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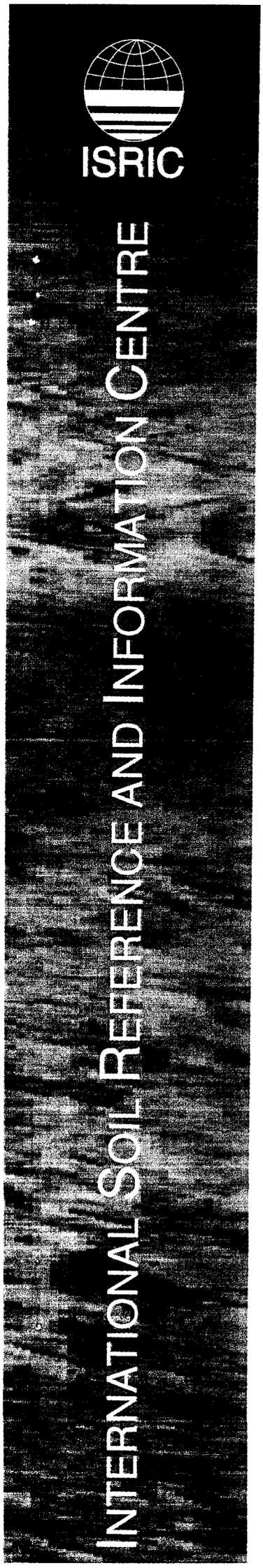

Sustainable Land Management for Agricultural Production in Hainan Province (Hainan-SOTER)

UNDP project CPR/96/105/A/99

USER GROUP ENQUIRY FOR THE HAINAN SOIL AND TERRAIN INFORMATION SYSTEM

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HAINAN - SOTER REPORT 3

Report 98/02

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November 1998

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Acronyms

CATAS	Chinese Academy of Tropical Agricultural Sciences, Danzhou
CICETE	China International Centre for Economic and Technical Exchanges, Beijing
DA	Department of Agriculture, Haikou
DEM	Digital Elevation Model
DER	Department of Environment and Resources, Haikou
DF	Department of Forestry, Haikou
DLA	Department of Land Administration, Haikou
DWC	Department of Water Conservation, Haikou
ECD	Economic Cooperation Department, Haikou
FSPI	Forestry Survey and Planning Institute of Hainan Province, Haikou
GIS	Geographic Information System
HBSM	Hainan Bureau of Surveying and Mapping, Haikou
HMB	Hainan Meteorological Bureau, Haikou
HPPB	Hainan Provincial Planning Department, Haikou
HPGC	Hainan Provincial Geomatics Centre, Haikou
ICER	Information Centre for Environment and Resources of Hainan Province, Haikou
ICT	Information Communication Technology
ISRIC	International Soil Reference and Information Centre, Wageningen
ISSAS	Institute of Soil Science, Academia Sinica, Nanjing
SOTER	Global and National Soils and Terrain Digital Databases
SOTER-Hainan	The Soils and Terrain Information System of Hainan Island at a scale of 1:250,000
SOTER-Country	The Soils and Terrain Information System of Four Countries at a scale of 1:50,000
UNDP	United Nations Development Programme, Beijing

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1 INTRODUCTION

1.1 Project background

Hainan-SOTER is the short name for the UNDP supported project on "Sustainable Land Management for Agricultural Production in Hainan Province". Full details of this project are given in the project document formulated in March 1997, of which relevant sections are summarized here.

The agricultural sector of Hainan Island is in a stage of rapid transition. Reasons for these changes are three-fold. Firstly, national and provincial policy plans aim at the intensification and diversification of the agricultural sector, focusing on a higher production of off-season vegetables, tropical fruits and quality seed. A strong market pull for these products comes from China's mainland, and partly from Haikou's expanding urban areas and export abroad. Secondly, other land uses and new agricultural land will be required, resulting from private, national and foreign investments in the agricultural sector. Thirdly, the environmental protection of the land resources needs to be strengthened, through the protection of primary and secondary forest reserves, and the promotion of sustainable land management practices. The latter with focus on the conservation of soils of the central mountainous and hilly land of Hainan Island.

The agricultural sector comprises a range of land utilization types. Family farms practising slash-and-burn agriculture in the mountainous area. Family farms growing rice and upland crops in the flat and low hill lands, which include collective farming on communal village land. State farms, mainly established in the late fifties to manage rubber plantations and to grow sugar cane. More recently commercial plantation and forestry enterprises are being established.

The agricultural support sector includes various entities. Governmental administrative, planning and specialized technical agencies at provincial and county level. Governmental education, research and extension institutions, having its nucleus in Danzhou with The Chinese Academy of Tropical Agricultural Sciences (CATAS) and the China University of Tropical Agriculture. It is expected that an increasing number of private agro-chemical and agro-equipment enterprises will enter the agricultural support sector.

To support the current and anticipated land use changes the government stimulates projects which strengthen the planning and agricultural support sector.

1.2 Project objectives and implementing agencies

The objectives of the Hainan-SOTER project include improved dissemination of soil and terrain information to the agricultural support sector and the introduction of new sustainable land management technologies for farmers. The main project targets are:

i) The establishment of a soil and terrain information system at CATAS, further referred to as the Hainan-SOTER Information System. This system will make available information in a digital form suitable for consultation and analysis by a wide range of user groups.
ii) The installation by CATAS of sustainable agriculture demonstration sites in four counties representing major agro-ecological conditions of Hainan Island.

