



**Sustainable Land Management  
for Agricultural Production  
in Hainan Province, PRC**

**Project CPR/96/105**

**3<sup>rd</sup> Training Workshop**

**Progress Report**

**V.W.P. van Engelen**

**June 1999**

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## **1 Introduction**

The author made a visit to the project from 9 to 29 April to participate in the third SOTER training as scheduled in the project's workplan. Originally, this third workshop was scheduled for the end of 1998 but due to several reasons that are further explained in this report dates have been postponed until 1999. The program consisted of three major parts: a workshop in Nanjing at the premises of ISS-AS in which various Chinese institutes presented their SOTER activities, a field correlation tour and technical discussions in Hainan and technical discussions in Nanjing.

Upon arrival in Nanjing and Hainan it appeared that so far the report of the FAO STS service mission of end 1998 was not yet received. Copies were distributed to the Hainan SOTER teams in Nanjing and Hainan. The full reference to the document is given at the end of this progress report.

## **2 The training workshop**

### **2.1 Workshop in Nanjing (9-10 April)**

A two day workshop was held at ISS-AS in Nanjing. The 24 participants (see Appendix 1) came from the hosting institute involved in the Hainan SOTER project and from institutes and organizations elsewhere in China that started compilation of several SOTER databases after the initial training workshop given by ISRIC in January 1998. Besides these advanced participants, also a small number of newcomers was present.

Half a day was dedicated to the latest developments of the SOTER methodology as well as a short general introduction. The participants from the institutes that are involved in compiling SOTER databases presented their results. This led to lively discussions about technical issues and problems in making such databases.

Besides the SOTER database of Hainan, such databases are now also being compiled in Shenyang Province, in Xinjiang Province, in Sichuan Province, Sunan area in Jiangsu Province and in the area between Beijing and Tianjin. Presentations on the progress and technical problems encountered were given by the various representatives of the institutes. A summary of the presentations is given in Appendix 2.

### **2.2 Field correlation tour in Hainan (12-24 April)**

#### *Status of the 1:250,000 Soil Information System of Hainan (HSIS)*

Discussions with the complete ISS-AS team (except for Mr. Luo Guobao, team leader, who has been hospitalized) have been held on the SOTER database of Hainan Island (Mr. Zhang Ganlin, Prof. Chen Hong Zhao, Prof. Chen Zicheng, Mrs. Zhao Wenjuu, and Mr. Lu Chengwen). So far, landform/lithology units have been delineated for the entire island on 28 sheets of the 1:100,000 topographic maps and reduced to 4 sheets at scale 1:200,000. Subsequently, this map has been digitized in ArcInfo. A total of 819 polygons have been made and regrouped into landform/

lithology mapping units. The digitized version, made on a contract base by the Nanjing Geophysical Technology Company, has severe shortcomings. It appears that the digitizing has been executed without proper registration on the boundary tics in decimal degrees, and without parameters of the map projection. So coordinates of the map are not in decimal degrees too. No polygon has been closed and all line segments end in dangling nodes. As a result the topology of the map cannot be made other than after extensive editing of the file. Other errors concern the inconsequent labeling of lines, resulting in a mixture of landform/lithology, coastline, rivers and town boundaries. At the moment there is no human capacity available at ISS-AS that can edit the first version of the digitized file. Zhang Ganlin has basic knowledge of ArcInfo and should be able to do it but he has no time due to many other commitments. An additional GIS operator will start his duty in the second half of this year.

Attributes of the terrain and their terrain components have been put in a spreadsheet (Excel). A copy of this file has been given to ISRIC.

For the 4 western sheets of the 1:100,000 landform/lithology maps soil components have been compiled and profiles selected from the soil survey report/map. Besides the 50 newly sampled profiles collected last year by ISS-AS and an odd 10 other complete profile sets from earlier ISS-AS work on the island, the bulk of the soil profile information (320 profiles) originates from the existing 1:200,000 soil map of Hainan published in 1991 by the Soil Survey Office of Hainan. This map is based on the 1:50,000 county soil maps made in the years 1984-1987. The legend of the 1:200,000 map contains more than 80 units. Analytical data are very limited and concern mainly soil fertility parameters (total and available N, P and K) and some other data (colour, structure type, pH-water and "physical clay" = < 0.001 mm). This disqualifies most these profiles from use in the SOTER database as many essential data are missing. In April all analyses of the 50 new profiles have been completed by the ISS-AS laboratory.

