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Report

Current policy issues in remote sensing: report by the International Policy Advisory Committee of ISPRS

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Abstract

The role of remote sensing in promoting sustainable development, its general benefits and easing access to remotely sensed images, especially for developing countries, have all been examined by the International Policy Advisory Committee of the ISPRS in 2003. This report, a slightly revised version of an article that appears in the September 2003 issue of the ISPRS's *Highlights* magazine, presents the committee's findings and recommendations.

1. Introduction

The International Society for Photogrammetry and Remote Sensing[1] (ISPRS) established an International Policy Advisory Committee (IPAC) some years ago to advise the Council of ISPRS on important policy issues that affect it and its members.

During 2003 the International Policy Advisory Committee[2] has been examining several remote sensing policy issues, in particular sustainable development, the benefits of remote sensing and access to remote sensing data. This article presents the reports from IPAC on these three issues as a means of interacting with a wider audience. Comments on the issues raised here are invited to *Space Policy* as letters to the editor or direct to the author.

2. Sustainable development

2.1. Indicators and their limitations

While there has been some examination of using indicators to measure sustainable development, the role of remote sensing so far may be only partial. A pure remote sensing approach, which just measures geophysical parameters, probably cannot capture the full information required, and there needs to be an interaction or fusing between the physical sciences and the social and political sciences. Remote sensing has been used to measure indirectly some social science variables, for example population and Gross Domestic Product (GDP) estimated using the DMSP city lights data set.

A good example of a focus for sustainable development that combines geoscience and social science is water availability, particularly drinking water availability. This subject contributes to the main UN conventions related to sustainability, namely those on climate change and on combating desertification.

The perspectives of different nations do have a bearing on the potential of remote sensing data for sustainable development. The concerns of the less developed countries are often more practical than those of Western nations, and the practical contributions of remote sensing data should be emphasised.

2.2. Access to data

Access to remote sensing and related geographical data remains a difficulty, particularly for the less developed countries. In many countries there are restrictions on access to remote sensing data of high spatial resolution and to map data of a useful spatial scale. For example, in some countries the national

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[1] http://www.isprs.org/.

[2] The members of the International Policy Advisory Committee in early 2003 were: Ade Abiodun, Nigeria; Raul Colomb, Argentina; Joanne Gabrynowicz, USA; Ray Harris, UK (chair); Yukio Haruyama, Japan; John Neer, USA; D P Rao, India; Gunter Schreier, Germany; and Frans von der Dunk, The Netherlands.

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mapping agency provides maps openly to the public and international scientists only at a maximum spatial scale of 1:1 million, even though maps exist at (say) 1:10 000 scale.

The legal basis of remote sensing is becoming firmer and guiding the data suppliers to provide data on a more open basis. A starting point is to be found in general international legal principles on access to data (for example the 1986 UN Principles and WMO Resolution 40), where for example UN Principles X and XI call upon states to disclose information promoting "protection of the Earth's natural environment" and "protection of mankind from natural disasters", which in an abstract sense could well be argued to include sustainable development. Such principles are not formally legally binding as such, and moreover contain too many loopholes and leave too much room for individual interpretation to be really effective. As data policy analyses have shown, there is still a lot to be achieved in tightening the international law parameters for such purposes. There is though a presumption of openness that supports greater availability of remote sensing data for the following reasons.

1. The UN Principles have achieved customary status because they have been negotiated and accepted for more than 25 years.
2. Non-discriminatory access policies have been adopted by major remote sensing nations, e.g. Japan, USA, Canada.
3. The data policies of some remote sensing missions (e.g. Envisat, Radarsat) specifically incorporate non-discriminatory access.

Although there is pressure from some quarters to reduce non-discriminatory access, the need to have open availability of remote sensing data to support sustainable development should continue to be emphasised.

2.3. Institutional framework

ISPRS can usefully provide an independent forum for making progress with the ideas of remote sensing, geoscience and social science data in aid of sustainable development. The institutional context is essential, and ISPRS should continue to work with UNEP, UNDP, CEOS and IGBP to find the most suitable and practical way forward. The meeting planned for September 2003 in Graz, Austria on the subject of the 'Use of Space Technology in Support of the Plan of Implementation of the Outcome of the World Summit on Sustainable Development' may prove a fruitful avenue for ISPRS to act as an independent authority to contribute to the theme of the meeting.