This report deals with an user group enquiry for the Hainan-SOTER Information System. This soil and terrain information system will include overview information at provincial level at a scale of 1:250,000 (shortly indicated as SOTER-Hainan), and detailed information at county level at a scale of 1:50,000 (indicated as SOTER-county). The complete system will be established at CATAS, for which purpose a database and GIS team will be formed and trained. The Institute of Soil Science - Academia Sinica (ISSAS) in Nanjing and the International Soil Reference and Information Centre (ISRIC) in Wageningen, will provide technical assistance to CATAS. The up-dating and expansion of the information system will be a task of CATAS, after the project has been finalized. Cooperation between CATAS and the Hainan Provincial Geometric Centre (HPGC) will focus on basic training in databases and GIS, and to guarantee information exchange between the two organizations. The main purpose of the information system is a strengthening of the information base of the provincial and county agricultural support sector. Furthermore the information system will help to identify areas to which the results of the demonstration sites can be extrapolated, and facilitate the selection of suitable land uses. Practical applications of the information system, foreseen in the project document, are assessments of soil fertility, land suitability and soil erosion risk. The project will prepare wall charts showing practical applications, an atlas with about 15 thematic maps on various soil and terrain characteristics, and a CD-ROM containing all maps and the database files. At present ISRIC anticipates that the CD-ROM should also include a so-called 'Viewer'. This is a software program, which enables the user to explore the data and information in the database in a user-friendly manner.

Figure 1 visualises the main components of the information system and the user groups of the project.

