

IUFRO

International Union of Forestry Research Organizations
Union Internationale des Instituts de Recherches Forestières
Unión Internacional de Organizaciones de Investigación Forestal
Internationaler Verband Forstlicher Forschungsanstalten

Global Forest Information Service

Papers presented at the Global Forest Information Service Side Event
The Third Session of the United Nations
Intergovernmental Forum on Forests (IFF 3)

Geneva, Switzerland
3-14 May 1999

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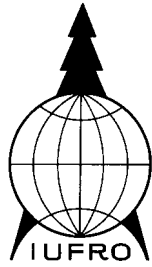
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Global Forest Information Service - Creating a Common Vision

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1. Background

Improving access to forest information was formally recognised as a priority by the United Nations Conference on Environment and Development in 1992 when it stated in Agenda 21, Chapter 40: *“Countries and organisations should exploit various initiatives for electronic links to support information sharing, to provide access to databases and other information sources, to facilitate communication for meeting broader objectives, such as the implementation of Agenda 21.”*

The Intergovernmental Panel on Forests in 1997 *“emphasised the need to review and improve information systems. Attention should be given to world-wide access to information systems that would encourage effective implementation of national forest programmes, increased private-sector investment, efficient development and transfer of appropriate technologies, and improved co-operation”*.

After meetings in Portland, USA 1996, Antalya, Turkey 1997, and Rovaniemi, Finland 1998, it was concluded that an Internet-based approach to improve the accessibility to and the quality of forest-related information would be financially and technically feasible (Päivinen et.al., 1998).

As a result of these meetings IUFRO established the Global Forest Information Service (GFIS) Task Force in the Fall of 1998. The mission of the Task Force is to *“develop a strategy for, and implement, an Internet-based metadata service that will provide co-ordinated world-wide access to forest information.”* The resulting service will provide multiple benefits to information users and providers including, facilitating user-friendly access to a greater amount of information, and improving the dissemination and quality of forest-related data and information.

This paper describes the activities and visions of IUFRO’s GFIS Task Force for establishing an Internet-based metadata service.

2. Structure and Information Flow of the GFIS

The structure and information flow of the Global Forest Information Service is illustrated in Figure 1.

1. The first contact point for those accessing GFIS will be a website, or the **“mother site.”** The mother site will instruct the user in how to find the information or data he/she is looking for.

2. The **information locator** is the technical tool for information searching using information classification systems, geographical distribution, and keywords.
3. **Metadata** is ‘data about data’, or a catalogue of the content of the participating websites. Metadata includes the key information the user will need for deciding whether the website is relevant to the search.
4. **Websites** of the information providers are their existing websites. They can be used with little or no adjustments required for connecting to the GFIS. In Figure 1, varying shapes, sizes and shading represent different content, spatial and temporal scales, format, and other attributes specific to each site.

Websites A and B have harmonised metadata, and some harmonised data - based on common standards. For example, National Forest Statistical offices may agree to use common standards and formats in presenting their information in their own websites.

Websites C and D do not have anything in common in their websites, but they will provide harmonised metadata to describe the contents of the site.

Website E has harmonised metadata, but the access to data is not free. In this case, harmonised metadata may help the user determine if the dataset contains information valuable enough to purchase.

Website F is only a link without any added value by GFIS.

It is intended, that GFIS will be an open ended system where information providers may join if they wish to follow the principles of GFIS. These principles will be expressed in the ‘collection policy.’

The collection policy will document the

- types of eligible information resources, including thematic contents of GFIS, and the boundaries and links to other services (agriculture, environment, etc.)
- format of metadata entries.
- quality of eligible information resources. The question is how strict the GFIS should be in accepting a website to be located through it.

3. Regional and thematic specialisation within GFIS

In developing advanced information services, we need to take into account that in many cases there may be technical or cultural obstacles in utilising GFIS.

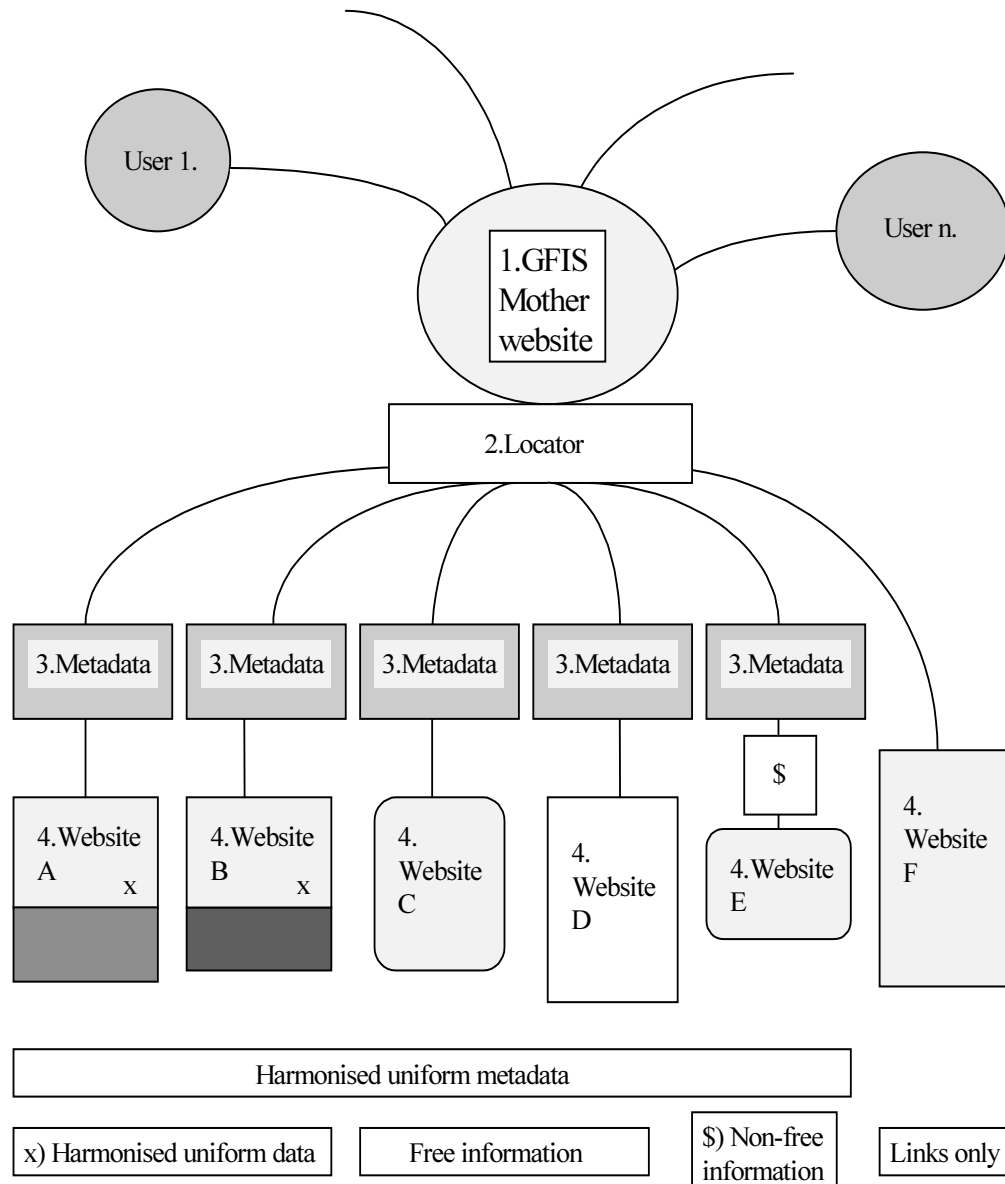


Figure 1. *The principle of the Global Forest Information Service*

Therefore it is essential that

- language issues be addressed in the early phases of development
- technological and educational capacity building be an integral part of the programme.

For these purposes, regional activities, supported by regional nodes could be a feasible solution (see Szaro et. al. 1999). Regional nodes would be institutions well placed to assess the availability of key information and well connected with existing networks and other relevant institutions within each geographic (or thematic) region.

It may be practical to implement the principle presented in Figure 1 in two phases, IUFRO website as the global mother site, and regional and thematic sites serving the users directly or through IUFRO

website. At the present, it is too early to say which degree of decentralisation will yield the best service for the users.

The core of the system is a distributed network of forest metadata databases, not just a structured set of forest-related web pages like WWW virtual library.

