USER REQUIREMENT STUDY

FOR
REMOTE SENSING BASED SPATIAL INFORMATION
FOR
THE SUSTAINABLE MANAGEMENT OF FORESTS

DRAFT VERSION 981215

PROCEEDINGS OF THE INTERNATIONAL WORKSHOP

ON THE PRELIMINARY RESULTS OF THE

USER REQUIREMENT STUDY

AT ITC, ENSCHEDE, THE NETHERLANDS
23 – 25TH NOVEMBER 1998

[Workpackage 8]

December 1998

ITC	**In cooperation with**	**FAO**	**IKC N**	**NIVR**
	IBN-DLO	**WAU**	**DOFI**	**NEO**
	Fokker Space BV	**NLR**	**TNO-FEL**	**Vissers DataManagement**

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FINAL REPORT

DRAFT VERSION 981215

WORKPACKAGE 8

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ON THE PRELIMINARY RESULTS OF THE USER REQUIREMENT STUDY
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and first preliminary comments by other members of the study team

December 1998

Preface

This study originates from the problems observed with information availability for sustainable forest management. It aims at addressing the following issues:

1. Identification of users of spatial information for forest management
2. Assessment of the information needs
3. Translation of these needs into functional and system requirements
4. Identification and assessment of existing and planned technology for application in forest management
5. Assessment of the extent to which information requirements are and/or can be met by existing/planned technology
6. Preliminary assessment of the need for an "end-to-end" monitoring system
7. Creation of a national and international platform to support the study

Three Netherlands Ministries have sponsored the study, i.e. the Ministry for Economic Affairs, the Ministry of Foreign Affairs (Netherlands Development Assistance – NEDA), and the Ministry of Agriculture, Nature Management and Fisheries.

The study has been carried out by the International Institute for Aerospace Survey and Earth Sciences (ITC) of Enschede, the Netherlands in cooperation with:

- Food and Agriculture Organization of the United Nations (FAO), Rome, Itly
- National Reference Centre for Nature Management (IKC N), Wageningen, the Netherlands
- Institute for Forest and Nature Research (IBN-DLO), Wageningen, the Netherlands
- Wageningen Agricultural University (WAU), Wageningen, the Netherlands
- DO Forestry International (DOFI), Bennekom, the Netherlands
- Netherlands Geomatics and Earth Observation BV (NEO), Lelystad, the Netherlands
- Netherlands Agency for Aerospace programmes (NIVR), Delft, the Netherlands
- National Aerospace Laboratory (NLR) Amsterdam, the Netherlands
- Fokker Space BV, Leiden, the Netherlands
- TNO-Physics and Electronics Laboratory (TNO-FEL), The Hague, the Netherlands
- Vissers Data Management, Wageningen, the Netherlands

The study results have been laid down in the following reports:

1. User Requirement Study – Final Report
2. International user platform
3. Study design
4. Forest functions, management principles and information systems
5. User needs
6. Country studies
7. User requirements
8. Remote sensing applications for forest management
9. Evaluation of requirements and applications
10. Proceedings of International URS Workshop
11. User Requirement Study – Administrative Report

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Appendices [not attached in this version]

Executive Summary

A very successful international workshop was held at ITC's headquarters in Enschede, The Netherlands from 23 to 25 November 1998. Fifty-seven people representing 20 countries, 20 government organisations, 6 international NGO's, 5 international organisations, 5 universities, 5 private sector entities, and 4 NGO's attended it. Participants represented a wide range of data users from the local to global levels. Discussions were focussed on three areas: data needs, constraints in obtaining data and options for improving data supply.

The purpose of the workshop was to *review* the preliminary findings of the "User Requirements Study for Remote Sensing Based Spatial Information for the Sustainable Management of Forests" carried out by a consortium of organisations with the International Institute for Aerospace Survey as coordinator, *formulate* conclusions and *advise* on follow up action. The workshop was highly interactive. It verified the study's preliminary findings, identified a large number of additional user needs and generated numerous new and important issues that would have to be addressed in subsequent activities and final report. Clearly, the idea of seeking user inputs prior to finalising the study has been invaluable.