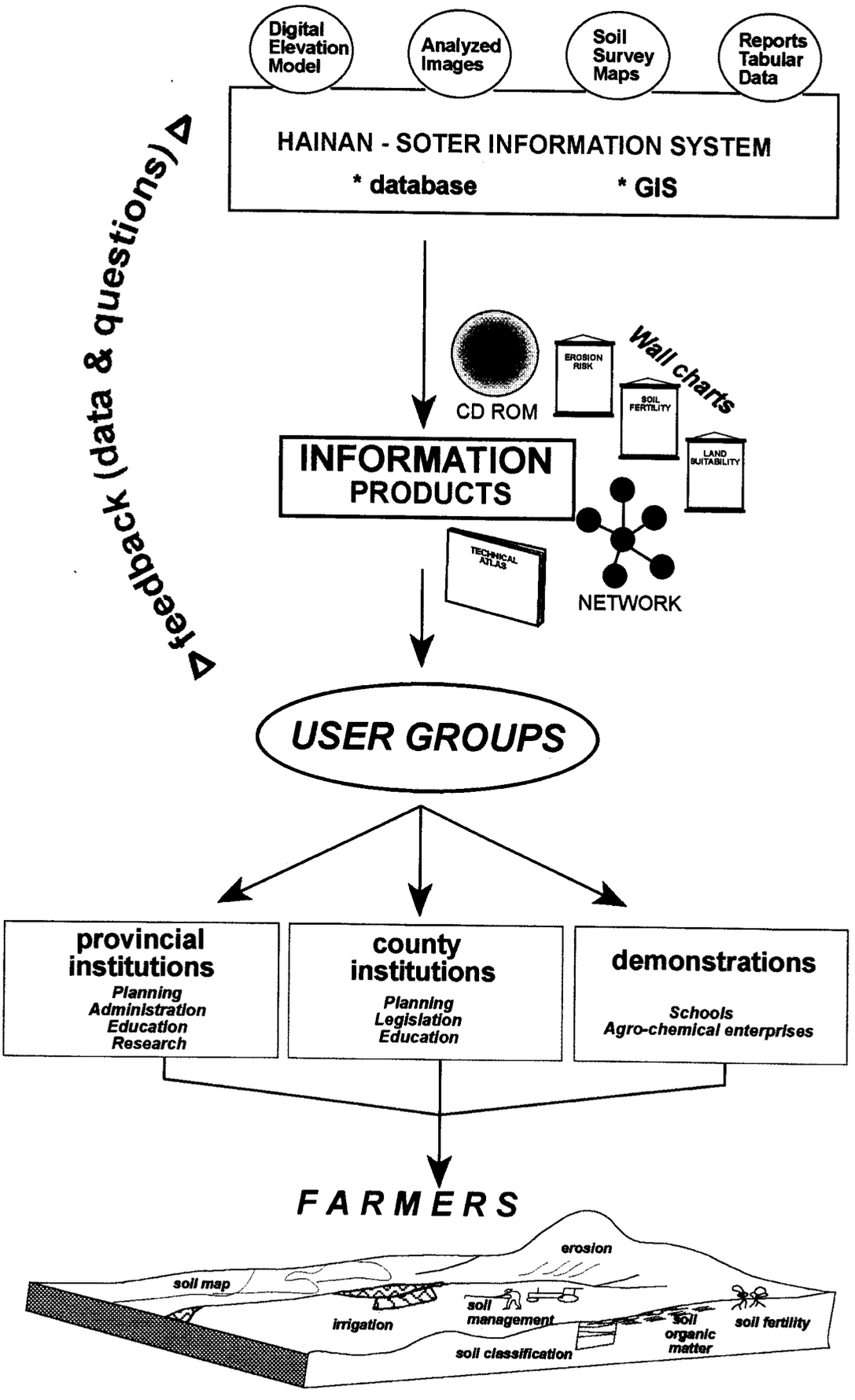

Figure 1 Main components of the Hainan-SOTER Information System

1.3 User groups, information products, what is needed?

The general complaint about soil and terrain information products as produced in the past - the "classical" soil map and accompanying report - is that this information is not understandable for non-soil specialists because of excessive use of scientific jargon. This certainly is one reason why this information is not or insufficiently used in agricultural planning and agricultural production. However, there is an increasing awareness that such information products failed, because they were developed without consulting potential users. In addition, the information of past soil surveys is currently only available in a printed format, unsuitable for the present day Information Communication Technology (ICT), being established at Hainan Island. It is one of the project objectives to collect and store this analog information in a computerized database and Geographical Information System (GIS). The practical applications and information products, mentioned in Section 1.2, were identified during the project formulation phase, which was based on a rapid consultation of CATAS key staff and several planning documents (Environmental Resources Limited, 1991; Government of Hainan 1995; Government of China 1995; UNDP, 1996). An User Group Enquiry is one of the first project activities to further analyse the needs of the main user groups of the Hainan-SOTER Information System. This Enquiry includes a verification whether the now envisaged information products will meet the expectation of the potential users and identify other changes in the demand side.

The active involvement of the main potential users groups in the development of the Hainan-SOTER Information System, and its outputs, is a cornerstone of the project. Users will have a role in the identification of the main problems to be targeted by the project and in the design of the proposed information products. This will facilitate functionality and efficient use of the information system and its information products by all interested parties.

The present focus of the project is on the establishment of the provincial database of Hainan on scale 1:250,000. The following potential user groups at provincial level were identified by CATAS:

Provincial Department of Planning
Provincial Department of Agriculture
Provincial Bureau of Land Administration (Provincial Department of Construction)
Provincial Department of Environment & Resources
Provincial Department of Water Conservation
Provincial Department of Forestry
Provincial Geometric Center of the Provincial Department of Surveying
Hainan Meteorological Bureau (data supplier to the information system)

At a later stage in the project, user groups at country level will be involved in the development of the required information products.

2 METHODOLOGY

The user group involvement in the Hainan-SOTER project is scheduled in three stages. Firstly, at the start of the project an User Group Enquiry has been made. This enquiry includes the participation of key persons in the project Inception Workshop, followed by a consultation of the user groups through questionnaires and interviews. Secondly, in the course of the project the user group will be consulted on intermediate results. Thirdly, at the end of the project the information products will be presented and discussed in a workshop with the user groups.
This report includes the User Group Enquiry at the start of the project. For this enquiry the following activities are realized:

- An invitation letter for the Inception Workshop was sent to the user groups listed in Section 1.3. The contact person and address information of the user groups is given in Appendix 1. It included information on the project goals, activities and results, and a questionnaire (Appendix 2).

- During the Inception Workshop one workshop session was scheduled for the user groups to express their interest in the project.

- Shortly after the Inception Workshop interviews with the users were held in their respective institutions. The questionnaire, see Appendix 2, was also used as a checklist for these interviews. Except for the Provincial Department of Water Conservation, all other Provincial User Groups residing in Haikou, could be interviewed. The results of the visits are presented in chronological order in Section 3.2.

- A draft report with the results of the User Group Enquiry was produced one month after the Inception Workshop. The English version and Chinese translation were sent, together with the second questionnaire (Appendix 3), to the User Groups listed in Section 1.3. The comments of the User Groups were included in the present report.

3 RESULTS

3.1. Inception Workshop and Questionnaires

All representatives of the user groups participating in the Inception Workshop indicated their interest in the Hainan-SOTER project. Before the Inception Workshop no answers were received by CATAS on the questionnaire distributed before the Workshop (Appendix 2).

After the distribution of the draft version of the report "User Group Enquiry for the Hainan-SOTER Information System" and the second questionnaire (Appendix 3), three institutions returned results of two questionnaire to CATAS, which are presented in Appendix 4.

Responses to the two questionnaires were rather limited. Interviews with the user groups at their offices, however, gave more detailed information on the capacity of the user groups to handle digital information and their specific interests in the information to be generated by the Hainan-SOTER Information System.

3.2. Consultation at User Group Institutions

These visits were aimed at a discussion on the main activities of the institution, the need for soil and terrain information, the availability and the present use of soil and terrain information, the interest in the data and information products to be generated by in the Hainan-SOTER project, and the prospects of the user group institutions to provide the project with data (e.g. on land use, agro-economy, climate etc.). Furthermore, the capacity of the institute to work with databases and geographic information systems was verified and included mostly a demonstration of the hardware and software facilities, available at the user groups.

3.2.1 Information Centre for Environment and Resources of Hainan Province (ICER)

Person contacted: Ma Li, Director

ICER forms part of the Provincial Department of Environment and Resources. It is a newly established unit with a staff of 4 persons. At the end of 1996 project computer hardware and software were installed at ICER with assistance of a World Bank project. This includes a work station Unix system, map printers, PCs, Foxpro database and PC-ArcInfo GIS.

At present ICER main focus is on the establishment of a database of pollution from various sources, which include hospitals and various types of factories. About 1000 sites

have been entered into the database and this work will continue. The next step will be the preparation of a location map and other GIS products. Furthermore, ICER holds a database on forest reserves with limited information per record. All this information is in principle available for the Hainan-SOTER project.

ICER has a great interest in the Hainan-SOTER project. There is expectation that the Hainan-SOTER Information System can supply information, such as the content of heavy metals, organic matter, soil moisture and infiltration rate. It was stated that such information is not easily available (too much dispersed over agencies holding this information). Although the Hainan-SOTER database has many soil variables of interest for ICER, it was emphasized that it does not include the content of heavy metals, probably also not infiltration rates. ICER would like to have information, generated from the Hainan-SOTER Information System in the form of maps and tabular format (both digital and printed). Various thematic maps are needed at scales ranging from about 1:10,000 up to 1:250,000.