4. Benefits of the GFIS

The benefits of the Global Forest Information Service are many and apply to both users and providers of forest information. They include:

Easier, user-friendly access to a greater amount of information: With a recognised focal point for engaging in information gathering, the user is relieved

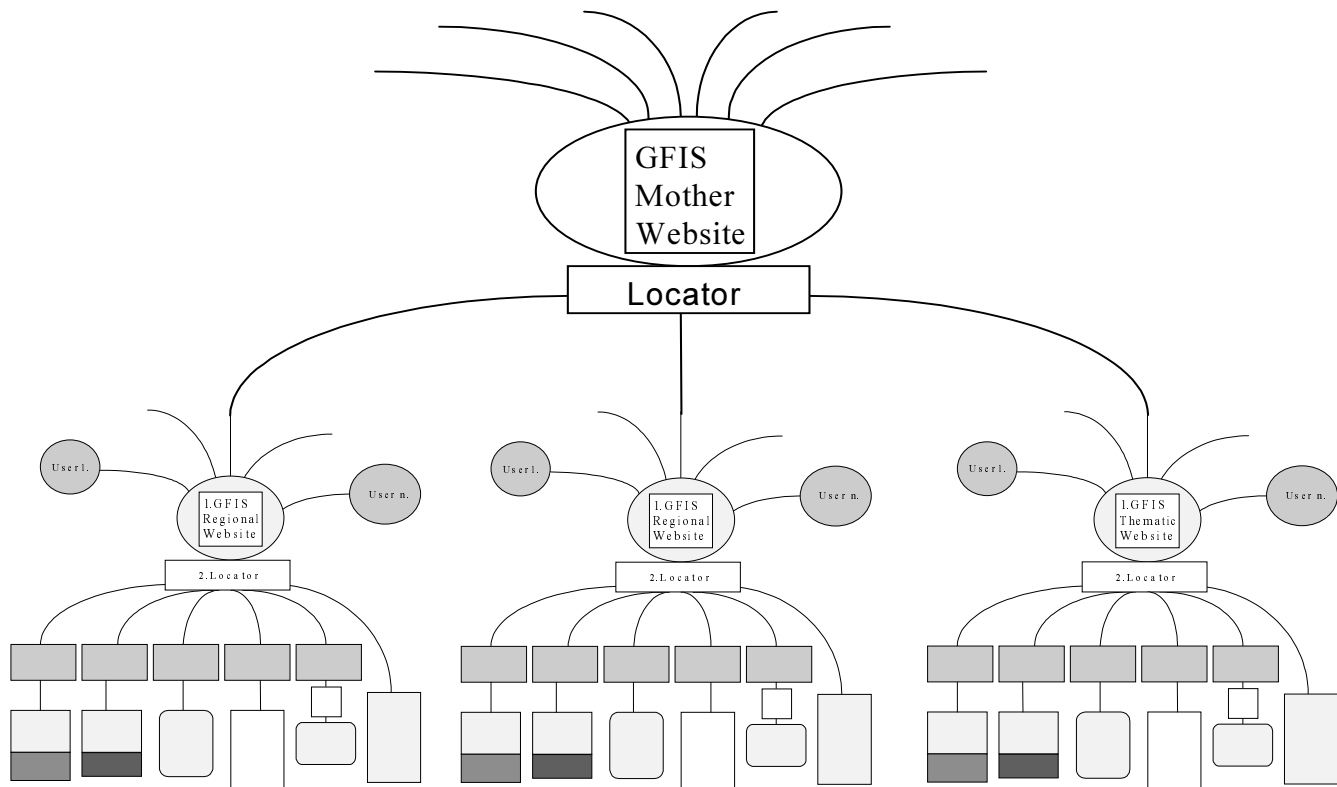


Figure 2: *Linking the regional and thematic nodes into GFIS*

of the task of conducting multiple data searches and can also be more confident that all possible sources of appropriate data have been identified. Information providers can be more confident of reaching their desired target audiences.

Better comparability of data sets: In the long-term we can expect that data set compilers will voluntarily “migrate” to common methodologies, standards, and terminology. The role of the global service is not to dictate, but to educate through improved communication and demonstration.

Improved user needs feedback to information providers: The global network will allow for users to communicate their information needs to providers. This will help shorten the time lag before relevant information is made available.

Identification of information gaps and duplication: The global network will reveal what information exists and what does not, thus assisting researchers and funding organisations in determining where to focus their attention.

Generation of value-added products: Periodic reports, newsgroups and workshops are a few of the spin-off products that can arise from a global network.

Reduction of dissemination burden and enhanced profile for researchers: Regional nodes will facilitate the dissemination of knowledge by assisting researchers and other information producers in “posting” their findings. Researchers will benefit as the network broadcasts their findings bringing enhanced opportunities for peer review, recognition and funding.

Improved technological transfer: The global network will establish well-defined conduits of communication, allowing for greater exchange of technological advances.

Fosters collective intelligence and knowledge transfer - Recognised access points provide a focal point where forest specialists will be given the opportunity to discuss and exchange ideas on a daily, rather than occasional, basis. (Päivinen et.al. 1998)

5. Technical options

The GFIS principles should not be too technology dependent. For instance, we do not know how long the Internet and websites will exist as they are today. However, we believe that something like it will be available. The basic assumptions are that

- more information will be published using electronic means,

- information users have easier links to electronic information sources,
- publishing information electronically is inexpensive, thus the threshold of publishing will be lower and the amount of information will increase, and
- the main problem for users will not be finding the information, but selecting sources corresponding to their needs.

Richards and Reynolds (1999) discuss the main issues related to the technology behind GFIS in a separate paper.

6. The next step: a working prototype

The next goal of the GFIS is to get a prototype running by the IUFRO XXI World Congress in Malaysia, in August 2000.

To accomplish this goal the following activities will be conducted:

1. Identify and engage a limited group of information providers, including those organisations involved with the Task Force (CABI, EFI, FAO, OFI, WCMC etc.)
2. Develop a draft collection policy for certain types of information (e.g. forest resources, bibliographic, research capacities)
3. Establish the IUFRO 'mother site' and develop an initial 'website locator'
4. Create links, through metadata, to existing websites, illustrated in Fig. 1. as 'free information with harmonised metadata'.
5. Collect feedback from users about prototype service.

At the same time, capacity building and fund-raising for GFIS will continue. Proposals for funding of various sectors of GFIS will be developed.

7. International Mandate

IUFRO's involvement in developing and implementing GFIS is appropriate as IUFRO is *global*, and it is an open ended *membership organisation*. As a consequence, through IUFRO all forest research organisations, world-wide, will have a possibility to comment on the development of GFIS.

In the International Consultation on Research and Information Systems in Forestry (ICRIS), an Austrian and Indonesian initiative in support of the programme of work of the intergovernmental Forum of the

Forests, in September 1998, emphasised the urgent need to improve access to information at all levels.

The Consultation recommended that the Intergovernmental Forum on Forests "endorse and promote the development of a Global Forest Information Service to enhance access to all forest-related information, ensuring that it is accessible to all stakeholders including policy-makers, forest managers, NGO's, community groups and the public at large." (International Consultation ...1998). We wish that IFF III will adopt the recommendations of ICRIS.

8. The Vision: GFIS 5 years from now

USER:

The user should be able to easily find the information he/she needs, maximising 'right hits' and minimising 'wrong' hits. The user should also be able to evaluate the quality of the information and relevance of it for his/her purpose. In addition -which may be an ambitious goal - the user should find the information gaps, and be confirmed if no information exists.

THE IMAGE:

We intend that GFIS will be the 'first stop shop' for forest information on the globe, and will be known by all forestry professionals and members of the public interested in forestry. It is also important that the users know GFIS as source of high quality information

INFORMATION PROVIDERS:

GFIS will help the provider make their information more accessible to a broader audience with minimal effort. The providers will be motivated to improve the quality of information, due to increased feedback and the requirement to describe the quality and reservations regarding their information in the metadata.

FINANCES:

A group of donors have funded the establishment phase of the service. Progressively, as service becomes known as a 'first stop shop' and the main gateway to forest information the service may fund itself through advertisements, for example.

DECENTRALISATION:

There are a number of geographically or thematically oriented 'nodes' facilitating the GFIS activities in their special field.

9. Conclusion

During the short history of the Global Forest

Information Service, it has become clear that there is a need for such a service. There are no other similar initiatives in the field of forestry, but there are activities in other fields, which could provide some expertise to be utilised in GFIS.

The most urgent needs for developing GFIS are

- confirmation of the global ‘mandate’

- fund-raising to cover costs of establishment
- construction of a prototype to demonstrate how GFIS could work in practice

After having feedback from users, based on their experience on the prototype, further decisions on the direction of Global Forest Information Service can be taken.

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<http://iufro.boku.ac.at/iufro/taskforce/hptfgfis.htm>

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Global Forest Information Service

Technical Options Paper

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1. Background

This paper addresses the technical concepts and options available for the implementation of an Internet based *Global Forest Information Service* (GFIS). The technology to implement such a system is not specific to forests or forestry but is generic. However, to make the service both functional and acceptable it must be designed by the forest community for the forest community. The concepts presented in this paper deal with Internet technology, metadata and metainformation, database interoperability and databases of databases. These concepts are fundamentally simple but are frequently presented in an overly complex or opaque manner. These terms and concepts may be unfamiliar to the general reader, but it is hoped that the presentation is sufficiently clear for their inherent simplicity to show through.

This paper provides an overview of some of the basic concepts and, more importantly, a vision of how these could be best utilised to achieve the ambitious goal of GFIS. The paper is not a reference manual but more complete descriptions are referred to in the text and where relevant URL references are given in the final section.

The Internet has, in a very short space of time, had a fundamental impact on the way in which information can be accessed and exchanged, from the global level to the local. The full impact of this technology on the way we work and on society is still unknown. Furthermore, the technology is, in many ways, in its infancy, and GFIS will need to evolve alongside technological developments.

Notwithstanding the potential value of the Internet and associated services, technology must not be allowed to drive the development of GFIS. The latter provides a means of achieving GFIS goals but is not an end in itself. Prominent advocates of knowledge management stress the need for a new balance to be struck between technology, on the one hand, and people and processes on the other, with at least three quarters of effort expended on the people side.