The key conclusions regarding *data needs* were:

- By far the most important level requiring data to practice effective sustainable forest management (SFM) was at the local level whether it be for the forest community, forest management unit or NGO
- The most important specific type of spatial data required at all levels is on land and forest cover and forest degradation (shifting cultivation, encroachment, illegal mining and illegal logging etc.)
- In addition to the themes identified in the URS, information on socio-economics, land tenure, carbon dioxide storage and biodiversity should be included
- Information/data needs are not static; they are likely to change over time for different user levels

The main conclusions concerning *constraints in obtaining data* were:

- The first priority is to make much better use of the existing terrestrial, aerial and space-born data acquisition systems (digital sensors, photographs, field observations, etc) to provide the necessary data for improved SFM practices
- The dissemination and flow both ways of available data/information is not working well. This requires the development of an "end-to-end" information system supported by research & development and training & education within the overall framework of an information strategy
- Additional knowledge on how to operationalise SFM should be sought

The key conclusions concerning *options for improving data supply* were:

- The major bottlenecks are the accessibility and affordability of existing spatial data especially at the local and sub-national levels. Improvements may be possible by establishing additional infrastructure (e.g. groundstations) and exploring means of providing free imagery to the users at local level
- Lack of training in the use and interpretation of remote sensing data is a major constraint at the national and local levels

Follow-up action is needed to: maximise the efforts already put into the URS; maintain the firm interest this initiative has captured in the world's forestry community; and, foster continued Netherlands Government support. The workshop recommended seven follow-up actions:

1. Follow up on the results of the URS, determine reasons for accessibility and affordability constraints and how these might be resolved and mitigated.
2. Establish a *supra national mechanism* (or mechanisms) to provide data/information to the local, sub-national and national users.
3. Develop a clear *information strategy* at international and national levels that ensures information flows are upward and downward.
4. Ensure data already stored is made available to users.
5. Improve the *international protocols* on data sharing and access.
6. In order to stimulate the actions listed above and to help develop the thinking generated during the workshop, identify a number of pilot projects in appropriate parts of the world. This will require significant work to determine locations, tasks, costs, viability, implementing agencies, funding, staffing etc.
7. Start conceptualizing and operationalising an end-to-end forest information system for data capture (using all available sources and systems), storage, analysis an information dissemination to users at various levels. Such a system should have flows in both ways and be supported by research & development and training & education within the overall framework of a holistic information strategy. Determine the exact structure and workings of such a system.

1. BACKGROUND

Global attention was focussed on the World's declining forest resources at the UNCED conference in Rio de Janeiro in 1992. The urgent need for developing sustainable forest management systems and the necessary information on which to base these systems was stressed. Agenda 21 Chapter 40 stated that "*effective and equitable availability of information generated at the local, provincial, national and international levels…should be ensured*".

Numerous fora since Rio have reiterated the importance of accessibility to information and the need to improve information systems. These include the Inter-governmental Panel on Forests, the Inter-government Forum on Forests, the World Commission on Forests and Sustainable Development, and, in the area of sustainability of forests: the Helsinki Process (European forests), the Montreal Process (non-European temperate & boreal forests) and the Tarapotu Proposal (Amazon forests).

More recently discussions between leading forestry organisations (CIFOR, FAO, IUFRO, WCMC, WFI, OFI, ICRAF & EFI) have been promoting the idea of a Global Forest Information Service using Internet as a means of communication.

The Netherlands Government has traditionally been extremely interested in the World's forestry sector and has for many years played a leading role in forestry development initiatives at both the bilateral and multilateral levels, world-wide. The urgent need for providing information in order to implement sustainable forest management systems has captured the imagination of knowledge-institutes in the Netherlands. This has resulted in the concept of an integrated "end-to-end" system that provides for the flow of data from the space-borne, aerial, and ground systems through a central processing and decimation facility to users at all levels. It depends on the flow of information both ways and is supported by both research & development and training & education within the overall framework of an information strategy. The knowledge-institutes involved recognised that, as a first step, actual user requirements would have to be identified and confirmed. It was decided this could best be done through an overall study to identify to what extent existing (and planned) remote sensing (RS) systems could provide the information requirements for SFM. The study was commissioned in December 1997 and entitled "User Requirements Study for Remote Sensing Based Spatial Information for the Sustainable Management of Forests (URS)". Through this study the Netherlands Government would be able to confirm the need for spatial information, the need for RS based spatial information, the constraints which currently hamper information distribution and the available options, limitations, solutions and capabilities of existing RS systems to meet information requirements.