3.2.2 Hainan Provincial Geometics Centre (HPGC)

Persons contacted: Li Pengde, Director and Xu Yan Ying, Assistant Director of HBSM.

HPGC is a in 1996 established information centre of the Hainan Bureau of Surveying and Mapping (HBSM) aiming to support the socio-economic planning of Hainan Province. HPGC offers a wide range of activities, summarized in their brochures. The centre has advanced equipment, which include fast computers, map-printers, a large CD-ROM storage device, scanners, digitizers, and various database and GIS software, enabling to analyze aerial photographs, satellite images, 3D-analysis, and to integrate several products. HPGC was inaugurated in 1997 and its information delivery capacity is quickly increasing. Its current main thrust is the establishment of the Hainan Land Resources Fundamental Information System (HLRFIS). This is a comprehensive land resources information system on a scale of 1:10,000. The realisation of this system is planned in two stages. First priority is the completion of the coastal zones and the low hilly land, the second priority is the central mountainous area. HFRFIS includes thematic maps: administrative boundaries, provincial triangular network, contour lines, road network, rivers, topografic information, orthophotomaps and a Digital Elevation Model (DEM).

With a Chinese version of Intergraph, other databases on a scale of 1:50,000 are also built. At present an ArcInfo information system on a scale of 1:250,000 is completed, which has various thematic maps. Also available are soil, geology etc. maps on a scale of 1:500,000. The latter include the series of "Maps of tropical natural resources of the Hainan Island", prepared by the Guang Dong Institute in 1985, also available at ISRIC.

A demonstration was given of an "electronic atlas" based on eight thematic databases. The annotation database included about 50,000 names of rivers, roads and urban areas. Each record in this database, i.e. each name, has additional information. Also maps of

rivers and lakes, land forms (a contour line map), and land use were shown. The electronic atlas made use of multi-media aspects, for example it includes photographs of several sites of the landscape, roads, rivers and lakes. Another demonstration showed the automatic stereo analysis of aerial photographs, which enables for example the generation of elevation. The last demonstration showed an integration of an ortophoto-image with an automatically classified land use satellite image.

In conclusion, HPGC holds a range of information products of interest for the Hainan-SOTER project, such as digital topographic maps, various thematic maps and a Digital Elevation Model (DEM). CATAS should make a request to HPGC for these products.

The HPGC expressed their interest in the Hainan-SOTER project information to be included as overlay in the system (ArcInfo format), such as a polygon soil and other thematic maps derived from the Hainan-SOTER Information System.

The HPGC confirmed their interest in training of the Hainan-SOTER team members in database and GIS procedures.

3.2.3 Forestry Survey and Planning Institute of Hainan Province (FSPI)

Person contacted: Ding Chang Chun

FSPI forms part of the Provincial Department of Forestry. FSPI is taking a leading role in surveying and monitoring of forests. This double task, also indicated as dynamic surveying, aims to provide the government with relevant forest information to support policy formulation and planning. In addition, consultancy services form part of FSPI mandate.

In 1997 a database-GIS section was established at FSPI, related to the Jian Fong Ling Natural Forest Park project. This section was established with an ADB supported technical assistance, comprising equipment and training. The following hardware and software is currently available at FSPI:

- ArcInfo, ArcView, and FoxPro
- A personal computer (Compaq 133 HZ, 32 M, 1.2 Gb hard disk), a Plotter HP750cp, and Colour scanner Mustek 12000SP
- Other software: Office 97, colour IT, Picture Publisher, and Photoshop.

An important activity of FSPI is the design of reforestation projects. Such projects are initiated by governmental and foreign agencies. An example is an Indonesian project, which aims at the planting of 30,000 ha of forest for paper pulp production. There are also many requests for smaller areas. FPSI executes the project planning, but is not involved in the implementation phase. Important trees for reforestation are: *Eucalyptus spp.*, *Acacia spp.*, pine species, and four other kinds of economic timber trees. In the

implementation of projects some soil related problems are encountered, such as a retarded growth of the planted trees in some locations.

FSPI is especially interested in soil information to be generated by the Hainan-SOTER project for its reforestation division, because it could strengthen its capacity for forest suitability assessment. FSPI would like to use the following information: soil parent material, soil depth (sum of A and B horizon), organic matter content of the topsoil, thickness of the topsoil, gravel content, rootable depth, soil texture, soil structure, consistency/compaction, and soil fertility indicators (pH and other soil chemical properties), and terrain information such as slope and presence of terraces. All this information will be used for the assessment of the suitability of the land for specific trees. In addition to its own procedures, FSPI is also interested in the land evaluation procedures used in the Hainan-SOTER Information System.

The FPSI can make data available to the Hainan-SOTER project. For example the map of Classified Forest Land Use at a scale of 1:200,000, prepared by FSPI. At present the map is only available in printed form. The matrix legend includes on the vertical axis the following classes: Chinese fir, pine, *Eucalyptus*, broad-leaved trees, natural forest, *Acacia*, two types of bamboo, rubber, and other economic trees. The horizontal axe include the development stage, such as young, mature, mixed stages, newly established, and open forest. The information for this forest land use map is based on the interpretation of aerial photographs and field observations. This map is the result of a four years project of FSPI, which was concluded in 1994. It would be of great interest for FPSI and the Hainan-SOTER project to produce a digital version of this map, which can be used as an overlay in the Hainan-SOTER Information System. It is proposed to discuss with HPGC the digitization of the forest land use boundaries and overlaying it on a 1:250,000 topographic base. Such an undertaking is of interest for the three parties involved.