All the profile data (originating from the provincial soil survey report as well as from other sources) have been put in a spreadsheet file (Excel). A total of about 1400 horizons are in the file, representing 320 profiles sampled for fertility analysis and 60 comprehensive profiles respectively. It has been advised to use the existing SOTER input software (DOS-version) as this prevents some of the input errors made in an ad-hoc database structure as defined by other RDBMS. The installation of a newly made Windows version of the SOTER input program was not successful although the limited testing program of this new version at ISRIC was successful. ISRIC will try to solve this problem a.s.a.p.

Taking into account the limited number of full reference profiles, it is advisable not to use a 1:200,000 scale but to maintain the originally agreed resolution of 1:250,000 which is already twice as large as the scale defined in the project document.

### *Field check of HSIS*

Three days were spend on verifying the SOTER units of the western part of the island: a strip of about 50 km wide along the western coast (Dongfang area). Based on the 1:100,000 landform/lithology units and their soil components extensive checks were made on the attributes of the units. Five new profiles are located in this area. It appeared that landform delineations are in general correct. Some discussions were held on the denominations of some of the level landforms and necessary modifications in the coding were made. In most cases the lithology is also right except for the coastal plain area developed on marine deposits. The three different base maps from which lithological information could be extracted (geological map 1:200,000 (1965), surface/

quaternary geology 1:100,000 and soil map 1:200,000 (1991)) contradict each other on the boundaries between the various facies/periods of the marine deposits and on the boundary between marine sediments and older rocks. This problem is also faced by the county study of Dongfang.

Soil boundaries figuring on the 1:200,000 have not yet been transferred to the landform/lithology map to further subdivide these units. Some modifications could be made on the boundary between recent and older marine deposits as this boundary appears clearly on the 1:25,000 topographic maps of the Dongfang window. However, other delineations of various different marine deposits could not be verified.

#### *Status of the 1:50,000 County Soil Information System (CSIS)*

During the FAO consultancy mission in November 1998, it became clear that in the current setting (amount of work and availability of manpower at CATAS) it will not be realistic to cover in the short term the entire four counties with a SOTER database. It has been advised to split the compilation work for the four counties soil information systems into two phases:

Phase 1: compilation of the soil information system of 4 window areas of 25 by 25 km ( $\pm 25\%$ ) in each county situated around the demonstration areas

Phase 2: expansion to the remaining 75% of each county depending on time and budget.

Currently phase 1 is operational. Landform/lithology units of all four windows have been delineated on overlays of the 1:25,000 topographic maps. Soil boundaries from the county soil maps have not yet been transferred to the landform/lithology units. Attribute data for terrain and terrain components for the Dongfang window have been recorded on the coding forms.

#### *Field checks of CSIS*

##### *a) Dongfang County*

During the field checks on HSIS in the area of the Dongfang window, particular attention was given to soil boundaries of the 1:50,000 county soil map that could be transferred to the landform/lithology map. In general landform boundaries were correctly delineated although some refinement was made on the boundaries of hills (SH and TH units). The county soil map seems to be correct in the delineation of the most recent (sandy) marine deposits but lacks this precision in the rest of the marine deposits area and in the transition towards the older rocks. Moreover, it appears that land use is a major differentiating criteria in the delineations of the soil mapping units. This might be correct for the purpose of the soil map (basically oriented towards soil fertility), but it is of limited validity as land use has changed tremendously since the survey was done in 1984. Therefore these soil mapping unit subdivisions are not very relevant for the SOTER database except those referring to paddy soils. Also for these units the area changes since the survey was completed are not visible.