The Ministry of Foreign Affairs, Ministry of Economic Affairs and the Ministry of Agriculture, Nature Management and Fisheries have sponsored the study. The International Institute for Aerospace Survey and Earth Sciences (ITC) is responsible for executing the study in cooperation with FAO and ten national organisations.

2. OBJECTIVES

2.1 URS objectives

Within the framework of the overall goal of SFM (defined as managing forest resources and associated lands to meet the social, economic and ecological needs of present and future generations) the URS aims at:

1. Identifying the users/stakeholders and their interests.
2. Assessing user information needs.
3. Translating information needs into functional and system requirements.
4. Assessing the existing & planned RS technology applications for SFM.
5. Comparing 3 & 4 above.
6. Soliciting support from the user community.

The study team undertook the following activities:

- Designed a framework for users of spatial information for SFM identifying and classifying users for a number of criteria (level of operation, geographical location etc.)
- Established an inventory of forest functions, decision support systems & information requirements
- Assessed user needs worldwide through a literature study, questionnaire survey and country studies (Brazil, Nepal, Malaysia & Costa Rica)
- Identified and assessed existing and planned remote sensing technology for applications in forest management
- Assessed the extent to which information requirements are and/or can be met by remote sensing technology applications, available now and/or in the foreseeable future
- Preliminariluy assessed the extent to which an end-to-end remote sensing-based monitoring system could contribute to addressing deforestation and forest degradation
- Create a national and international platforms to support the user requirement study.

2.2 Workshop objectives

The project's rationale for conducting a workshop was to test out, and if possible validate, the preliminary findings of the URS study by bringing together users ranging from local to global, NGO's to international organisations, tropical to boreal and less developed to developed countries, *before* completing the study by December 1998. In this way vital inputs from practitioners could be captured to enhance the final report's validity.

Preliminary results of the study were summarised in a document prepared for workshop participants. This was supported by seven workpackage reports listed in Appendix 1. Together they formed the background material on which the workshop was based. The purpose of the workshop was to:

1. Review preliminary findings contained in the URS documents.
2. Discuss findings and results.
3. Draw conclusions.
4. Advise on follow-up action.

3. ORGANISATION OF WORKSHOP

Fifty-seven persons representing 20 countries, 20 government organisations, 6 international NGO's, 5 international organisations, 5 universities, 5 private sector representatives and 4 NGO's attended the workshop. Participants are listed in Appendix 2. Three working groups were created to address separate themes:

Working Group 1:	Data Needs
Working Group 2:	Constraints in Obtaining Data
Working Group 3:	Options for Improving Data Supply

The members, chairperson, rapporteur, and resource persons for each Working Group (WG) are listed in Appendix 3. The workshop started with an introductory plenary session of 6 presentations (Appendix 4). WG meetings to assess and discuss study results followed this. Each WG presented their findings for discussion at the second plenary session. The WG's then met again to refine their findings in the light of plenary discussions and to develop conclusions and follow-up action. WG results were presented at the final plenary session followed by a summary of conclusions by the Chairperson and concluding remarks by the representative of the Government of the Netherlands. The workshop programme for the three days (November 23 to 25) is shown in Appendix 5.

4. WORKING GROUP SESSIONS

WGs were guided in their task by the Matrix of Key Issues shown in Table 3.1 of the summary report (Appendix 6). This table contained separate discussion issues for each group to provide focus. Additional issues were added as necessary by each WG. WG presentations to the final plenary are provided in Appendix 7.