The current focus of FPSI database-GIS section is the production of Forest Land Use Maps on county level at a scale of 1:50,000. The first map has recently been completed. The base for these 1:50,000 scale maps are, by FPSI, scanned topographic maps. In principle this error-prone scanning is not needed, because HPGC already has quality digital topographic maps.

The Provincial Department of Forestry is also involved in a large project for the establishment of four forest protection and management demonstration sites. The information generated by this project could be of interest for both for the Hainan-SOTER Information System and the planned Sustainable Land Management Demonstration Sites in four counties.

3.2.4 Hainan Meteorological Bureau (HMB)

Person contacted: Gan Yu, Vice Director.

HMB will not be a user of the Hainan-SOTER Information System, but it is holder of climatic data of interest for the Hainan-SOTER project. HMB is the provincial service for weather forecasts, climatic research and consultancy services. HMB has 21 climatic synoptic stations, for which information is collected on basis of 24, 12 or 3 hours registrations per day. The registration period of all stations is 40 years, except for Haikou with 48 years. CATAS to discuss with HMB a request for a 'package' of climatic data.

In addition to HMB climatic station, Hainan Island has several other weather observation stations, such as CATAS's own meteo-station in Danzhou, and about 90 stations at state-farms. Climatic data for these stations should be obtained from the respective institutions, because HMB does not have this information.

Mr. Gan Yu indicated that the major climatic constraints for agriculture are cold wave intrusions, typhoons and droughts. Climatic change over the past four decades is restricted to air temperature, which is increasing.

3.2.5 Bureau of Land Administration (BLA)

Persons contacted: Ding Shangqing, deputy director and Wang Guo Hai, computer staff.

BLA focusses on three main fields of action: land planning, land tenure and land pricing. At present, BLA is installing a computer centre, which consists of an office network of about 20 PCs (COMPAQ presarios) and a server (SQL server 6.0). Later, a GIS will be installed.

BLA is planning the development of a Land Use database. Pilot tests are going on and it is expected that at the end of 1998 this database will become available. The database will be mainly based on the data of end nineteen-eighties.

Studies executed by BLA include soil type and soil classes. BLA uses the national survey of the nineteen-eighties. Data were collected at county level (scale 1:10,000) and presented on maps on scale 1:50,000.

BLA county level study on 10,000 scale will include about 100 variables. BLA receives data for their studies from various departments, such as the hydrological, the water conservation, and agriculture sector. To determine the value of the land, all these data are indexed and weighted according to their importance. Examples of evaluation components are: terrain topography, soil depth, drainage conditions and soil fertility. The latter assessment is based on properties such as pH, organic matter content, macro nutrients (N, P and K content), and the capacity of releasing these plant nutrients.

BLA considers the Hainan-SOTER Information System of importance for Hainan Island and of great interest for their own activities, with a prime interest in land suitability. BLA is interested to receive Hainan-SOTER data in a digital format. No further specifications can be given at the moment, because the BLA information centre is under development. Also some county offices have PC facilities.

3.2.6 Department of Agriculture (DA)

Person contacted: Jiang Hua-An

The mandate of DA is macro agricultural planning. DA also provides technical advisory services and information service to farmers and commercial enterprises. At present no computer information centre is operational. According to the planning such a centre should be installed at the end of 1998.

DA needs information on climatic, soil and water conditions, which determine agricultural production (five factors were mentioned: insolation, heat, wind, soil and water). DA expects this information from the Hainan-SOTER Information System. DA' especial interest is in the field of crop regionalization ('agro-ecological crop suitability'), which include suitability assessment of crops and crop distribution. Mr. Jiang Hua-An mentioned that involvement and capability of the user groups are success factors for an effective Hainan-SOTER Information System.

DA is frequently approached for questions related to the suitability of Hainan Island for specific crop varieties. DA would like to have detailed information on which crop and varieties can be grown best in the different agro-ecological zones of Hainan Island. DA has specifications of these crops and their edaphic growth requirements. It was emphasized during the interview that this information is indispensable for crop suitability analysis using the Hainan-SOTER Information System.

DA confirms that many soils of Hainan have a low fertility and that organic and inorganic fertilizers are needed to maintain productivity. Family farmers woth relatively little land, but also larger commercial enterprises are interested in soil fertility and other recommendations on their land.

Soil conservation is not DA field of action, except for judicial fertilizer use. Soil conservation programmes are the task of the forestry department and the water conservation department.

DA recommends to extract agro-economic data from agro-statistical yearbooks of Hainan Island. These yearbooks have for example the following information aggregated per county: crop yield/ha, total fertilizer consumption per county or per ha (the latter to be calculated from the total agricultural land).

3.2.7 Hainan Provincial Planning Department (HPPD)

Persons contacted: Liu Fenghua, director of the foreign capital utilizing division, Huo Juran of the State land division, and Shen Weifang of the agricultural economic division.

HPPD is responsible for macro-planning for the government of Hainan Island. These plans include the agricultural sector and the projected needs for seeds, subsidies, establishment of training centres, agricultural research (in addition to CATAS), schools and academies.

The Hainan-SOTER Information System is considered very important to the work of HPPD, because so far only rough estimations about land suitability were used in the planning activities. There was no detailed information available on such items as soil suitability for specific uses. Once such information will become available from the Hainan-SOTER Information System, it can directly be used by HPPD.