Similarly, in terms of its information content, GFIS should be demand-led rather than supply-driven. This means that GFIS must provide information that is genuinely useful for forest policy and management decision-making, not just data which scientists think are 'a good idea'.

Although based on emerging technology, GFIS must be available to all. This will take time to achieve, but we must try to keep the 'G' in GFIS. This paper deals with technical issues but is mindful of the need for access to be offered equally to all prospective users.

2. The Internet

The Internet and, in particular, the World Wide Web ('web' for short) provides a highly effective mechanism for sharing information among a community of agencies and individuals, and is ideal for implementation of GFIS provided users have appropriate access. A few advantages of the web over 'traditional' methods of communication, such as post, telephone, or face-to-face gatherings, are:

- permanence: web-based services are available 24 hours per day
- immediacy: information may be discovered when needed, without significant delay
- content: text, images, databases, video and sound can all be integrated into a web site—the chief barrier to the design of web-based services is the human imagination
- accessibility: anyone with a web browser can access web-based services with little or no training;
- ownership: decentralised approaches can ensure that agencies maintain full rights and ownership of the information they provide to a web site, modifying it as desired, and
- value for money: considering the features listed above, the development of a web site is an extremely low-cost solution

If these advantages are to be realised fully then contributors to GFIS may require guidance on how to manage their information resources in ways that facilitate access and interpretation by users.

3. A Common Vision for GFIS

GFIS has a number of special characteristics which, taken together, create a unique role within the global forest information community. These are:

- *Intergovernmental approval.* GFIS arises from the Action Points of the Intergovernmental Panel on Forests, it was presented to and approved by the IPF/IFF ICRIS¹ Government Led Initiative,

¹ International Consultation on Forest Research and Information Systems - ICRIS.

7-10 September 1998, Gmunden, Austria. The meeting was sponsored by the governments of Austria and Indonesia in cooperation with IUFRO, CIFOR, FAO and the IFF Secretariat. Subsequent to this IUFRO was called upon to establish a multi-agency task force to take forward a pilot service. This has been achieved.

- *User orientation.* GFIS aims to provide a service to its users. Although many scientists and researchers will contribute to GFIS, the service will be demand-led, not supply-driven. This is a crucial distinction. In practice it means that the content of GFIS will reflect the needs of its users more than the wishes of its suppliers.
- *Focus on countries with greatest need.* GFIS is intended to serve the wide community of professionals working to achieve sustainable forest management globally. However, within this community, certain special target audiences stand out: those in low-income countries; countries with poor access to forest information; and countries with significant forest resources. Individuals who are expected to use GFIS include forest policy analysts, forest resource managers, environmental professionals and consultants, government administrations at various levels, as well as intergovernmental organisations and non-governmental groups.
- *Task force composition.* The IUFRO task force is currently comprised of representatives from:
 - CAB International
 - CATIE, Costa Rica
 - Centre for International Forestry Research
 - Eric Landis, USA
 - European Forest Institute
 - European Joint Research Centre
 - Finnish Forest Research Institute
 - FAO, Forestry Department
 - Forestry Research Institute of Ghana
 - IUFRO, Special Programme for Developing Countries
 - Oxford Forest Institute
 - University Putra Malaysia
 - UN-ECE
 - US Forest Service
 - World Conservation Monitoring Centre

As well as observers from the European Environment Agency and key parts of the European Commission. The aim is to build GFIS in a cooperative, sustainable fashion, avoiding duplication with other initiatives and seeking synergies wher-

ever possible. The task force is growing and it is hoped to include wider representation in future, especially from low-income/high forest countries.

- *Content.* It has been noted that GFIS is intended to promote sustainable forest management. This means that its content must encompass a very wide range of topics, including forest policy, resource management, biodiversity, protection, sustainable utilisation, land use, as well as issues like technologies, technology transfer, training, contacts and sources of expertise. This list is very long and GFIS will begin modestly and grow over time as new information suppliers join the service. The aim is to evolve GFIS into a ‘one stop shop’ for forest information.
- *Catalogue approach.* Rather than centralise information in one location, GFIS will build connections to a wide range of suppliers, forming a global network of distributed information resources. Suppliers will retain full managerial control of their information; indeed they will be expected to actively manage it and improve its quality over time. GFIS will simply provide a ‘shop window’ where users can find the information they need. To do this, GFIS will invest in a master catalogue of information across the network (known as a metadata database or metastore), which users will be able to search and explore as required.

4. Fundamental Concepts

Data, Information and Knowledge

The following distinction is made between data, information and knowledge:

- **Data** (plural) are unprocessed facts or observations which may or may not be meaningful in themselves. They are the building blocks of information.
- **Information** consists of assemblages of data which, taken together, answer a specific need.
- **Knowledge** is more than assemblages of data and information. It is a product of information and human interpretation. Knowledge encompasses the context in which observations were made, and their inter-relationship with other activities.

This distinction can be illustrated with a weather forecast stating ‘tomorrow will be dry and sunny’. This simple piece of information may be based on very

large amounts of underlying data, such as meteorological readings, satellite images and numerical models. When we receive the information we can combine it with all the other things we know about tomorrow and, armed with this knowledge, plan the day's activities. On a day to day basis we are much more likely to use information than the raw unprocessed data.

Metadata and metainformation

Metadata² are 'data about data'. A more precise definition is:

*Metadata provide the necessary auxiliary information needed to understand, locate, or search for data.*³

This can be illustrated using two common examples:

Measurement details

In order to interpret a series of measurements, some background details may be required. These are the metadata associated with the measured values, for example: calibration factor, start time of acquisition, number of samples, sampling interval, and units of measurement.

Catalogue information

To search for a document within a large catalogue, various background details or metadata are useful as follows: index number, title of dataset, date acquired, shelf number or location, contact person, subject classification, and thesaurus terms.

Like Russian *matrioshka* dolls, metadata can be prepared at different scales or levels of detail, depending on how they are intended to be used. At the highest level, a metadata record may be akin to an advertisement for the dataset (or other information resource); at the lowest level it might be technical documentation. We use metadata and metadata concepts all the time but refer to them in other ways, like 'catalogue details', 'descriptions', or 'technical details' etc.

Collection Policy

A collection policy is an integral (if sometimes unseen) part of any information system and is particularly important in the case of metadata systems. The collections policy provides guidance on the type of information which should be stored within the system; in other words it is a transparent definition of the system's content. Key influences on the policy include:

- the scope and purpose of the information system
- the goals and constraints of the maintaining organisation or partnership, and
- pragmatic concerns such as available resources and the stability of the proposed records

The collections policy of a metadata database defines which information resources will be provided with metadata records. An example of the type of policy decision which needs to be made occurs when including metadata records for the most ubiquitous of information resources: books. Records could be prepared for individual books, for small book collections or groups, or for whole libraries (particularly small libraries and those with specific themes). Clearly, the most comprehensive option is to include individual book records, but this is also the most labour intensive. The decision rests on how the metadata database is intended to be used, and what level of resources are available.

One of the early challenges of GFIS will be the preparation of a collections policy that strikes a balance between popular demands for an unlimited range of high quality information on forests, and the potential of information providers to respond in practice. Inevitably, the collections policy of GFIS will start modestly and evolve as service expands, both in partnership and in scope.

Interoperability

In the GFIS context, interoperability is the ability for the user interface to operate with multiple disparate metadata repositories in a transparent manner.

² In the same way that we distinguish data from information, metadata may be distinguished from metainformation. Metadata, then, comprise data about datasets, whereas metainformation is data about any form of information resource, including datasets, but also including organisations, people, documents, services etc. Simply for convenience, however, we shall use the more popular term metadata in both cases.

³ This definition is based on the G7-ENRM 'Meta-information' working group (MITWG) definition, http://ce.gelos.org/free/TWG/MI_definitions.html

Imagine, for instance, that you wanted to find out which forestry interventions were being sponsored in Namibia by development cooperation agencies. You would have to contact all the individual agencies, one by one, and piece the information together yourself. In an ideal world, each of the agencies would use the same methodology to describe its projects, and make them accessible on the Internet such that all the agencies can be included in a single search.

A search of this kind is most easily made when the various information providers have established interoperable systems that share the same structures and standards, including the same semantic base. Interoperability cannot be achieved through technology alone: it must be built in to the knowledge management strategy of the organisations concerned. When designing web-based knowledge management systems, standards can be employed in three main arenas: content, classification and technology.

Standards referring to the structure, transmission and meaning of information are known as content standards. They define how to store and share information unambiguously. Three steps provide a basis for defining content standards:

1. The first step in defining content standards is to identify what types of information need to be shared. In common with many other activities, development cooperation programmes can be resolved into an obvious set of resources, including (but not limited to) organisations, people, documents, events and projects. Information on these resources (which represents a common currency of development cooperation) may be shared in the interests of coordination.
2. The second step is to decide how to structure the information. Element sets may be employed to structure information on each of the resources listed above. These may be derived from leading international metadata standards, including the Global Information Locator Service (GILS), in common with initiatives like GELOS. Where new elements are needed to describe application-specific content (e.g. extended information on projects, or in-house administrative details), these may be added without loss of compatibility with the standard. The only fundamental requirement is the presence of a core (i.e. minimum) set of elements.