A total of 25 analyzed profiles located in the window area could be extracted from the soil survey report. As already noted in the HSIS part of this report mostly soil fertility parameters were determined. This makes these profiles unsuitable as SOTER reference profiles. In order not to lose this fertility information it was advised to make a new separate profile table (e.g. S-PROFILE.DBF) with only those attributes that can be extracted from the soil survey report.

The field checks also revealed some shortcomings in the geological map outside the marine deposits area. Some schists areas in the Dongfang Dam area have been erroneously mapped as granite. Corrections in the landform/lithology codes of these units have been made.

The major data bottlenecks of the Dongfang window are in resume:

1. The county soil map at scale 1:50,000 displays many different soil mapping units that are only different in land use
2. Land use has changed since the survey in 1984 (and as a consequence the soil map?)
3. Relations between lithology and soil mapping units are non-existent in the marine sediments
4. Geological information (at scale 1:200,000) is too general, and sometimes wrong
5. Soil profiles have only a limited set of attributes (total and available N, P and K, pH-water, structure type, physical clay and colour)
6. Soil classification (FAO or Soil Taxonomy) is not possible with the current profile data
7. Not much correlation between the HSIS map of Dongfang and the county soil map.

Some recommendations for improvement can be made:

1. Aerial photograph interpretation to determine the boundaries between the various marine sediments and their soils, and to adjust the extent of the paddy soils
2. An additional description and sampling of 20-25 profiles, resulting in  $\pm 300$  samples that must be analyzed for the mandatory attributes: sand, silt and clay %, very fine sand % (needed for USLE), pH-water, bulk density, CEC-soil, exchangeable cations, exchangeable acidity (for acid soils only), org C%.

#### b) Danzhou County

A one day field check was made to the window area and its demonstration site. Landform/lithology boundaries have been well established and their location verified. Some minor changes were needed in some of the level landform definitions, similar as in Dongfang County.

Lithological boundaries are much more outspoken than in Dongfang, easy detectable in the field and it therefore expected that the broad soil pattern of the county soil map can be used to further subdivide the landform/lithology units. It is therefore not considered necessary to use aerial photographs for further precision of the soil boundaries.

The same lack of adequate soil profile data as in the other counties plays also here a role. Similar recommendations as for the other counties can be made.

#### c) Qiong Shan County

A two day field visit was made to this area. Being a rather flat area, landforms in the window area are restricted to the level types, with the exception of some isolated hills (craters), developed on basalts and recent pyroclastics. The soil map legend, when grouped into similar soils, shows a dominance of ferralsols. Only in the extreme south and east a different lithology is present: marine deposits and granite.

The same approach as with the other counties is advised. Fortunately, several of the new profiles for HSIS are located in this window and can contribute their data. to this CSIS.

#### d) Baoting County

No visit was made to this area but it is expected that similar problems as in Danzhou will be encountered.

### 2.3 Technical discussions in Nanjing (26-28 April)

Final discussions on the technical difficulties were held with the two leaders of the team. Bottlenecks that were identified during the field trip in Hainan were reviewed and possible solutions were sought. A revised workplan was adopted. It stated that the completion of the provincial database (HSIS) could be achieved before August 1<sup>st</sup>. This will allow sufficient time for cross-checks by ISS-AS and ISRIC.

Additional land use requirements for the envisaged land utilization types will have to be collected by ISS-AS.

The transfer of boundaries from the county soil maps to the window SOTER maps will require about 2 weeks/county: in total 8 weeks. Additional sampling will require another month in total. Analyzing the samples will require 1 - 2 months depending of the availability of technicians. As available time for the two staff members involved in the compilation of the database is rather restricted, the National Project Director expected that this work could be completed around the end of this year.

ISS-AS should transfer a copy of the 1:200,000 landform/lithology map with the locations of the 60 fully analyzed profiles, together with the profile.dbf and rephoriz.dbf files to CATAS a.s.a.p. so they can be used in the window studies.

For some of the applications detailed climate data are required: it is expected that daily data for one year for a station in each county could be sufficient. CATAS will investigate the possibilities to use the data of their own station in Danzhou and to obtain data for the other 3 counties from other sources.