HPPD considers land suitability information as one of the most important applications of the Hainan-SOTER Information System. A scale of 1:250,000 will be very appropriate for their work. For example, comprehensive analyses are needed for the current re-structuring plan of the agricultural sector of Hainan Island. In the planning document for the period 1995 - 2010 a large increase in agricultural production is projected. This includes also crop diversification, mentioned are the following: tropical fruits, off-season "winter" vegetables, especially those not produced in the greenhouses near large urban areas, and seed production. HPPD considers China's mainland as the main market, followed by Hainan's own urban areas and export.
HPPD considers very important the assessment of newly to be introduced perennial fruits, because these need a few years before becoming productive. If a wrong variety is introduced, then the negative effects only become apparent after several years, with investment loss as a consequence. The discussion centred about the question, who can deliver the crop growth requirements related to soil and climate of the desired crop varieties, CATAS, Department of Agriculture or elsewhere? It was queried whether the Hainan-SOTER Information System can also provide such information, based on information and experiences in other countries. It was emphasized, that if growth requirements of different varieties can be made available, this information could be assessed with the Hainan-SOTER Information System. It was also explained that, so far, the information system has no capacity to assess micro-nutrients and non-soil related factors such as pest and diseases.

HPPD is also interested in the potential for various agricultural land uses on the soils of the low hilly land. The current recommendations for annual crops at Hainan Island is not to use land with a slope gradient of over 15 %. HPPD indicated that the Sustainable Land Management demonstration site in Meiwan village is an example where agricultural models of growing crops on land with slopes over 15% can be

introduced and tested. If these tests proves to be successful, results can be extrapolated to other areas in Hainan.

A soil fertility assessment, preferably with estimated needs of fertilizers is also of great interest for HPPD, for making projections of the total fertiliser need. A shortage of special fertilizers -composite and micro nutrient ones- is foreseen, however, such fertilizers are only needed in small amounts.

It was concluded that HPPD has great interest in basic data and derived information from the Hainan-SOTER Information System. HPPD has a computer network for general office purposes, but will not manage a database and GIS system of its own, because such services will be delivered by HPGC. Therefore, if the Hainan-SOTER project is transferring the information to HPGC, then HPPD will get this information from HPGC. It was mentioned that both institutions are linked to the chinese computer network (which is also linked to Internet). At the moment of the interviews it was not clear whether all consulted user groups are linked to the chinese network.

HPPF indicated that general agro-economic information is available in the statistical yearbooks and from the Department of Statistics. It was mentioned that these data should be carefully used, because this information is sometimes based on estimations.

Copies of the report "State land integrated planning of the Hainan Province for the period 1995-2010" were handed over to CATAS and ISRIC. This document is prepared by HPPD, printed in 1996, and only available in Chinese.

3.2.8 CATAS

CATAS is both an implementing agency of the Hainan-SOTER project and an important user and dissemination centre of the information to be generated by the Hainan-SOTER Information System.

4 ISSUES FOR CONSIDERATION

As mentioned in section 1.3, soil and terrain information is a complex product. The effectiveness of this information is time-determined, because the capability of user groups to handle information will change over time. This is especially true for the changing Hainan society, which is reflected in the rapid economic development of the past decade, the stronger market orientation, and privatization of the state-farms. The on-going establishment of computerized systems in governmental agencies create a changing demand for information. Therefore, as mentioned in section 1.3, classical printed information products are no longer considered suitable for the contemporary user groups.

Another issue for consideration is the change in the methodological approach of information transfer. In the past the ***"linear"*** type of information transfer process prevailed. This means information developed by the researcher, was transferred through governmental extension institutes to the farmer. Currently use of ***"tailor-made"*** consultancy services and ***"learning"*** processes are progressing. The latter refers to problem-solving by a cooperative effort of scientist and farmers or other stake-holders (Röling, 1995). Today, part of the scientist's effort is facilitating access to information users (Röling, 1996; Kraak, 1998). Learning processes are especially effective in complex problems such as the promotion of ecologically sound land management practices. Therefore, the project implementing agencies need to be alert for changes during the project period and thereafter. It is recommended that in the course of the project, originally proposed information products be re-evaluated together with the user groups on their effectiveness. The present User Group Enquiry is considered a first step in this process.

There is still uncertainty about the availability of data for the Hainan-SOTER Information System. The amount of data, the completeness, and the correlation of data coming from different sources need to be evaluated in the course of the project.

A feed-back is also needed from the user groups with respect to "non-soil" data, which is expected to be supplied by the user group institutions. These data refer to land use and socio-agro-economic information.

So far, commercial agro-chemical and agro-equipment enterprises were not consulted on their specific needs for information. Action on this topic is needed during one of the coming ISRIC missions.

A good cooperation between HPGC and CATAS is required to get an information system compatible with the HPGC information system. As indicated before this should include basic training of CATAS team in database and GIS, and the exchange of data between the two institutions.

The planned Hainan-SOTER Information System will form part of an emerging information network for the agricultural support sector at Hainan Island. One of the main characteristics of succesfull information networks is active participation of stakeholders. Participation generates trust, encourage stakeholders to enter the process of keeping essential data maintained and accessible to others (World Conservation Monitoring Centre, 1996).

5 CONCLUSIONS AND RECOMMENDATIONS

1 The consultation with the user groups, which involved interviews, resulted in more information on all user groups in comparison to the limited response on the two questionnaires.

2 Except for the Hainan Meteorological Bureau, soil and terrain information is used by all governmental agencies consulted so far. All agencies are interested in receiving information from the Hainan-SOTER Information System and the majority indicated their willingness to supply the project with land use, soil and agro-socio-economic data.

3 All government agencies are in the phase of establishing a computerized information centre in their institutions. All indicated their interest in receiving digital information from the Hainan-SOTER Information System in the form of database and GIS files.