4.1 Working Group 1: Data needs

WG1 was charged with discussing user needs for spatial information in terms of themes and user groups. Both themes and user groups originally developed by the URS were expanded by the WG to better address perceived information needs. In particular there was a need for information on forest dependant communities (specifically location and boundaries of settlements) and inclusion, as well, of forest management units and municipalities under the local user group. Also the inclusion of a sub-national category was proposed to include provinces, states etc. Additional themes included forest degradation (shifting cultivation, encroachment, illegal mining, and illegal logging), forest health (insects, acid rain), forest function (conservation, production, protection and subsistence), forest products (timber & non-timber), land tenure, socio-economic, CO2 sequestration, biodiversity etc.

Table 1 provides the groups rating per theme for each user level using plus and minus symbols (++ = very much needed; + = needed; - = not needed).

Table 2 provides the groups priority rating per user level using numbers (1 = high, 2 = moderate, 3 = low).

Table 1: Rating per Theme for Each User Level

Theme	Global	Supra/ Nat.	Nat.	Sub.	Local
Land forest cover	+	+	+	+	+
Forest degradation	+	+	++	++	++
Forest function	+	+	++	+	+
Forest types	+	+	+	+	+
Biodiversity	+	+	++	+	+
CO 2 sequestration	++	+	++	+	+
Land use	+	+	+	+	+
Land tenure	+	+	+	++	++
Fire damage assessment	+	+	++	++	++
Fire hazard assessment	-	+	+	+	+
Fire identification	+	+	++	++	++
Forest health	+	+	+	+	++
Forest products	-	+	+	++	++
Forest dep. communities	+	+	+	+	+
Stand parameter	-	-	+	+	++
Site (topo, hydro, geo)	-	-	+	++	++
Socio-Economic	-	-	+	++	++

Table 2: Priority Rating per Theme and User Level

Theme	Global	Supra/ Nat.	Nat.	Sub.	Local
Land forest cover	1	1	1	1	1
Forest degradation	1	1	1	1	1-2
Forest function	3 (1)	3 (1)	1	1	2 (1)
Forest types	2 (1)	2 (1)	1	1	1
Biodiversity	1	1	1	2	3 (1)
CO 2 sequestration	1	1	1	2	3
Land use	3	3	1	1	2
Land tenure	3	3	1	1	2
Fire damage assessment	2	2	1	1	1
Fire hazard assessment	3	2	2	1	1
Fire identification	2	2	2	1	1
Forest health	3	3	1-2	1-2	1
Forest products	3	2	2	1	1
Forest dep. communities	3	3	2	1	1
Stand parameter	3	3	3	2	1
Site (topo, hydro, geo)	3	3	2	2	1
Socio-Economic	3	3	2	2	1

The WG's proposed scales at which information is required were linked for the most part to the different level of users:

Global	1 : 1,000,000	to	1 : 10,000,000
Supra national	1 : 1,000,000		
National/sub-national	1 : 50,000	to	1 : 250,000
Local	1 : 1,000	to	1 : 25,000

Conclusions drawn from WG1's discussions within their group and during subsequent plenary sessions are included later in this report.

For the most part discussions focussed on present and immediate future information needs. Little was said about the foreseeable quantum increase in demand for information on forest values that have been or will be generated by legally binding conventions (e.g. Climate, Desertification and Biodiversity Conventions) and soft law arrangements (e.g. Agenda 21 et al). Additionally, national commitments to the practice of SFM are being translated into criteria to define such practices and indicators that are a measure of these criteria (e.g. Montreal Process, Helsinki Process and Tarapoto Proposal).

4.2 Working Group 2: Constraints in obtaining data

WG2 focussed on the constraints in obtaining timely and adequate information to practice SFM. Major problems facing world forestry stem from the rapid transition to a more dynamic approach to SFM. New features include understanding the multi-functionality of forests, coping with the multi-disciplinary needs for managing forests, taking an integrated approach (e.g. being concerned with forest and non-forest areas) and being aware of climate change implications of management practices. SFM is an integrated part of comprehensive natural resource management; this implies new challenges for data/information needs from ground and RS data particularly in regard to indicators that are to be used for assessing the viability of such management practices.

Table 3 provides an analysis of the major constraints identified by the group according to the *type* of constraint (P = political, I = institutional, T = technical, H = human capacity), the *level* of constraint (GL = global, N = national and sub-national, L = local) and the *type* of organisation (GO = government, NGO = non-government). An asterisk (*) indicates where the constraint is primarily caused.

