

Pushing the Right Buttons

One of the greatest problems facing mankind today is fulfilling the basic needs of an uncontrollably expanding world population without causing irreversible degradation to the environment. All over the world machines support increasingly intense agricultural activity. An abundant supply of cheap fossil fuel keeps these machines on soil track. The result is a devaluation of human muscular strength shoving the majority of rural populations - especially those living in developing countries - into poverty. Many try to escape desperate straits by grasping at some small straw of prosperity in the cities; they move to peripheral suburbs and become packed together in accommodation constructed from the waste of the wealthy.

Proper Interpretation

Indeed, recent history has demonstrated an explosive migration of people to urban areas. Today half of the Earth's population lives over three billion people lives in urban conglomerates. What was a city three decades ago has now turned into a metropolis, and metropolises have turned into megalopolises. Since this process is still in acceleration, the current 1% of land area covered by cities will expand rapidly and organically to encroach on agricultural zones and natural ecosystems. Poor housing, lack of potable water, depletion of vegetation cover, soil erosion, transportation congestion, storm water run-off problems and pollution of air, soil and water; all of these are the result. Arriving at solutions may yet have a chance if sufficient detailed, accurate and up-to-date geo-information is available. However, availability is not enough; to be of any value geo-information has to be processed and interpreted by knowledgeable and skilled professionals.

Proper Cascade of Approaches

Any information extraction process requires that knowledge be available about the road leading from initial data to the requested information. Within the framework of earth observation from space, this road is often only vaguely known. Suppose that, for planning purposes, some urbanised local government administration aims at arriving at insight into the population density of an informal settlement. There are many roads along which this information can be derived from the variety of geo-data that may already be in the administrator's office or can be quickly and easily acquired within the framework of a well-functioning geo-spatial data infrastructure. How to choose the right road? One of the main criteria is that the chosen route should be a short one, involving the minimum of human effort. Another alternative is to go the satellite imagery way. Of course, it will be impossible to count people individually from satellite imagery. But by using an indirect measure of the number of dwellings, or more generally housing density, it may be possible to estimate a figure that makes sense. However, and in turn, housing density is very hard to measure in a direct way. Searching for an indirect measure, one finds that the sealed surface, the aggregation of all types of buildings, roads, parking places and so on can be used. So that by following a cascade of indirect approaches an estimate of the requested information may be arrived at.

Proper Spatial Subtraction

Another example demonstrating the complexity of information extraction from satellite imagery is determination of size of informal settlements within and at the fringe of an urban conglomerate. Outlining informal settlements would seem at first glance quite simple. Recent, high-resolution satellite images covering the entire urban area are ordered and delivered within 36 hours. Delineation of the built-up area is determined by heads-up digitisation. Next, the boundaries of the legally built-up areas are taken from the digital master plan. By carrying out an overlay operation, in particular cutting out the legally built-up areas from the digitised built-up area, the illegally occupied areas are isolated. It is merely a matter of spatial subtraction. However, in practice things are never this simple. In many countries the difficulties manifest themselves not at the level of GIS functionality but at that of data availability. Many local administration authorities are not so well organised that such seemingly simple information as the city master plan is available from a computer hard disk within a reasonable amount of time and in the right format. And when it is available, the information might reside under the auspices of a different department, or a director who is not your friend, and thus ages might pass before information delivery is mandated, let alone materialised.

A steady increase in the spatial and temporal resolution of sensors, in conjunction with rapid progress in computing power and software tools seems to be bringing satellite imagery to the desktop of any civil servant involved in planning, monitoring, construction or maintenance of the built-environment. However, the presence of data does not necessarily mean that information requested will be on your desk within 24 hours. The inroad from satellite imagery to available useful information is long and paved with complexity and uncertainty.

All the gigantic number of terabytes of satellite imagery in the world is of no help in solving problems induced by massive migration of people from rural areas to the urban fringes so long as these terabytes fail to reach the hands of knowledgeable and skilled professionals. And with "knowledgeable and skilled" is meant not "knowing how to push the button" but thorough understanding of all the facets of the technology and, by far most vital, knowing how to focus all available resources: human, technological, monetary and so on.