3. The third step is to define what the various elements mean, i.e. provide a consistent semantic base. Classification standards are used to organise and categorise information on resources so that it can be discovered and appreciated by more people. For example, it might be helpful to classify documents according to the issues they cover, or to categorise projects according to the country in which they are based.

People need to employ approximately the same terminology and semantic base in order to realise the benefits of information sharing. This allows their resources to be described—and later interpreted—with less ambiguity. The use of universally accepted terminologies to describe information resources furthers the objective of interoperability. Standardised semantics make interoperable searching relatively straight forward. Where data providers use different standards then metadata “cross-walking” can be used to cross from one set of defined terms to another.

Once a commitment has been made to provide open, transparent access to information, the Internet (and the tools and technologies which have grown up around it) is immediately important. It is clearly important to avoid incompatible technologies at this stage. A host of standard-following tools are available to facilitate the process of making information available over the web. Many are described in Christian 1998⁴. Examples include:

- tools to manage content, such as document management systems, groupware and Intranets
- tools to describe resources, such as metadata systems, tagging systems, and robotic document capture tools
- tools to search and discover information, such as web browsers and search engines
- server-side tools to respond to requests for information.

Information server

Internet technologies are developing very rapidly, and attempts have been made to put the essential tools into a single package for the mainstream user, particularly those in governmental organisations with extensive information resources. From these developments the *information server* concept has evolved.

⁴ Christian, E. (Ed.) 1998. *Advanced Search Facility: Framework Specification*. Preliminary draft, 21 September 1998.

An information server, as opposed to a web server, is a web-based system which allows the user community (rather than the web master) to define the content of a database of resources. Resources include entities such as: *people, organisations, services, products, events, documents* and *datasets*.

To submit resources a user must be registered. An unregistered user can freely browse information contained in the database but may not submit new information. Because resources are stored in a database system, users may search the database to locate a given resource on the basis of the resource type.

An information server may also provide other types of facilities within the same site, for example list servers, conventional static web pages, links, Z39.50 gateways, etc.

Centralised and distributed architectures

Different configurations utilising either a centralised or a distributed model can be envisaged. A centralised model would collect or harvest all meta-information to one location. This super-metastore could be duplicated or mirrored at other locations around the world, to improve access. An example of this might be the AltaVista site which contains very large amounts of meta-information and links collected in one place, but in turn this is replicated with some regional variations. A distributed architecture, on the other hand, would leave metadata records, and the responsibility to maintain them, with the data providers. The system would provide the locator information required to find the data providers and the necessary framework within which to work.

5. Required Functionality

Utilising the concepts of the web, metadata (catalogues), database interoperability and valid keywords (semantic standard) we can envisage a coordinated information service which is distributed across the Internet.

There are various functional elements which are desirable. We can consider:

- information server - resource registration
- user networking - list servers, discussion forums etc.
- subject gateway - e.g. like Yahoo!
- document indexing - e.g. like AltaVista
- distributed catalogue searching

We need to make a clear distinction between these different components. However, GFIS can, and

should, be comprised of a combination of them. At an early stage it was decided that GFIS should be more than just a collection of forest related links and that by combining these elements we can propose a system which fosters catalogue and semantic standards, coordination between participating contributors and access to information.

Various demonstrator/prototype initiatives have shown that this approach can be effective.

Types of GFIS Nodes

We can therefore envisage three types of GFIS nodes:

- The ***GFIS Information Server Node(s)***. This type of node (sometimes called the *home* or *mother* website) would provide users with:
 - the ability to register information resources - events, organisations, etc.
 - user networking facilities such as discussion forums & list servers
 - provide a forest subject gateway
 - web page search engine
 - a gateway to distributed meta catalogue searching at the GFIS Catalogue Nodes
- The ***GFIS Catalogue Nodes***. This type of node would have a standardised meta catalogue of information resources accessible through a standard interface using common semantics. All information providers complying with the GFIS cataloguing search protocols constitute a GFIS Catalogue Node.
- The ***GFIS Affiliated Nodes***. This type of node is a forest related web-site which is accessible as a link from the GFIS Information Server Node, but which does not provide catalogue searching.

We would expect there to be a small number of GFIS Information Server Nodes, distributed on a regional basis, a large number of GFIS Affiliated Nodes, which with time will migrate to GFIS Catalogue Nodes with full catalogue searching.

Presented in Figure 1, below, is one design concept. It is based on an information server with gateways to interoperable databases at participating organisations. It should be noted that the multiple database searching is possible via any of the catalogue nodes, whereas the other services are provided only by the information server node(s).

GFIS Information Server Nodes

The information server provides an individual web access point, either for the whole of GFIS or for a region. The GFIS Information Server Node would provide the services described in the previous section.

As indicated previously, information resources may contain information on the following type of resources: people, organisations, services, products/services, events, documents and datasets.

To access the system a user needs only an Internet connection and a web browser. Any unregistered user may browse the system without editing rights.

Any registered user, whether they are an individual, an institution or a company, would be able to register resources with the GFIS Information Server Node. Registered resources may contain links to other resources on the web. The GFIS Information Server Node would maintain a database of registered resources. Resource databases, held at information server nodes, would be limited to registered resources and would not contain copies of the GFIS Catalogue Node catalogues. This will enable information providers to retain complete control, access and responsibility for their own metadata catalogues, and, ultimately, their own information.

GFIS Catalogue Nodes

In addition to the GFIS Information Server Node's functionality describes above these nodes will provide gateways to the more detailed catalogues of forest information providers - GFIS Catalogue Nodes. These GFIS Catalogue Nodes will make their catalogues accessible using a defined protocol, based upon either HTTP⁵ or Z39.50⁶. It is proposed that by defining some simple standards it will be possible to make participating GFIS catalogues interoperable. That is to say multiple catalogues may be searched via a single query and the query will have broadly the same meaning to each catalogue. Thus, via any GFIS node users will be able to query the catalogues of multiple organisations, on different web-sites, in a single search operation; with query results being returned to the user's web browser.

Like a traditional catalogue search, the results of the query are provided at a metadata (card-index) level. However, in many cases the catalogue entries will provide onward links to the actual information resources described. Therefore, having found the reference (card-index) to the information of interest the user will be able to request access to the information itself. Granting access to the information remains within the domain of the data provider, who may, give the information freely, specify conditions of use or

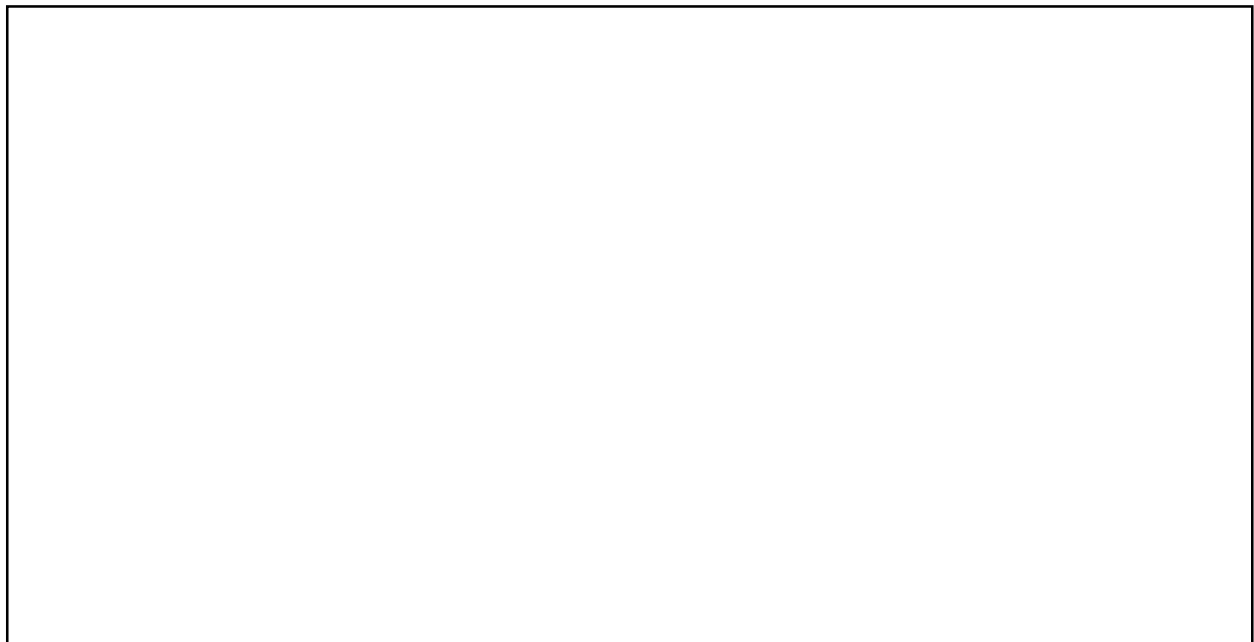


Figure 1. GFIS Functional Diagram

⁵ HTTP - Hyper Text Transfer Protocol

⁶ Z39.50 - An emerging standard for catalogue interoperability on the internet.

charge a commercial or distribution fee, depending on the organisations information policy.

The mechanism which facilitates this interoperability is a *catalogue resource locator database* which enables any GFIS Catalogue Node to be cognisant of all other catalogue nodes, their location on the web, their format etc. Furthermore, conforming to a common metadata standard and common valid key-words greatly enhances interoperability by setting a common framework.