Table 3: Analysis of Main Constraints

Issue	Type of constraint				Level			Type of Organisation	
	P	I	T	H	GL	N	L	GO	NGO
Inadequate Formulation of Policies	*				*	**		*	
Inadequate Implementation of Policies	*					**	**	*	*
Lack of Political Will	*					**	*	*	
Over sensitiveness for National Security	*				*	**		*	
Inadequate Commitment to SFM	*				*	**	*	*	*
Inadequate Organisational Structure	*	*				**	*	*	*
Inadequate Organisational Capacity	*	*			*	*	**	*	*
Inadequate Information Strategy	*	*			*	**	*	*	*
Inadequate awareness on information systems	*	*		*		*	**	*	*
Inappropriate technology	*		*		*	*	*	*	*
Lack of standardisation/compatibility	*		*		**	*		*	
Inadequate human capacity/training		*		*		*	**	*	*
Over centralised control on flow of information	*	*				**		*	*
Inadequate communication between levels		*	*	*	*	*	*	*	*
Inadequate methods and systems			*	*	*	**		*	
User unfriendliness			*	*		**		*	*
Insufficient interdisciplinarity			*	*	*	**	*	*	*
Poor socio-economic working conditions	*	*		*		*		*	
Shortage of accurate field data		*	*	*	*	*		*	*
Usability (inadequate data)			*	*	*	*	*	*	*
Availability of data			*		*	*	*	*	*
Accessibility of data	*	*			*	*	*	*	*
Affordability of data (cost effectiveness)	*	*			*	*		*	
Timeliness (delay in procurement/delivery)		*	*			*		*	*

WG2's conclusions appear later in the report.

4.3 Working Group 3: Options for improving data supply

WG3 was charged with discussing options available for providing data and information to support SFM practices. Considerable time was devoted to preparing a matrix table showing user requirements against the features of 12 existing airborne and space-borne sensors. The list of information needs included cover/use, forest type, vegetation change, topography, species, slopes, soils, productivity, forest health, forest fires and management practices. The limitations associated with each sensor were added to the matrix table. These included scale, cloud cover, price, availability, area covered, spectral resolution, territorial resolution, copyright etc. Although the WG decided not to complete the matrix table the exercise was very useful in flushing out some important observations:

- The 12 sensors selected have limited ability in collecting information on forest types, tree species, management practices, forest productivity and forest health. All these are required to practice SFM
- User needs are varied and existing sensors are also varied; the challenge is to match specific user demands with specific sensor characteristics
- Presentation of data is crucial as both the politicians and local people cannot interpret the RS data themselves; they need information presented in a suitable format
- Currently the researchers have difficulty in producing the type of information and the accuracy requested by politicians
- Forest managers and NGO's need something now and cannot wait for the development of new sophisticated sensors
- The capacity in developing countries for image processing and interpretation is limited. Often the hardware and software is available but persons to operate the equipment are not engaged; thus training and capacity building is vital
- At a cost of some $ 400 to $500 a scene, NGO's and local people can not afford to purchase the imagery required; this is a major constraint
- There is plenty of room for improving the ground segment through receiving stations, analysis and cheaper data
- It may be possible to increase the availability of satellite data with a non-profit approach such as that proposed for Landsat 7
- Remote sensing data should become available to all potential users
- The inclusion of socio-economic data is an important challenge for the future;
- Of the sensors reviewed SPOT HRV appears to have fewer limitations in regard to information required for SFM than others
- The greatest hurdles to use of satellite imagery are accessibility, affordability and user friendliness

To focus discussions better on existing sensors and the potential for using them for forest applications the WG followed the scheme below:

Awareness?
↓
System Availability?
↓
Accessible?
↓
Affordable?
↓
User Friendly?
↓
(Timeliness)
↓
USE

This led to WG3's conclusions contained in the next section.

5. CONCLUSIONS

Participants validated the preliminary results of the URS and considered the workshop a great success in terms of generating useful new insights and developing ideas on the way forward. They were also complimentary about the workshop's structure, organisation, wide user level participation and conducive environment for exchanging ideas.

Each working group provided conclusions generated from their discussions.

