them or, on the contrary, hide them.

For the Anaghlia project, two contrasting study areas were chosen. One of them is the watershed of the Raganello river in Calabria, where more than 150 archaeological sites were discovered, dating mainly from the Bronze Age and Hellenistic periods.

THE DRONE: FLEXIBLE, FAST AND INEXPENSIVE

Another technological contribution, that can help to validate these results with field measurements that isn't too time consuming, is the UAV *(Unmanned Aerial Vehicle)*, which is turning out to be very useful. Better known as a drone, this remote-controlled machine takes a video or stills camera on board. It is easy to programme the parameters to be recorded as well as the course changes. The fact that it is easy to programme, easy to handle and relative inexpensive, explains the recent success of the drone. Nowadays it is no longer rare for academic research centres or private organisations to acquire their own observation drone.