Not all information providers will have created metadata catalogues to describe the resources they wish to contribute (i.e. 'advertise') to GFIS. Many may just have a web page with a series of hyperlinks to key data holdings. These contributors will be GFIS Affiliated Nodes and may or may not migrate in the future to GFIS Catalogue Nodes, providing inter-operable catalogue searching. The GFIS Information Server can manage appropriate links to relevant pages of GFIS Affiliated Nodes.

From both practical and political points of view it may be desirable not to have one GFIS Information Server node but a number of regional nodes dealing with regional and linguistic differences. To harmonise content and avoid duplication, regional information server nodes could synchronise their resource databases on a daily basis and take steps to ensure they are consistent.

6. Example of Structured Catalogue Searching

The following example illustrates how someone equipped with a computer and an Internet connection might access information on forests. Our imaginary user is starting work on a watershed management project in a mountainous region of West Africa and is interested in finding spatial information on vegetation distribution, terrain and climate.

Our user starts naïvely by submitting the word 'forest' to one of the major public search engines and is presented with more than 2 million pages of information. This is far too much to process; much of the information is also irrelevant to their circumstances (pages cover everything from interesting forest issues to football clubs). The user then progressively refines their search by entering 'forest ghana' which generates a list even longer than the first; then '+forest +ghana' (requires both words to be present in all pages) which generates 2,800 pages; then '+forest +ghana +watershed' which generates 529 pages; and

finally '+forest +ghana +watershed +maps' which returns just 91 pages. The last two searches generate a manageable volume of information but they present this in an unstructured way. Surprisingly, many irrelevant pages also remain. Our user now has to sift through many pages and is aware that some important ones may have been missed. Furthermore, they have to access each web site in turn and start browsing through them to find out what is actually available. The experience is sobering.

This example illustrates the power but also the problems associated with conventional search engines on the Internet. Ten years ago such a service would have been impossible. Now that it is possible more and more people are asking: is it good enough?

So, how could GFIS provide an alternative? First, a GFIS node – whether this is centrally or regionally placed – would deal only with forest-related web sites and databases. Although the precise boundary may be difficult to define, this approach would allow GFIS users to search just a small fraction of the Internet eliminating millions of irrelevant pages at a stroke. Secondly, every GFIS node would hold a database of participating member organisations. This could function as a simple list of forest web sites, but could also link to metadata catalogues at those sites and act as a gateway into quality-assured information resources. Queries submitted by users to the GFIS node would be cascaded to the member's metadata catalogue as shown in Figure 2, and have quality-assured results fed back from multiple locations.

Where a GFIS node is aware of the topic specialisations of different organisations, this information can be built into the search process. For example, data provider A may have information on non-wood forest products; provider B on trade volumes; provider C on watersheds boundaries; and provider D on vegetation distribution maps. The GFIS node would cascade our example user's request for information on West African vegetation and mountains to providers C and D only. Grouping providers into topic-based collections, for example non-wood products, agro-forestry, etc., would render searches much more efficient (many providers would probably belong to more than one collection, and some to none at all).

The difference between this approach and our conventional search engine example is the emphasis on metadata. Rather than rely on automated ('robotic') web crawlers to scour the web for information on all topics, GFIS would encourage data providers to gen-

erate full featured metadata records which would enable sophisticated and accurate search. This is significant because search is then based on actual information rather than automated assessments of web pages. The relationship between the user and the information is much more direct. This is not to say that conventional search engines are obsolete; in fact the two approaches can work side by side and may eventually merge.

7. Availability of Internet Technology

The Internet has seen an explosive growth in the last five years, both in terms of the numbers of people using it and the quality of the services offered through it. It has now become a mainstream technology employed extensively across the globe.

However, whilst the Internet is fully accessible in countries as diverse as India, Costa Rica and Uganda,

it remains dominated by North American and European users. This is partly due to the relatively high costs of connection, which are fairly constant across the world, and therefore relatively more expensive in developing countries.

One of the goals of GFIS is to improve access to forest information in developing countries, so that practices and policies can be improved. If individuals in such countries are unable to access the Internet then it will be of little help in fulfilling that aim. Naturally, one solution would be to assist key individuals and organisations in becoming connected, not only to access web-based services, but to increase communication efficiency via email. A programme of capacity assessment and capacity building will be necessary to ensure uptake of GFIS in developing countries, and a proposal for this has been presented to DG Development of the European Commission.

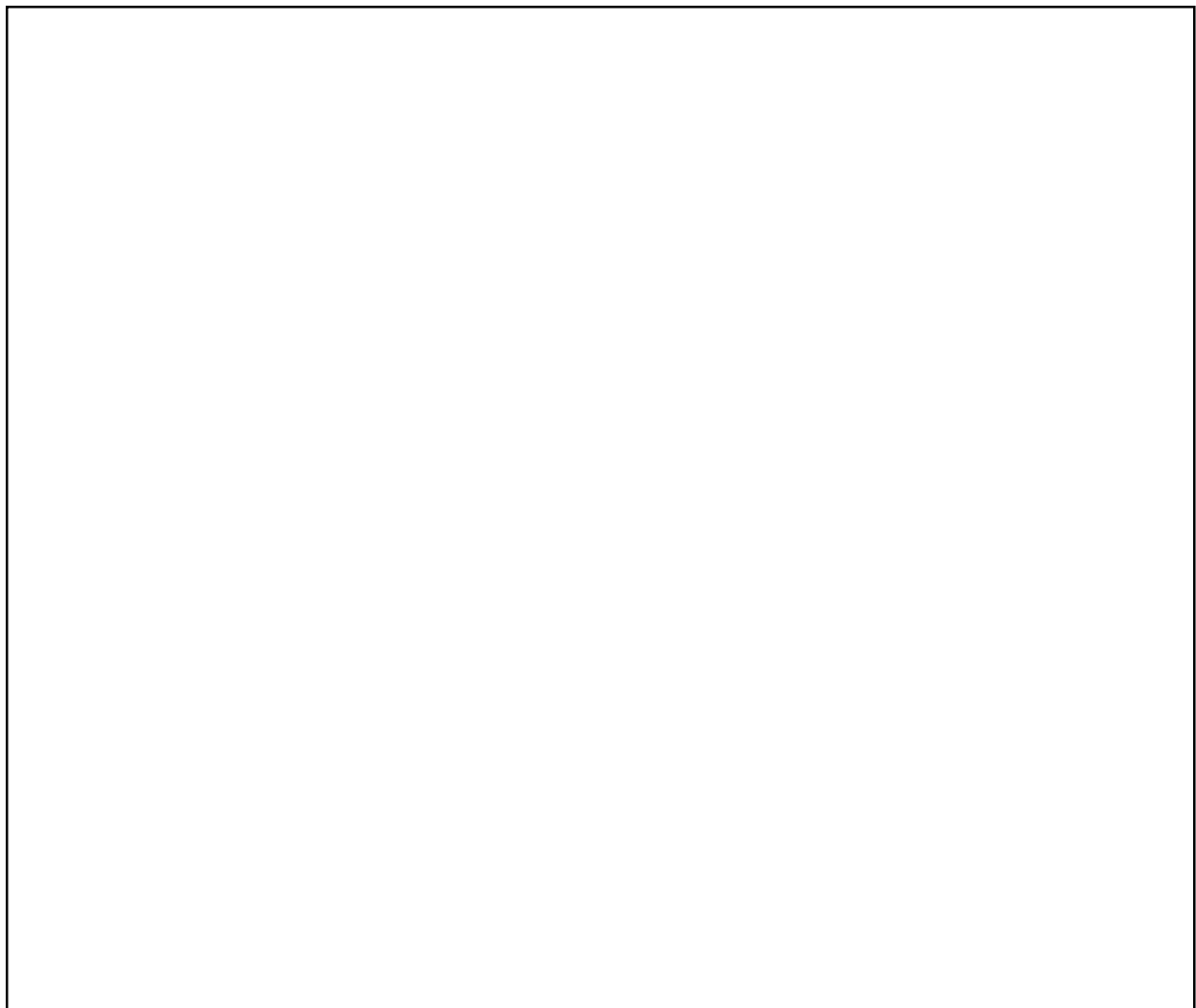


Figure 2. GFIS search strategy

In terms of using GFIS (as distinct from providing information to GFIS), no technologies other than a relatively recent web browser and access to the Internet are required. Where specific file formats such as Adobe Acrobat are used to transfer information, the technologies to view these are available free of charge over the web.

8. Recommendations

An Internet-based Global Forest Information Service based is technically feasible now. However, the technologies involved are still evolving and will take time to fully mature. Rather than be left behind waiting, it is recommended that the forest community begins preparing itself now and starts to lay the foundations of an operational system. While there are obvious technical challenges, much of the ground work will be people-based, for example improved coordination between data providers in the areas of terminology, standards and transmission protocols. Other communities have already embarked on similar initiatives. The forest community should build on these developments and shape them to their needs. There follows a list of recommendations to achieve the goals of GFIS.

The IUFRO Task Force on the Global Forest Information Service recommends that:

1. A GFIS metadata recommendation should be defined and published. This should be simple and generic and should draw from existing or emerging established standards, such as the Dublin Core and the ISO Metadata Standard. Adoption of a specific standard does not preclude migration to currently emerging standards in the future.
2. A GFIS valid key word list should be defined and published, describing a taxonomy of forest topics. Again this should be derived, where possible, from existing classifications such as the Forest Decimal Classification.