5.1 Working Group 1: Data needs

1. The greatest need for information is at the local level (forest community, forest management unit or NGO) followed by the sub national level.
2. In terms of themes, land forest cover/forest use and forest degradation have the highest priority for information needs at all user levels.
3. At the NGO level the highest priority demand is for information on forest function, forest types and biodiversity.
4. Information on biodiversity and CO2 sequestration was given high priority at the global, supra national and national levels.
5. Regarding the remaining themes listed in Tables 1 and 2 there is a tendency for a decrease in information needs and detail from the local to global levels.
6. It is desirable to aggregate from lower to higher user levels but this is often not possible or feasible.
7. It is important to have more information about both the state and the change parameters for the themes. Capturing change data is important at all user levels.
8. The identification of areas at risk, or under threat from fire and insect attack, is needed at all user levels.
9. Information on land tenure is needed at all levels if parks and protected areas are included under the definition of land tenure.

5.2 Working Group 2: Constraints in obtaining data

Recognising the constraints identified through the study, and subsequent discussions by WG2, the following conclusions were drawn:

1. There is plenty of scope to make far better use of *existing systems* (terrestrial, aerial and RS) to provide the necessary data for improved SFM practices.
2. It is vital to raise *awareness* at all user levels of the importance of SFM and the multi-functionality of forests.
3. There is an urgent need for *capacity building* (human & institutional), nationally and locally
4. Knowledge of *methods and systems* for operationalising SFM should be enhanced.
5. Governments should define and implement a holistic *information strategy* for SFM seeking external assistance if required. The components of such a strategy might include:
    - Production, analysis, use and dissemination of data
    - Participation by stakeholders through partnerships
    - Inter-disciplinarity of data gathering and analysis
    - Data fluxes between provider and user of data
    - Access to information and transparency
    - Standardisation and compatibility
    - Organisational infrastructure
    - Skill requirements
    - Two way flow of data from and to the user
6. *International access.* A protocol is required to enable the open exchange of data between global and national data users.

7. *Research and development.* There is a need to investigate proper technologies for the implementation of an information strategy for SFM and its integration into operational systems and procedures.

5.3 Working Group 3: Options for improving data supply

1. Highest priority must be given to making better and fuller use of existing data generating facilities. It is clear that there is unrealised capacity within the existing sensory systems, which has to be taken advantage of before embarking on establishing new sensors.
2. Short-term actions should be developed to solve current bottlenecks/constraints to RS for forest applications such as accessibility, affordability and user friendliness/lack of trained people etc. To address such major constraints a series of pilot projects aiming at developing solutions should be identified and expeditiously implemented.
3. In the longer run and only if the demand for more, better and new data increases provide the rationale and justification should forest specific technology and systems dedicated to the needs of the sector be considered.
4. Increased accessibility and affordability could be achieved by improving the infrastructure (e.g. groundstations-mobile & fixed) and by providing data free (on the Internet, by identifying organisations that could buy existing data or by asking powerhouses to release data).

6. THE WAY AHEAD

Strong indicators were provided by the workshop of the follow-up action that needs to be taken: (a) to maximise the effort already put into the URS, (b) to maintain the firm interest this initiative has engendered in the worlds forestry forum and (c) to foster continued Netherlands Government support. Participants agreed positive action is needed on the following priority tasks:

1. Put a supra national mechanism or mechanisms in place for provision of information and data to the local, sub national and national user levels.
2. Make the organisation(s) responsible for ensuring that information flows are upwards and downwards.
3. Make data already stored and available accessible to users.
4. Review the international protocols on data sharing with a view to introducing improvements.
5. At the national level develop a clear holistic information strategy.
6. In order to stimulate the actions listed above and to help develop the thinking generated during the workshop, identify a number of pilot projects in appropriate parts of the world. This will require significant work to determine locations, tasks, costs, viability, implementing agencies, funding, staffing etc.
7. Start onceptualizing and operationalising an end-to-end forest information system for data capture (using all available sources and systems), storage, analysis an information dissemination to users at various levels. Such a system should have flows in both ways and be supported by research & development and training & education within the overall framework of a holistic information strategy. The exact structure and workings of such a system will have to be determined.