2.4. Conclusions on sustainable development

Sustainable development issues should be tackled using both geoscience and social science. ISPRS is in a strong position to promote this theme, and to emphasise the variety of perspectives from countries at different stages of economic development. The subject of water availability provides a potentially useful focus in this area.

ISPRS is in a strong position to continue to press for easier and more open access to remote sensing data in support of sustainable development.

ISPRS should continue to act within an international institutional context to ensure that the role of remote sensing in sustainable development is given its full recognition.

3. Benefits of satellite remote sensing

3.1. Balance of benefits

It has been clearly recognised by many that the benefits of satellite remote sensing are wide and varied. However, when we try to capture the benefits against the costs of remote sensing, the strictly economic benefits are (1) relatively small and (2) typically not appropriated by those organisations that carry the costs.

There are many services, which depend on Earth Observation data, that government establishments are expected to provide to society. In many of these instances while the cost of data may be quantifiable, aspects of the economic and social benefits may not be amenable to such monetary quantification. For example, how much monetary value does one want to place on the life of a human being rescued from a natural disaster that benefited from the use of Earth Observation data? On the other hand, particularly in areas such as property management, business applications, development and management of utilities, tourism and agricultural production, the application of monetary cost/benefit ratios is practicable. In the case of geostationary meteorological satellite data, for example, the benefits are estimated at more than US$1 billion, although meteorological data are essentially provided free of charge.

The economic return on information (ROI) for satellite remote sensing is in direct proportion to the users' ability to address specific natural and manmade issues. The value of remote sensing systems is in the value added exploitation of the data, not in the creation of it via satellites. Within the US government there is a historical rule of thumb that suggests there is an economic force multiplier effect that comes from information such as that provided by satellite remote sensing: spend US$1 on information and it leverages

5–10 times the investment. Investing in information leverages the economic strength of a nation.

3.2. Tangible and intangible benefits

The benefits of remote sensing are both tangible and intangible. The intangible benefits are far more numerous than the tangible ones and typically are long term social benefits, not easy to convert to monetary values. In India, for example, satellite remote sensing data have been extensively used in many fields of development such as mapping, environmental impact assessment, disaster management, pollution control, communications, environmental forecasting, urban planning, source-finding for drinking water and associated water conservation planning, in addition to research applications including global change. All of these applications are helping immensely in the Indian national effort toward sustainable development. The Indian experience indicates that, when compared to conventional methods, satellite remote sensing methods are cheaper and faster at least by a factor of 2–3, and more in some cases.

The social benefits are intangible. Depending on the area of application, some benefits could be immediate, some short term and many are long term. For example, during the 1970s, coastal cyclones on the Indian east coast resulted in thousands of deaths. Since the 1970s very few deaths have been reported because of improved meteorological forecasting combined with early warning systems that help in evacuating the people of the area to shelter homes. This is an example of immediate benefit, here saving human lives, which cannot be equated with monetary benefit. Locating drinking water sources for villages (with no existing source) is a short-term benefit. Arresting land degradation and restoring its past productive status is a long-term benefit.

3.3. The wealth of nations

Benefits are often expressed as economic benefits. However, a pure GDP approach only recognizes the ''kinetic energy'' of a nation to produce wealth, it does not properly value the ''potential energy'', i.e. the wealth stored in its people and natural resources. If there were a way to value this potential energy (like oil in the ground) and apply remote sensing information as an ''economic multiplier'' more investment could be made or at the least justified. There is a role for international organisations to develop improved means of estimating the wealth of nations. Satellite remote sensing data can be seen as an information raw material on which wealth can be built.

In order to achieve benefits from remote sensing, it is not merely enough to acquire satellite data. Countries need the necessary infrastructure facilities integrated into national actions and manned by trained personnel who are capable of converting data into information. The use of such information for decision making requires institutional support and, for implementation and follow up, necessary budgetary support. This also means political commitment supported by approved policies and effective implementation of the policies. Any shortfall in these requirements results in a failure to show visibility of the benefits of remote sensing. Perhaps this may be the reason why in many developing countries we do not see the benefits of remote sensing on a scale that makes it visible. If the developing countries need to develop fast, the use of remote sensing is an imperative and not a choice.