3. Both the metadata fields and the valid key word list should contain numeric and mnemonic codes and descriptions. The numeric code would be fixed where as the mnemonic code and descriptions can be translated into different languages.
4. An interoperability protocol should be adopted. It is recommended that both Hyper Text Transfer Protocol (HTTP) and the Z39.50 protocol are acceptable during the development phase of GFIS.
5. A central GFIS information server should be established providing the following facilities:
 - member registration;
 - resource registration, people, organisations, services, meetings, databases, web sites;
 - search by resource type, topic, spatial and temporal coverage;
 - email list server with subject oriented list; and
 - forest web site links.
6. Following the establishment of the central GFIS server a network of regional nodes should also be established, adhering to the same philosophy and sharing the same metadata, valid keyword, and interoperability standards.

9. Acknowledgements

The authors would like to thank all of their colleagues on the IUFRO GFIS Task Force who have all contributed either directly or indirectly to this paper. The authors would also like to thank their colleagues in their respective institutions who have made comments, in particular Margherita Sini of JRC.

10. More Information

IUFRO GFIS Task Force
<http://iufro.boku.ac.at/iufro/taskforce/hptfgfis.htm>
ICRIS
<http://www.iisd.ca/linkages/sd/iufro.html>

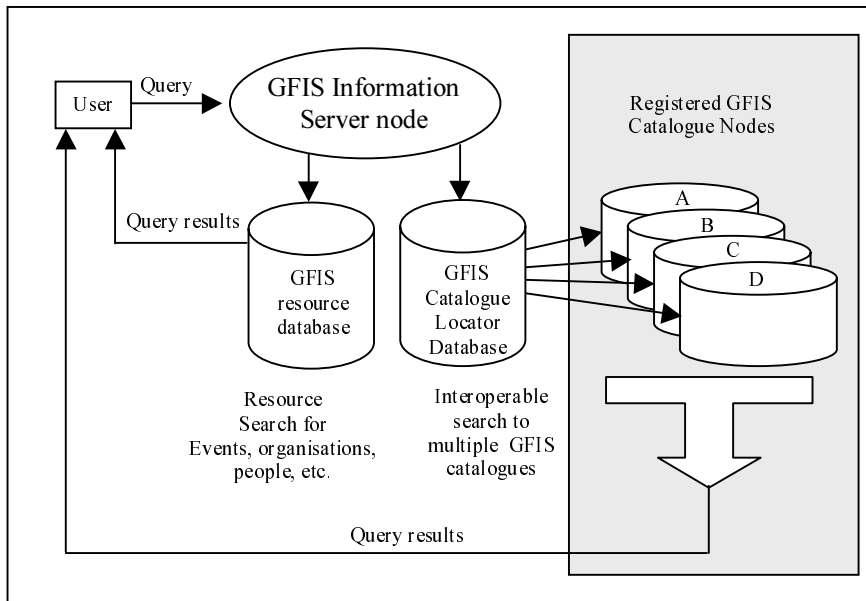


Figure 1. GFIS Functional Diagram. (p. 17)

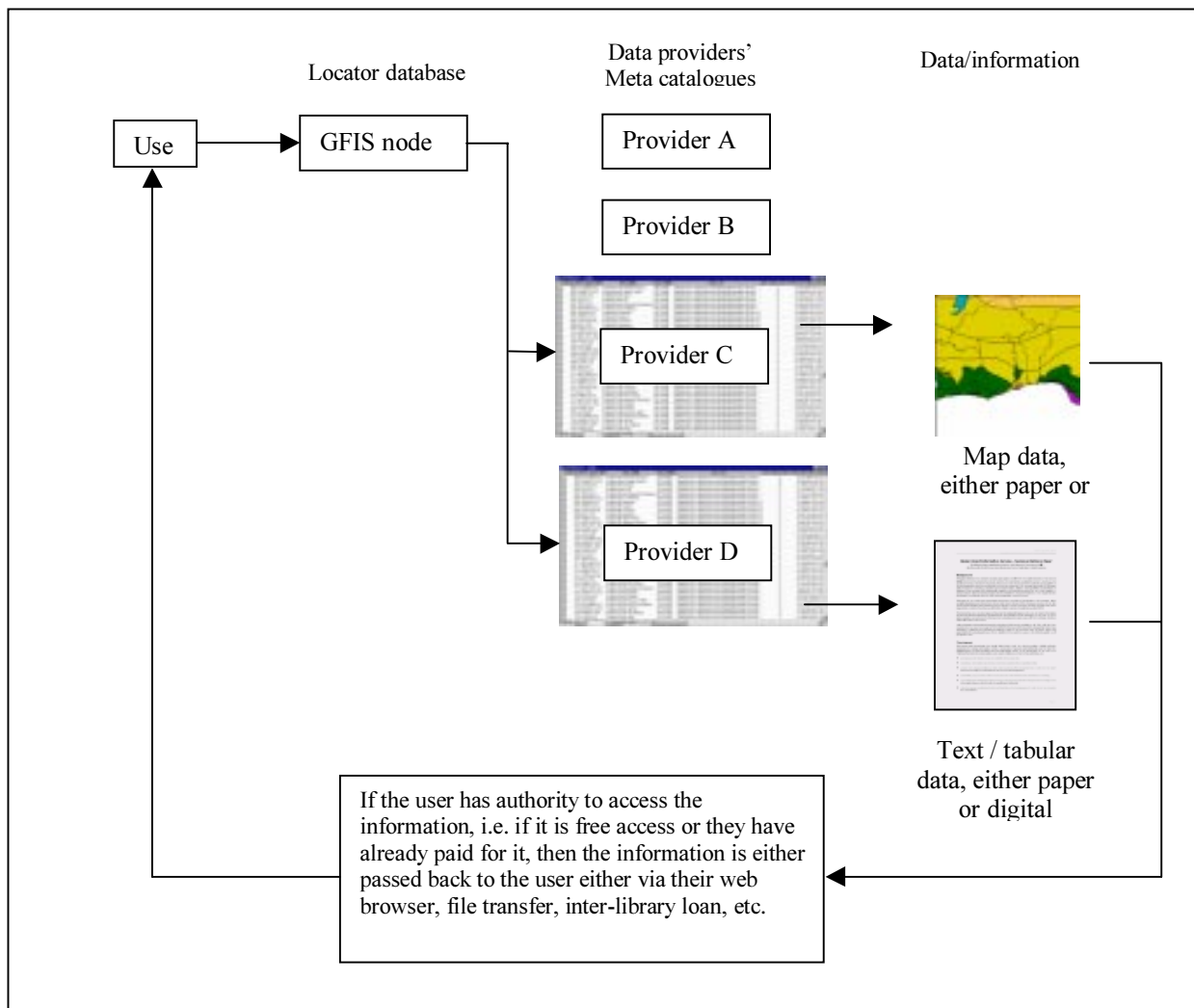


Figure 2. GFIS search strategy (p.19)

Mobilizing Scientific Information on Forests to Promote Their Sustainable Management in ACP Countries

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1. Background

1.1 Relevant Policy

The crucial importance of forests world-wide and the need for them to be managed sustainably is now formally recognized in many international instruments. There is a particular need in ACP countries (Table 1) for access globally to the latest available scientific information on forests and their management. Equally, there is a compelling need for the scientific information generated in ACP countries to be widely disseminated. IUFRO is leading the effort to organize a Global Forest Information Service, which would facilitate access to key scientific information. For ACP countries, this would be a cost-efficient way to build capacities for accessing and providing forest information in electronic format in order to aid in the development of policies for the sustainable management of their forest resources.

Within the last several years, thousands of publications have addressed issues important to sustainable approaches to natural resources management such as: the evolution of ecological concepts, perspectives on the results of past resource management practices, biodiversity inventory and conservation, a renewed emphasis on the concept of sustainability and an on-going debate about what is the appropriate interaction of humans with their environment. The result is an enormous pool of ideas, information, and critiques regarding resource management. For any individual, accessing and synthesizing this information and knowledge is difficult, if not impossible. Within the African context, much of this information is simply not readily available but exists as single copies of unpublished research reports and analyses oftentimes in someone's filing cabinet or desk drawer. This has led to much duplication of effort even within the same country and little transfer of the information into the management and policy arenas.

1.2 The Need for a Scientific Basis for Management and Policy Development

Policy and management decisions are highly dependent on the quality and quantity of the available information and science. The foundation for a sustainable approach to management requires not only sound science, but the right science -- knowledge and understanding of how major ecosystems function,

how they can support and tolerate human use, and how policies and management decisions affect resource use, environmental impacts, and recovery. Improvements in the scientific knowledge that informs decision-making can often greatly improve the development, implementation, and assessment of policies and programs. Decision-makers must turn to science with greater frequency to provide scientifically credible technical guidelines to resolve management and policy problems and issues. In addition, an increasingly involved and informed public is challenging the scientific and technical credibility of management plans and decisions. Information is the common thread for decision-making and it is critical that the most scientifically sound information is available to all stakeholders.