4 Use of the Hainan-SOTER Information System for land suitability assessments for crops, especially for new crop varieties and tree species, appear to be the prime interest of most user groups.

5 Adequate crop and crop variety assessment can only be realized if adequate information can be made available on the crop growth requirements of currently grown and new varieties proposed for introduction on Hainan Island. Especially CATAS and DA should make this information available to the Hainan-SOTER Project.

6 Assessment of soil fertility is seen as a second practical application by the user groups.

7 The assessemnt of soil erosion risk was mentioned by only a few of the agencies consulted so far. However, the Water Conservation Service, having this task in its mandate, has not been consulted so far. In addition these aspects did not get sufficient attention during the consultation of the Department of Forestry. It is recommended to approach both organizations on this issue.

8 Active involvement of the user groups in the development of the Hainan-Soter Information System during the project period is critical for success. Therefore, it is recommended that user groups should discuss with CATAS those activities in their workplans, which require soil and terrain data of the Hainan-SOTER Information System.

9 It is recommended to digitize the printed Land Use Map, prepared by Forestry Survey and Planning Institute, on a 1:250,000 topographic base.

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APPENDIX 1 - Addresses of the User Groups consulted

Information Centre for Environment and Resources of Hainan Province (ICER)
Mr. Ma Li, Director
59, Haifu Road
Haikou
Hainan Province, 570204

Hainan Provincial Geometics Centre (HPGC)
Mr. Li Pengde, Director
Mr. Xu Yan Ying, Assistant Director of HBSM
53 Bailong-Nanlu Road
Haikou City
Hainan Province, 570203
Tel: 0898-5367084
M.P. (0)1397589331
E-mail peter@han.ci.gov.cn or hbsm@public.hk.hg.cn

Forestry Survey and Planning Institute of Hainan Province (FSPI)
Mr. Ding Chang Chun
80, Haifu Road
Haikou
Hainan Province
Tel: 0898-5342889

Hainan Meteorological Bureau (HMB)
Mr. Gan Yu, Deputy Director
60, Haifu Road
Haikou 570203
Hainan Province
Tel: 0898-5346152

Bureau of Land Administration (BLA)
Mr. Ding Shangqing, Deputy Director
Tel: 5352845

Department of Agriculture (DA)
Mr. Jiang Hua-An, Deputy Director
Office Agricultural Department
Haifou road
Haikou
Tel: 0898-5342651 (office) 5345264 (home)
BP: 127-5837251
E-mail: jst@han.cei.go.cn

Hainan Provincial Planning Bureau (HPPB)
Mr. Liu Fenghua, Director of the Foreign Capital Utilizing Division
Mr. Huo Juran, Staffmember of the State Land Division,
Mr. Shen Weifang, Staffmember of the Agricultural Economics Division.

APPENDIX 2 - Questionnaire of January 1998

Sustainable Land Management
for Agricultural Production
in Hainan Province
UNDP project CPR/96/105/A/99

Short title of the project
Hainan-SOTER

For general information on the Hainan-SOTER project see the background information. More information can be obtained from Dr. Chen Qiubo, project director, CATAS (address see below)

1 Could you shortly describe the main fields of work/activities of your institute which might benefit from the Hainan-SOTER project?

.....

.....

.....

2 Is your institute using Soil and Terrain information? Yes/No

3 What kind of soil and terrain information are you most interested in?
Please specify:

.....

.....

4 If you are not using Soil and Terrain information is that because:

a) You do not need this information Yes/No

b) This information is not available to you Yes/No

c) The available information is not comprehensible/not usable Yes/No
if Yes, please mention the reasons:

.....

.....

d) Other arguments (please specify):

.....

.....

5 Could you specify your interest in the Hainan-SOTER project. Are you interested in:

a) The Soil and Terrain data stored in the database Yes/No

b) The derived products of the three main research subjects,
which are presently envisaged Yes/No

c) Do you have other questions/demands for information products from the Hainan-SOTER database? Could you shortly describe these questions:

.....

.....

d) For which kind of purposes/work you envisage to use the information as listed in questions 5a, b and c? Please specify:

.....

.....

6 Is your institute holding information of interest to the project? A list of information of interest for this project is annexed to this questionnaire.

a) Could you briefly describe the topics of this information:

.....

.....

b) How is this information available?
(Please indicate also if this information is available in printed or digital format)
Tables
Maps
Other (please describe)

.....

.....

7 Please mention other relevant issues:

.....

.....

Thank you for completing this questionnaire.
Please send by mail or fax the completed questionnaire to:
CATAS
Dr. Chen Qiubo
P.O.Box
Danzhou

APPENDIX 3 - Questionnaire of March 1998

Questions which accompanied the draft version of the User Enquiry Report, sent to the user groups.

