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**Ad Hoc Working Group on Environmental Monitoring**

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(Item 3 (d) of the provisional agenda)

**TOWARDS A WORK PLAN FOR TASK 4 “REMOTE SENSING”**

Discussion paper by the European Environment Agency (EEA)

Introduction

1. In the pan-European context, consistent environmental information is difficult to obtain. Furthermore, some areas are poorly covered by ground-based monitoring. Satellite information may play an important role in this context. The Working Group will invite some institutions to make proposals on the role that remotely sensed environmental information could play in monitoring environmental problems across Europe. It will assess these proposals and make recommendations.

QUESTIONS TO BE DEALT WITH

**A. What is the present role of remote sensing in monitoring and reporting on environmental issues in Europe?**

2. Regular reports on the state of the environment in Europe help decision makers to assess the effects of past action and lead to improved choices and decisions in the future. EEA and its European Environment Information and Information Network (EIONET) are called upon to report on the environment in Europe, facing the challenge of synthesizing a holistic ‘environmental picture’ of the European continent without losing accuracy and reliability when describing partial aspects or priorities of regional/local importance.

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3. While environmental problems are of common concern to all countries, priorities, methods and data availability may differ largely. In order to achieve a synoptic and synthetic picture of Europe, it is desirable to make use of the best available data sources on the environment and on human activities.

4.. Remote sensing is a unique instrument to provide complementary information to existing ground-based monitoring systems. Remote sensing can be used to meet the need for timely information and can provide synoptic cross-boundary information. Data and information obtained through Earth observation (EO) can easily be used within geographic information systems for overlay and comparison with other geo-referenced information. Despite these advantages EO has been used very little in the production of national environmental reports and has also been limited at the international level; it is most often used literally for illustration purposes.

#### **B. What are the environmental issues remote sensing is used for in Europe?**

5. It has become apparent from previous studies that, while EO can qualitatively address several environmental monitoring targets, it does not respond to quantitative specifications in the same way as other existing analytical/chemical techniques do. Operational use of EO is well known for terrestrial (i.e. land) applications. Satellite-derived land cover/use databases can be used, in turn, as input to environmental information systems and models, which renders EO indirectly useful to applications other than terrestrial ones.

6. The themes for which EO can be used in an operational way for reporting are the following (listed in order of decreasing experience:

- (a) Changes in land cover and land use: mapping and updating on a small to medium scale;
- (b) Vegetation state and vigour: identification and follow-up;
- (c) Biotopes: assistance in delineating and detecting change;
- (d) Urban environment: quality assessment and follow-up of spatial expansion;
- (e) Oil spills: more than circumstantial detection but still not permanent follow-up;
- (f) Floods: quasi real-time observation, impact assessment and, to a limited degree, risk analysis;
- (g) Sea and inland waters in terms of pollution indicators: mapping and updating overall distribution for extended areas:
- (h) Forest fires: risk analysis, circumstantial detection and impact assessment that are cost-effective for significant events;

- (i) Transported air pollution: guidance for response and circumstantial assessment of state and detection of pressure.

**What is the potential use of Earth observation by remote sensing in Europe?**

7. EO can be used to maintain consistent nationally reported information (i.e. on land, soil and urban parameters) by improving the comparability of measurements at European level and by providing an independent means for synoptic evaluation of the spatial distribution of important environmental events and their impact (e.g. natural disasters).
8. EO can help to gather information in areas which are not comprehensively covered by ground-monitoring networks (e.g. Black, Caspian and Barents Seas, Baltic States, Russian Federation).
9. EO can be used for retrospective trend analyses and diachronic detection, particularly of slow changes, such as urban expansion, due to the existence of long historical satellite records.
10. EO can be applied in conjunction with dispersion modelling to track very dynamic phenomena, such as transported air pollution, at regional scale, but pilot experience is missing.
11. Policy makers demand indicators to monitor environmental progress. EO represents a holistic rather than an analytical approach, which could help improve links between different components of the DPSIR causality model (Driving force, Pressure, State, Impact, Response) through a more integrated methodology.

**D. Why is the use of remote sensing in environmental monitoring and reporting still limited at the pan-European level?**

12. Considering the theoretical potential of remote sensing techniques, it is necessary to ask why EO data are not used more extensively e.g. in atmospheric or marine environmental applications. Part of the answer may lie in the still considerable gap between research and operational (cost-effective) applications of EO related projects.
13. The space industry now seems to have reached a level of technological maturity at which it is becoming commercially oriented to the real needs of the satellite data users (e.g. new European initiative on Global Monitoring for Environment and Security (GMES)). Furthermore, new opportunities arise to operationalize remote sensing environmental observation, as methods and algorithms currently under development will improve the implementation of EO-based monitoring schemes in the next few years.

**E. What are the relevant institutions to assess the recent and future role of remote sensing**

**in the field of environmental monitoring and reporting in Europe?**

14. Recommendations for a better use of EO by remote sensing in monitoring and reporting environmental issues should be based on an assessment of existing European initiatives such as the work carried out by the former Centre for Earth Observation (one of the main projects carried out during the 1990s by the Space Applications Institute at the Joint Research Centre in Ispra, Italy), and the new European initiative on Global Monitoring for Environment Security (GMES) (initiated by the European Commission together with the European Space Agency and discussed with users at the GMES Workshop organized in Stockholm on 21-22 March 2001).

15. The assessment should specifically address the following questions:

- (a) To what extent can EO data be used in the reporting on Europe's environment?
- (b) Which most needed information can nowadays be made available (cost-effectively) by means of remote sensing?

16. This challenging analysis should cover a wide range of environmental applications (13 prominent European environmental problems) for a specific objective (e.g. the next State and Outlook Report 2004) and the results obtained could represent a comprehensive assessment of the role that EO can play in environmental reporting.

17. The following institutions could be invited to prepare an assessment and to submit proposals on the role of remotely sensed information in monitoring and reporting on environmental problems across Europe:

- Joint Research Centre  
Space Applications Institute  
Strategy & Systems for Space Applications Unit  
Ispra
- European Commission  
DG Research, Dir. 1.  
European Initiative on Global Monitoring Environmental Security  
Brussels