4. Access to satellite remote sensing data

4.1. Economic issues

Satellite remote sensing data that are not free of charge are often regarded as expensive. This is in part because of the difficulty of capturing the benefits as discussed above. However, most if not all satellite remote sensing data are sold at a loss in a commercial sense. Landsat data cost the US government about US$2000–3000 per scene, where a scene is a $1^\circ \times 1^\circ$ latitude/longitude cell or about 3600 sq. nautical miles. This is a simple calculation based on total capitalisation and operations costs over the lifetime of the Landsat satellites. The US government sells a Landsat scene at a price of about US$600. A cost of $2500 and a sales price of $600 does not make a commercial business case. SPOT data sales recover the costs of the ground segment of the SPOT system but not the investment costs in the SPOT satellites.

This mismatch of a perception of high prices yet a fact of low prices is hampering the development of a mature remote-sensing sector. One solution is for an organisation to buy satellite remote sensing data in bulk and then make the data available to a selected community. This has the potential to satisfy the data providers on the one hand because commercial prices can be established, and the users on the other hand because data could be made available at (say) the marginal cost or even for free. A version of this approach is under active consideration in the Landsat Data Continuity Mission, and has been discussed in Europe in the context of the Global Monitoring for Environment and Security (GMES) initiative. For the less developed countries, particularly in Africa, the UN could play an active and fruitful role here.

The global picture of satellite remote sensing is changing. In the past there were only a few suppliers of data, and these were located in western nations, but now there is a dramatic increase in the number of remote sensing satellite launches by less developed

nations, for example Algeria and Nigeria in the Disaster Management Constellation (DMC). This change in the number and the type of nations launching their own missions could help to promote data sharing in specific geographical regions, in a sense a further form of bulk buying of data. This in turn places more emphasis on the need for infrastructure and for trained manpower to turn data into information and information into knowledge.

4.2. Downlink access

Commercial operators are concerned that the resources of their satellites are used by paying customers, i.e. costly data recording time is reserved for paying customers. If these resources are not used and their use would not mean additional costs and/or technical problems, commercial satellite operators might not be concerned how they are used. In other words, when a high resolution commercial satellite is imaging parts of (say) Africa and directly downlinking the data to an African station, the commercial operator of this satellite may not be concerned to lose precious resources over Europe (where they might have paying customers).

It can be helpful that sensed countries should have the right that the satellite operator allows them (and makes technical provisions on the satellite system) to receive the data directly from the satellite. Remote sensing satellites should have direct downlink capabilities in order to allow (subject to technology and to costs) reception of the raw data. If not for the very high resolution satellites, this should be considered for the Landsat-class of medium resolution satellites.

4.3. Non-discriminatory access

The first sentence of Principle XII of the United Nations Principles on Remote Sensing of the Earth from Outer Space (Resolution 41/65) states:

> As soon as the primary data and the processed data concerning the territory under its jurisdiction are produced, the sensed State shall have access to them on a non-discriminatory basis and on reasonable cost terms.

This principle appears now to be accepted as customary law. A number of interesting issues about access are raised by the principle.

- 'Non-discrimination' provides for a basis or point of departure from which in appropriate cases (the core question is then of course: what would be an 'appropriate' case) deviation would certainly be possible, for example when it would be reasonable from a cost perspective.
- What is '(non-)discrimination'? Discrimination refers to treating equal cases unequally, but what is an equal case? To give a very obvious example: if EUMETSAT treats requests for data from member states fundamentally differently from requests from non-member states this is not considered discrimination because those member states have contributed millions to develop, launch and operate the satellite system. It should by no means be concluded that 'non-discrimination' simply means treating all states equally (apart from the fact that Principle XII predominantly focuses on (non-)discrimination of the sensed state).

4.4. Conclusions on benefits and access to data

The ISPRS community and the United Nations family can contribute to the issues raised in this paper by the following.

- Pay greater attention to measures of estimating the wealth of nations and the contribution that satellite remote sensing data can play in measuring that wealth.
- Promote the opportunities for bulk buying of remote sensing data followed by controlled distribution.
- Use regional associations, collaborations and groups to develop better means of sharing remote sensing data and expertise, always in the frame of turning data into information and information into knowledge.