

DIGITAL DEVELOPMENT DEBATES

Managing competition, monitoring natural resources: the role of Earth Observation technology

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Environmental change is a major challenge worldwide, putting into question people's stable access to food, water and energy. While many communities are already affected by existing changes to their natural environment, climate change impacts may mean that greater numbers of people suffer the adverse effects of environmental change in future.

Vulnerable people particularly rely on access to land for their subsistence, to produce their food and assure their survival, but there are multiple pressures on land; for example, tourism, mining, and growing bio-fuels are activities which may clash with existing uses of land. Governance over natural resources means dealing with these multiple pressures as well as moderating competing claims by different actors. It is now widely recognized that economic and governance conditions can improve or hinder communities in adapting to changes in their environment. There is therefore a need for updated, reliable information on environmental changes and impacts in specific locations, in order to support decision-making.

Enabling quick analysis of potential conflicts

Geo-referenced data on both location of natural resources and evolution of exploitation of natural resources is of great interest for policymakers and social scientists. Earth observation products and tools to monitor changes both in the natural and built environment have been used to support policymakers in environmental and security domains. Typical uses are in assessment of deforestation, soil erosion, or agricultural production.

Technological tools such as geographical information systems (GIS), using satellite images, maps and models, are widely used for monitoring natural resources. These technologies can help to support policy aims in environmental and natural resource governance. Spatial decision systems, based on GIS and simulation modules take into consideration, geo-spatial, and socio-economic information in order to form a comprehensive view of the current or future evolution of the situation. Such a system should enable a decision maker to quickly analyse a potential conflict situation.

In the G-Mosaic Project, for example, research is being done into natural resource exploitation, population pressure and land degradation which can affect food security and potentially become grounds for inter-communal competition. G-Mosaic, or (GMES services for Management of Operations, Situation Awareness and Intelligence for regional Crises) is a project currently funded by the European Commission's seventh framework programme for research. It is one of a series of European Earth monitoring projects which provide information on the state of the earth's environment as part of the GMES (Global Monitoring of Environmental Services) Programme. The organisations in the GMES programme monitor land, oceans, atmosphere, atmosphere and climate change, in some cases to support emergency response and security. They provide updated, independent information to crisis managers in emergency response (e.g. in case of natural disasters, technological accidents or humanitarian crises) and on security-related issues (e.g. maritime surveillance, border control).

From Space via maps and SMS to the affected communities

To give an example, in case of a crisis, such as a flood, the size of the population that will be affected can be measured and mapped using information about the location and extent of the flooding, and other information about the number of people living in the area. This information can then be quickly provided to emergency response services in the form of maps, reports or SMS and telephone warnings. In a country affected by civil disorder or conflict, depending on available information, updated maps and reports can also be produced, informing about the state of the communities affected.

One activity in G-Mosaic has focused on combining information from satellite images with information on the social and political situation of two African countries in particular, with the broader aim of developing crisis early warning information. The countries in question are Zimbabwe and the Democratic Republic of Congo, which, for different reasons, have both been the subject of international concern.

In Zimbabwe over the last decade rural areas have been dramatically transformed by new political drivers. Decisions about land redistribution have been taken at national level; the consequences for social, economic and environmental sustainability at local level are not yet clear. International development partners, investors, NGOs and civil society organizations continue to debate the impacts of land redistribution on food production and on the stability of the society as a whole.

The mineral resources of the Democratic Republic of Congo (DRC) have been the object of contention since the 19th century. Most known deposits of strategic mineral resources are found in the East and South of the country and in Eastern DRC, mineral deposits continue to change hands between different armed movements.

Researchers from Germany, Italy, Austria, France, the Czech Republic and Poland have combined information from satellite images with conflict and population data to give an updated view of how changes in the environment might affect the population in particular areas of Zimbabwe, and the DRC.

Combining satellite pictures with information on peace and conflict

The satellite images show the extent and type of environmental changes, or changes to natural resources such as land or sites of mineral extraction. Several independent civil society organisations provide information about actual conflicts (for instance on battles, and other violent events, but also on positive happenings such as peace talks). For instance: the International Peace Information Service (IPIS), the Centre for the Study of Civil War, Peace Research Institute of Oslo (CSCW, PRIO) and FAST: the now defunct early warning project of swisspeace (the Swiss Peace Foundation).

Part of the research has been to compare carefully these different sources of information on conflicts. The information on environmental changes is then analysed along with information on location and size of population, location of natural resources, mine locations and the transport network. The maps and reports that result show potential areas of depletion of natural resources, such as minerals, or forests in conflict areas. The maps also show where conflicts have occurred in the past, highlighting patterns of conflict occurrence and re-occurrence in particular locations. Innovative solutions for sustainable management of the environment are always greatly needed, but to be useful, this information needs to be timely, accurate and easily understandable.

The results described in this paper, have been presented and discussed with several field organisations active in Zimbabwe and in the DRC, but further research and more field studies would be needed, to see if such an approach is useful for other countries and other environmental contexts.