



Tunisia: Detecting change with remote sensing

Roads, afforested areas and buildings funded by IFAD projects can be seen from space. By knowing a location's coordinates, satellite imagery can be used to monitor changes that have taken place.

The IFAD-funded [Agropastoral Value Chains Project in the Governorate of Médenine](#), Tunisia, constructed over 140 km of road which are easily detectable on satellite imagery. Whereas visiting these roads in person would have taken two days, checking their entire length in Google Earth took only a few hours.

Other sites that the project has invested in, such as dams and greenhouses are also visible (see images below). High and very high resolution imagery makes it possible to track progress as roads, buildings, bridges, irrigation schemes, reforestation and other types of investments advance.

Using earth observation to detect changes is a cost-effective option to monitor large areas and multiple sites. It cannot replace field visits or engaging with beneficiaries, but it is especially useful to track, monitor and evaluate the impact of activities in areas that are remote or not accessible, for example, due to conflict.



Photos of a greenhouse built by the project in the municipality of Beni Khedache, taken on location (left, © PRODEFIL) and by satellite (right, © Maxar Technologies)

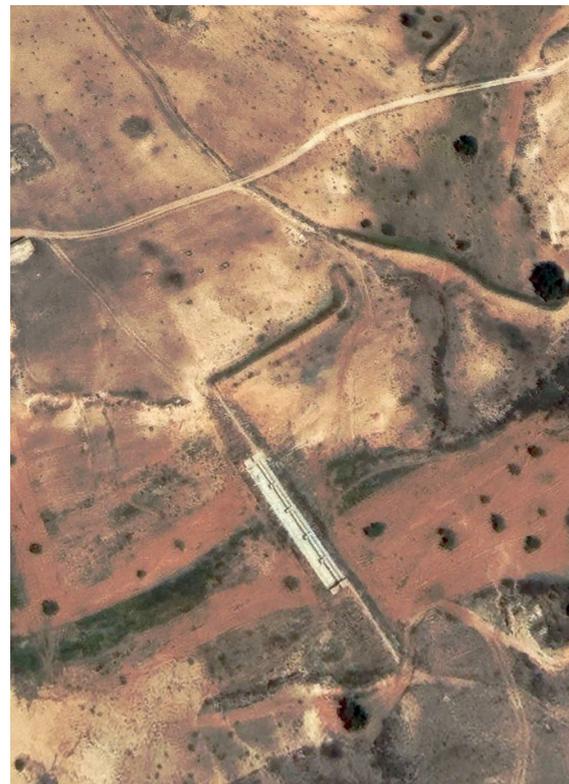
Mapping investment sites is essential

To do this, GPS data must be collected from the investment sites. Without knowing the exact location, analysts cannot know where to look for change or may detect change that is not due to the project.

Location-specific data should preferably be captured using GPS and saved in “shapefile” format. Shapefiles come in three different flavours: polygons capture areas

(e.g. irrigated farmland); polylines indicate transects (e.g. roads), and points, which are single locations that have latitude and longitude coordinates (e.g. a warehouse). While geo-data can also be captured using a smartphone or tablet, specialized GPS devices should be used when there is a need to provide better accuracy for analysis. The type of investment and when the activity was undertaken should also be recorded, to facilitate analysis.

Over 60 IFAD-funded projects already collect GIS data of their activities to varying degrees - for example, engineering contractors take GIS measurements during the design of infrastructure. Efforts should be undertaken by IFAD to systematically collect these data, to facilitate remote monitoring and evaluation.



Photos of a dam for groundwater recharge built by the project in the municipality of Beni Khedache, taken on location (left, © PRODEFIL) and by satellite (right, © Maxar Technologies)

Plotting investment sites against satellite imagery

Once a location has been geo-referenced, its coordinates can be used to locate it on satellite imagery. Quick and simple analysis (as done with the roads analysis of this case study) can be done with free and user-friendly tools such as [Google Earth](#) or [Global Forest Watch](#) that give access to a small set of high-resolution imagery.

More sophisticated analysis requires GIS and earth observation expertise, to know where to find suitable imagery and how to process it. Analysts can use programmes such as QGIS, ArcGIS, ERDAS, Google Earth Engine, R or Python for advanced data processing. Satellite imagery providers often have one or several portals where data can be downloaded or where cloud computing can be facilitated.

These data can be free or paid for - the former being usually medium or high resolution (down to 10 metres at its most accurate), and the latter very high resolution (as small as 30 cm). The resolution for free data is usually less accurate the farther back in time it is available for (250 m in 2002).

IFAD can use these data to monitor changes in the landscape - including infrastructure development, such as in this case - but also identify historical trends in an area, map ground elevations (for flood and landslide prevention or rainwater collection), and record land ownership. Depending on the type and scope, this can be done by IFAD or paid service providers. Within the United Nations, the World Food Programme's [Asset Impact Monitoring from Space](#) (AIMS) service uses satellite imagery and landscape



Photos of a water cistern being built by the project in the municipality of Beni Khedache, taken on location (left, © PRODEFIL) and by satellite (right, © Maxar Technologies)

monitoring techniques to evaluate activities of its projects dealing for example with infrastructure development and landscape restoration, and this methodology was applied here.

Earth observation has its limitations. Satellite imagery data is limited over areas with persistent cloud cover. Certain activities may be too small or subtle to be detected (e.g. a rehabilitation of a bridge). High-resolution imagery comes at a cost. But the combination of GPS location information and satellite imagery offers project planners, managers and evaluators a powerful tool to improve the effectiveness of development investments.

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