Please could you make available to CATAS the following additional information:

1 Specify in detail, preferably in tables as given below, which type of soil and terrain data you use in your work, land evaluation analyses etc. Please group these data according to the following categories. Please note that only a few examples are giving, but you are invited to make a comprehensive list

a) Terrain data (2 examples are given)

slope gradient		
terrain form		

b) Hydrology data (2 examples are given)

drainage conditions		
depth of the water table		

c) Land use data (6 examples are given)

annual crops	primary forest	
perennial crops		
plantation		
fallow land		
secondary forest		

d) Soil physical data (e.g. textural composition is given as an example)

sand content		
silt content		
clay content		

e) Soil chemical data (2 examples are given)

pH		
Organic Matter content		

f) Soil Mineralogical data (type of clay mineral)

g) Other (please specify)

2 Where do you obtain soil and terrain data?
Please indicate whether the data are from :
a) own surveys
b) extracted from publications
c) delivered by institutions

3 Describe briefly the procedures your institution uses for soil/land suitability.

APPENDIX 4 - Response to Questionnaires

The draft version of the User Group Enquiry for the Hainan-SOTER Soil and Terrain Information System was translated into Chinese. Both Chinese and English version were sent to the user groups. So far (20 August, 1998) three institutes gave comments on the draft User Enquiry report and replied to the two questionnaires. These institutes are: Forestry Survey and Planning Institute of Hainan Province (FSPI); Hainan Provincial Geometics Centre (HPGC) and Hainan Meteorological Bureau (HMB). The response from these three user groups is summarized as follows:

Responses to "Questionnaire of January 1998" (see Appendix 2)

1. Could you shortly describe the main fields of work/activities of your institute which might benefit from the Hainan-SOTER project?

The soil and terrain information will be used for allocation of tree species to adequate land, for forest and agricultural planning and designing, for forecasting of yield of forest trees (FSPI), for thematic planning of such as forest and agricultural planning (HPGC) and for establishment of thematic databases linked to Hainan State Land Resources Basic Information System to ensure precise planning (HPGC).

Calculation of climatic value of small grid point for mountainous area: Meteorological element value is evaluated at a scale of 1 km^2 based on the data from the meteorological stations of 19 cities/counties, and state farms in Hainan, as well as the elements of land form and relief such as elevation, slope direction, slope gradient, etc. (HMB).

2. Is your institute using Soil and Terrain information?

All three institutes said yes.

3. What kind of soil and terrain information are you most interested in? Please specify:

FSPI: All soil and terrain information except for paddy land;
HPGC: Soil types, soil thickness, pH value, humidity, etc; digital elevation model, water system, roads, etc.
HMB: Slope direction, slope gradient, elevation, soil moisture content, runoff, leakage, evaporation and soil fertility.

4. If you are not using Soil and Terrain information is that because:

FSPI: This information is not available.
HMB: This information is not accessible due to their forbidding high cost.

5. The institutes are interested in the soil and terrain stored in the database (FSPI, HPGC, HMB) and the derived products of the three main research subjects, which are presently envisaged (FSPI, HPGC). **HPGC:** only interested in soil data; the data will be used for planning, and GIS will be made full use of.

6. Is your institute holding information of interest to the project? A list of information of interest for this project is annexed to this questionnaire?

a. Could you briefly describe the topics of this information:

HPGC: 1:50,000 digital topographic map; 1:250,000 digital topographic map; part of 1:10,000 DEM; orthophoto images.

b. How is this information available?

HPGC: Tables, maps in both digital and printed formats; **HMB:** Digital format; they are available through charge.

7. Some institutes asked the project to offer training course when the products or database derived from the project are delivered to them.

FSPI: An Indonesian company has planned to set up a 600,000 ton pulp mill in Hainan and 230,000 ha (excluding 30,000 ha mentioned in section 2.3) of pulp forests is required to be planted to provide pulp wood to the mill. Land suitability evaluation to specific tree species is therefore needed imperatively.

Responses to the Questionnaire of March 1998 (Appendix 3)

1. The soil types and terrain data the users use in their work, land evaluation, fertility assessment, land suitability of crops, etc.

a) Terrain data

slope gradient	slope direction (FSPI, HPGC)
terrain form	elevation (FSPI)
slope location (FSPI)	distribution of soil types (HPGC)

b) Hydrology data

drainage conditions	catchment (HPGC)	rate of evaporation (HMB)
depth of the water table	runoff (HMB)	rate of transpiration (HMB)
rivers (HPGC)	infiltration (HMB)	

c) Land use data

annual crops	primary forest	grassland (HMB)
perennial crops	upland (HPGC)	wet land (HMB)
plantation forest	paddy land (HPGC)	shores (HMB)
fallow land	economic forests (HPGC)	
secondary forest	waste land (HPGC)	

d) Soil physical data

sand content	soil thickness (HPGC)	soil bulk density (HMB)
silt content	soil moisture (HPFC)	soil available water content (HMB)
clay content	soil porosity (HMB)	soil classification (HMB)

e) Soil chemical data

pH
organic matter content
N.P.K. content (HMB)

2. The soil and terrain data obtained are from their own surveys and publications (HPGC).

3. As to information on soil fertility trials HPGC say no, while other institutes gave no answer.

4. The crops, crop varieties, fruit tress and other trees for soil/land suitability assessment.

rubber (HPGC)	rambutan (HPGC)	*Casuarina equisetifolia* (FSPI)
mango (FSPI)	vegetables and melons (FSPI)	*Acacia confusa* (FSPI)
litchi (FSPI)	edible bamboo (FSPI)	*Pinus elliotii* Engelm. (FSPI)
longan (FSPI)	wood-purpose bamboo (FSPI)	*Pinus carbaea* Morelet (FSPI)
coffee (HPGC, FSPI)	rattan (FSPI)	*Eucalyptus* spp. (HPGC)
cashew (FSPI)		

5. The procedures for soil/land suitability assessment

FSPI: Sample-plot method is used to survey such factors as tree, soil, land form, topographical features, etc. in the sample plots. The resultant data are analysed to find out the maximum factors affecting tree growth, and the soil/land suitability is thereby assessed.

HPGC: The soil/land suitability is assessed based on the requirements of various crops by using the GIS system through classified remote digital maps to have a clear understanding of the surface cover, and DEM to analyze the slope gradient, slope direction, elevation. etc.)