1.2 The Need to Establish a Global Information Service

For over a decade it has been known that better access to forest information would assist policy-makers, researchers, forest managers, conservationists, and others in their efforts to address society's needs regarding sustainability of the world's forest resources. Improving access to forest information was formally recognized as a priority by the United Nations Conference on Environment and Development in 1992 when it stated in Agenda 21, Chapter 40: *Existing national and international mechanisms of information processing and exchange, and of related technical assistance, should be strengthened to ensure effective and equitable availability of information generated at the local, provincial, national and international levels ...* ”.

The role of electronic information systems was also noted in Chapter 40: *“Countries, international organizations, including organs and organizations of the United Nations' system, and non-governmental organizations should exploit various initiatives for electronic links to support information sharing, to provide access to databases and other information sources, to facilitate communication for meeting broader objectives, such as the implementation of Agenda 21, to facilitate intergovernmental negotiations, to monitor conventions and efforts for sustainable development, to transmit environmental alerts, and to transfer technical data”* (UNCED, 1992).

Table 1. Signatories to the Lomé Convention

Africa		
Angola Benin Botswana Burkina Faso Burundi Cameroon Cape Verde Central African Republic Chad Comoros Congo Congo Brazzaville Côte d'Ivoire Djibouti Equatorial Guinea Eritrea	Ethiopia Gabon Gambia Ghana Guinea Guinea Bissau Kenya Lesotho Liberia Madagascar Malawi Mali Mauritania Mauritius Mozambique Namibia	Niger Nigeria Rwanda Sao Tomé & Principe Senegal Seychelles Sierra Leone Somalia South Africa Sudan Swaziland Tanzania Togo Uganda Zambia Zimbabwe
Caribbean		
Antigua and Barbuda Bahamas Barbados Belize Dominica	Dominican Republic Grenada Guyana Haiti Jamaica	St Christopher and Nevis St Lucia St Vincent & the Grenadines Suriname Trinidad and Tobago
Pacific		
Fiji Kiribati Papua New Guinea	Solomon Islands Tonga Tuvalu	Vanuatu Western Samoa

There are currently a number of sources through which forest-related information can be accessed. Increasingly people are using the World Wide Web to access the information they need, and a number of organizations now maintain Websites with forest information. Among the more prominent international agencies that maintain forest information on the Web are FAO, JRC, EFI and WCMC. For the information-seeker it would be more time-efficient if they were

able to access integrated information through one Website. Additionally, if these organizations could work together to produce information standards and criteria it would lead to less confusion among the information users.

Many of the information users are in developing countries that have tropical forests. These users are not restricted to countries with closed moist forests

but include nations with more open, dry and savannah-type ecosystems. The current issues in forestry such as certification of sustainably managed forests, the economic value of non-timber forest products and the management of forests for biodiversity conservation are particularly relevant to agencies in developing countries, and these will be addressed in full by the proposed Information Service. Among the organizations that will be users of the Service are national and international policy makers, institutes of higher learning and research, students, NGOs, intergovernmental agencies, regional organizations and others, as shown by the Users' Needs Analysis carried out by WCMC.

The Intergovernmental Panel on Forests in 1997 re-introduced the importance of gaining access to information when it stated: *The Panel emphasized the need to review and improve information systems. Attention should be given to world-wide access to information systems that would encourage effective implementation of national forest programmes, increased private-sector investment, efficient development and transfer of appropriate technologies, and improved co-operation* (CSD, 1997).

In this spirit, the International Union of Forestry Research Organizations and the USDA Forest Service co-sponsored the World Forest Monitoring Workshop in 1996 to address the challenges of improving national monitoring efforts. The workshop participants concluded that an Internet-based information system was needed, which would be simple, decentralized and adaptable to changing information needs (World Forest Institute, 1996). Subsequent discussions between IUFRO, CIFOR, WCMC, WFI, FAO, OFI and EFI, have led to the idea of a consortium operating a system for forest information on the Internet, with the suggested name of:

Global Forest Information Service (GFIS).

To advance this idea, CIFOR hosted a workshop on "Provision of forest information on the Web" at the XI World Forestry Congress in Turkey in 1997, where the concept of a GFIS was well received and the need for a task force to develop it was identified.

Subsequently, the Executive Board of IUFRO directed IUFRO Group 4.02 to organize a *Task Force* on information with a view to contributing to the IFF

intersessional meeting "International Consultation on Research and Information Systems in Forestry (ICRIS) in September 1998. As a result of the universal support by the experts for GFIS at the consultation, IUFRO formally established a Task Force with the following mission statement:

The mission of the Task Force is to develop a strategy for an Internet-based metadata system that provides co-ordinated world-wide access to forest information to assist meeting national and international efforts in achieving sustainable forests.

The resulting system will provide multiple benefits to information users and providers including, facilitating user-friendly access to a greater amount of information, and improving the dissemination and quality of forest-related data and information.

The system will provide for access to electronically and non-electronically available information on; forest resources, forest policy, criteria and indicators for sustainable forest management, research activities, and other timely and relevant issues.

In the initial phase of work, the task force will conduct activities necessary to develop a plan for implementing the system. These activities include, but are not limited to, the following:

- Designing and carrying-out limited feasibility studies.
- Developing the system's "collection policy."
- Developing budgets, including identifying possible revenue streams and expenses.
- Identifying and resolving technical and legal issues.
- Identifying candidate institutions for hosting thematic or regional nodes

In follow-up phases, the task force will conduct activities to ensure successful implementation of the system. These activities may include the following:

- Designing necessary pilot programs.
- Advising and assisting with regional node activities including technical and financial needs.

- Conducting activities necessary for promotion and use of the system.
- Monitoring and reporting on the progress of the system.

2. Building GFIS Capacity in ACP Countries

2.1 Objectives

The overall objective should be to build capacity within the ACP countries to allow them to fully participate in a global network of forestry institutions providing broad access to science and research on forests and their utilization using the World Wide Web. Timely, credible and transparently produced information is essential to formulating policies and strategies to promote the wise and sustainable use of forests. ACP countries can benefit significantly from increased infrastructure, training and networking in electronic information data and retrieval. A consortium of international forest information providers is prepared to join hands with key partners in the ACP countries to undertake a number of important actions that will promote the greatest possible involvement and engagement of ACP countries in the international dialogue on forests and to develop the capacity of ACP countries to form scientifically and technically sound forest management policies.

The credibility of the envisioned information service, Global Forest Information Service (GFIS), and its protocols can be greatly enhanced if developing countries such as member states of the ACP region are active in the task force from the beginning. Equally, early and visible participation of ACP country institutions in a GFIS will reinforce the intent of the service to be a highly decentralized system. While the GFIS will be accessible worldwide, it will be of particular interest to tropical forest countries because of the specific mapping projects of the members of the Service (e.g. the TREES project of the JRC), the work that FAO puts into the representation of tropical countries in its Forest Resources Assessment (e.g. giving fragmentation, forest protection and ecological zone information) and the tropical forest projects of WCMC, and will lead to greater accessibility of existing scientific information and analyses. It is crucial that ACP scientific institutions participate early in development of the GFIS if it is to be a global success.

2.2 Mechanisms to Ensure ACP Country Participation

Only by establishing input nodes within the ACP countries will they be able to be full and active participants. All nodes should have the following mandates: (1) inputting research information, publications, and data and (2) providing networking opportunities for topic specific networks to foster coordination and cooperation across Africa in areas of critical information needs (nodes will be initially established in the Pacific and Africa). The nodes should: (1) compile, organize and provide in electronic form the existing research information sources concerning the state of African and Pacific forests, their conservation, their utilization and their management; (2) provide that research information in forms useable by policy makers and end users; (3) foster the free exchange of research information within and between ACP countries; and aid in the development of web-based topic specific scientist networks (Table 2).

2.3 Capacity building

Capacity building will apply at two levels. Almost all nodes involved in GFIS will require capacity building, insofar as compliance with database protocols is concerned. Many sites should be able to comply with required protocols by following clear guidelines defined by the GFIS Steering Committee. Other levels of capacity building will require start-up facilitation in terms of computer provision, Internet access, training, web-site development and digitization programmes. One of the priorities of GFIS will be to ensure that those with poorly developed or non-existent Internet facilities or skills will not be prevented from participating in the global forest information community. Funds and training will need to be part of the step-wise approach to building GFIS as a truly global system. In this, donor agencies play an important role (Table 3).

While it is recognized that GFIS will be at the core an Internet-based service, this does not mean that all forest information to which the user is directed will be in electronic form. GFIS is essentially an *electronic navigation tool* leading to a variety of types of information, many of which will be in print form. Books, journals, maps, newsletters, botanical specimens, plant genetic material in seed banks and the like, and indigenous knowledge will all remain a vital part of the information chain and must be made

Table 2. Roles and Responsibilities of Regional Nodes

- 1) Developing and maintaining technological arrangements for successful electronic linkages with regions information sources and users
- 2) Providing system set-up and technical assistance to multiple users of regional system
- 3) Providing periodic GFIS training to region's information providers and users
- 4) Identifying and resolving gaps and duplications of forest resource information
- 5) Serving as liaison within region for acquiring linkages to relevant information and data sets
- 6) Developing and enforcing regional collection policy and metadata standards
- 7) Conducting workshops and conferences and other educational
- 8) Promoting GFIS to potential users within region
- 9) Maintaining institutional and technological arrangements with GFIS managers and other regional nodes.
- 10) Writing and distributing appropriate documentation for GFIS regional users and information providers including, collection policy, user's manual.

Table 3. How GFIS Will Continue to Build Country Capacities for Sustainable Forests

- 1) Greater access to relevant data/information
- 2) Enhanced broadcasting of relevant data/information
 - a) providing support to research programs
 - b) responding to international/national reporting requirements
- 3) Known centers (nodes) for GFIS-related activities
 - a) periodic publications
 - b) workshops, conferencestraining centers for information programs and other emerging issues

accessible to as wide an audience as possible. Increasing awareness of these non-electronic sources of information will lead to increased demand for them and it will be necessary to find ways of digitizing such information to achieve fast and effective delivery systems.

2.4 Expected Results and Benefits to ACP Countries

General improvement of information flow, policy development, and sustainable management of forests throughout ACP countries specifically by:

- Improving access to reliable research information on forests to assist decisions on their sustainable management.
- Building capacity in ACP countries to manage, disseminate and access scientific information on forests.

- Sharing experience and good practice in information management between ACP countries.
- Enhancing integration and comparability between national research data on forests throughout the ACP countries.
- Encouraging feedback from users to providers of research information to improve its usefulness and applicability.
- Developing and enhancing web-based research networks for synthesizing currently available information and to help develop research strategies to fill existing gaps in our knowledge crucial for sustainable forest management.

2.5 Linkages with Other Efforts

- *Forestry Research Network in sub-Saharan Africa (FORNESSA – FAO and IUFRO-SPDC):* In reply to the expressed needs and to the requests

received from countries, the Forestry Department of FAO and IUFRO-SPDC undertook to formulate a regional project framework involving interested countries and sub-regions of Sub-Saharan Africa. That project aims at capacity building, development of collaborative research activities and networking; the ultimate result of that project would be the creation of an association of forestry research institutions in Sub-Saharan Africa, a federating mechanism across language boundaries, which will strengthen and build on sub-regional networks already active such as CORAF in Central and West Africa and SADC-FSTCU in Southern Africa

- *African Academy of Sciences Networking Project* (Nairobi, Kenya): The academy's capacity building in forestry research is starting a research network (AFORNET) that will initially focus on sustainable forest management and biodiversity, community-based forest management, and reforestation/rehabilitation of degraded and saline lands. This SIDA funded project comes under the FORNESSA framework and is closely coordinated with IFS, FAO, and IUFRO-SPDC efforts.
- *Regional Environmental Information Project (REIMP)*: The Congo Basin Rainforest (CBR) is the second largest contiguous primary rainforest in the world. In the region, several donor agencies are involved in efforts to assist national authorities to develop and set up strategies related to the Convention on Biological Diversity (signed and ratified by all of the project countries except Gabon). The main goal of REIMP is to improve and strengthen planning and management of natural resource in the Congo basin by providing the various stakeholders with appropriate environmental information. The project has four specific objectives: (i) ensuring information circulation and adding value to existing initiatives, (ii) fostering involvement of decision-makers in environmental information use and facilitating sound land use planning in the Congo Basin, (iii) providing users with environmental information meeting their demand, and (iv) strengthening national capacities.
- *European Tropical Forest Research Network (ETFRN)*: ETFRN was established on the initiative of the Directorate General XII (Science, Research and Development) of the European

Commission, in October 1991. ETFRN has member institutes in 16 European countries. ETFRN aims to contribute to the international efforts towards wise, sustainable management and protection of (sub)tropical forests and woodlands. For this purpose, ETFRN creates different fora for information exchange and discussions; the network also gathers data and publishes information on European institutes and projects involved in tropical and subtropical forest research.

- *Miombo Network Initiative* (Harare, Zimbabwe): The network serves as a vehicle for mobilizing and enhancing regional scientific capacity in global change research in sub-equatorial Africa. This includes assessing the current distribution of land cover and land use in the miombo region and modelling land cover changes in Southern Africa. This network will provide critical information concerning a large portion of dry woodland habitat in south-central Africa. Again, the proposed project will complement Miombo Network and help disseminate its findings.
- *Certification Information Service* The CIS project, coordinated by EFI, contributes to the GFIS by collating information on forest laws, regulations and initiatives towards sustainable forest management in Europe and in ACP countries. Additionally it collects and distributes information on trade and maintains a database of literature about certification. It has links to other databases where data about the area of certified forests and maps displaying their locations are available. The proposed project will give ACP countries access to the latest information on certification issues around the world.
- *The JRC TREES Project* is developing a Tropical Forest Information System (TFIS) for the storage, analysis and retrieval of both spatial and non-spatial information on tropical forests. This system operates with spatial data at the pan-tropical and regional scales. Activities in 1999 include collaboration with the EU funded ECOFAC projects in Africa for provision of GIS data and tools at the regional and local scales. Central to the system is a metadata database structure for cataloguing data holdings. Work has commenced on developing a simplified system for the WWW. The TFIS concept and activities

are considered by both JRC and IUFRO to be complementary. TFIS is primarily a spatial information system whereas GFIS encompasses all types of forest information.

- *EC/FAO Partnership Programme on Data Collection and Analysis for Sustainable Forest Management: Linking National and International Efforts*: This partnership programme brings together the EC DG VIII, the FAO Forestry Department and the African and Caribbean ACP countries through a series of regional workshops, information networks and outlook studies to analyze data needed for sustainable forest management and to accumulate what is known about forest resources and their utilization at the national and international levels. This partnership's work programme includes activities to broadly share and update this information through the FAO web presence. The thrust of the programme is to build capacity in the ACP countries to collect and analyze information fundamental to sustainable forest management in the context of the country's own resource and economic situation.
- *Tree-Link*: The purpose of the project is to ensure that Asia Pacific Association of Forest Research Institutions (APAFRI) members will have sustainable support systems for regional forestry information exchange and networking, enhanced human resource capabilities in information services, forest renewal, conservation and domestication, and improved policy formulation and implementation. The expected results of the project are: 1) marketable standard based training programs to improve the quality of research in APAFRI's forest renewal priority areas and to facilitate the dissemination and application of forest research; 2) improved systems of exchange and dissemination of applied forest renewal research information and results between APAFRI member institutions and forest stewards; 3) a gender balanced cadre of forest research professionals and graduate students with strong links to the field users of forest renewal research results; 4) increased capacity of APAFRI to serve sustainable, financially independent network Coordinator and contract service broker to forest member collaboration.

2.6 Potential Activities in Developing Capacity in ACP Countries

- Establish project advisory committee, to be drawn from the five selected regional scientific institutions, EC, IUFRO and others as appropriate (to be organized and managed by IUFRO-SPDC).
- Regional institutional representatives, participating as members of the GFIS task force join in the adoption of a set of classification and metadata standards that would be embraced by GFIS members to code their information resources.
- Design and build GFIS interface to provide access to forest research information. This interface is founded upon the set of common classification and metadata standards embraced by the GFIS task force (see GFIS technical options paper by Richards and Reynolds (1999)).
- Establish regional nodes for GFIS within ACP region.
- Provide appropriate training and capacity building. Acquire needed software and hardware. Deploy this equipment to the regional institutions. Load information resources and debug systems.
- Foster the establishment of information networks and provide support to participants wishing to provide information.
- Modify facilities in response to feedback.

3. Conclusions

The crucial importance of the world's forests and the need for them to be managed sustainably is now formally recognized notably in the Convention on Biological Diversity (CBD)(see Article 17 and the Proceedings of the November 1996 meeting)) and the Climate Change Convention. The Forest Principles (e.g., Principle 2c) and the Intergovernmental Panel on Forests (IPF) have been established specifically to address the wise use and conservation of forests at an international level. IPF "*invited relevant international organizations and international financial institutions to review and initiate the development of improved forest information systems with a view to enhancing coordination and data sharing among interested parties regarding the implementation of national forest programmes, ODA programming, the provision of new and additional financial resources,...*"

Much of the groundwork for building capacity in ACP countries has already been completed: contact has been made with the relevant international forest information providers, a prototype of the GFIS has been launched on the Web, a Users' Needs Analysis has been carried out, and enthusiastic agreement in principle to the concept of the GFIS has been received from FAO, JRC, EFI, OFI, IUFRO, CIFOR and WFI. This Service will answer needs highlighted by the Convention on Biological Diversity, the Intergovernmental Panel on Forests, the Convention on Climate Change and the Forest Principles. Without access to good information on forests, policy-makers, forest managers, economic planners and researchers from many disciplines do not have a solid basis on which to operate. This is particularly important in tropical forest countries, where forest change is happening most rapidly. GFIS will serve the needs of a great variety of people, and ultimately lead to a better understanding of the world's forests and management impacts, both positive and negative.

The use of digital mapping and the Internet now give the opportunity to integrate and distribute forest information routinely. Common users include: UN organizations, international conventions, multilateral and bilateral donor organizations, international and national NGO's, intergovernmental mechanisms (e.g. the EC), the corporate sector, national governments, universities and research institutes including the CGIAR network, and the public. The GFIS will contribute to the clearing house mechanism being established by the CBD to promote international technical and scientific cooperation.

GFIS and its regional nodes will be a valuable information resource for decision-makers in tropical forest countries, and others. In particular it will provide forest information and generating integrated information products. The use of the World Wide Web is rapidly increasing in the developing countries, and GFIS will give agencies in those countries an opportunity to use information that has up to now only been accessible through inter-library loans or after long searches through foreign institutional facilities.

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