Also more precise requirements of the envisaged land uses (mango, rambutan, vegetables) are to be collected in the course of this year.

#### *Training*

GIS (ArcView, ArcInfo). Although it was stressed by ISRIC that a time schedule would be fixed for GIS training, no decision could be made as CATAS has to find out possibilities for such a training in Haikou. Contact should be made a.s.a.p. with the HPGC to inquire about possibilities for such a training.

English for those staff that will participate in the 4th SOTER training in the Netherlands.

#### *Next SOTER training*

Taking into account the delay in the compilation of the two databases with respect to the original workplan it is expected that the SOTER applications training in the Netherlands can start in the last quarter of 1999 for ISS-AS and in the first quarter of 2000 for CATAS staff. Final dates will be discussed between the National Director ISS-AS and ISRIC.

#### *Revised workplan*

- a. ISS-AS
  1. Completion of the provincial database (HSIS): 1-8-99
  2. Collection of land use requirements for the envisaged land uses: August-November 1999



3. Participation 4<sup>th</sup> training (in the Netherlands): starting 4<sup>th</sup> quarter 1999 (provisional)
- b. CATAS
  - 1 Completion of the county databases (CSIS): 31-12-99
  2. Collection of land use requirements for the envisaged land uses: 4<sup>th</sup> quarter 1999
  3. Participation 4<sup>th</sup> training: starting 1<sup>st</sup> quarter 2000 (provisional)

### 3 Conclusions and Recommendations

1. The findings of the FAO STS service mission report of January 1999 (Kauffman, 1999) referring to the strengthening of the project team at ISS-AS responsible for the 1:250,000 Hainan SOTER have become more urgent due to various reasons:
  - a. The illness of the senior project member Mr. Luo Guobao has created an acute shortage of qualified manpower in the execution of the project. As a result, Mr. Zhang Ganlin, originally only involved in the GIS part of the project, has become the main technical person, coordinating all technical issues of the project. Being already responsible for a wide array of other tasks and projects within ISS-AS, time for the additional SOTER work is limited.
  - b. The absence of fully trained GIS staff at ISS-AS is hampering the creation of the SOTER database. No training has been foreseen by ISS-AS but a junior staff member trained in this matter has been recruited for the second half of this year. It is expected that his presence will alleviate the backlog in GIS work for the project.
2. Also at CATAS the project team needs strengthening as the two members responsible for compiling the SOTER database of the four counties in Hainan (Mr. Qi Zhiping and Mr. Lin Dian) are almost fully occupied with teaching work. Training in English for those team members who will go to The Netherlands for further training is essential.
3. Taking into consideration the limited staff capacity at CATAS it was already recommended by the FAO mission to limit the county database compilation to selected windows of 25 x 25 kms around the demonstration sites. The currently available data seems to be inadequate for filling the database with relevant attributes needed in the planned applications. Additional sampling is required and it has been agreed that for all counties an additional 20 soil profiles will be sampled and analyzed. This will further delay the completion of the county databases but it is considered essential in arriving at a reliable product.
4. Local training of CATAS staff in GIS is foreseen in the project document but has not yet materialized. A concrete planning for training has to be made by the national project director. The focus of this training should be on ArcInfo and ArcView.
5. If no additional manpower can be made available in both institutions for the compilation of the databases, it might be recommendable to apply for additional assistance from ISRIC. This could be organized as an on-the-job training of 2 to 3 weeks both at ISS-AS and at CATAS. As no budget has been allocated within the project for this additional work, funds could either come from the existing Chinese allocations or from newly sought sources.

**Reference**

Kauffman, S.K., 1999   FAO STS service mission report "Land data management and utilisation mission for UNDP Hainan SOTER project" (CPR/96/105/A99). FAO Regional Office for Asia and the Pacific, Bangkok 1999.

## Appendix 1

### Participants SOTER Workshop at ISS-AS (9-10 April)

Name	Affiliation/Address
Zhang Xuelei	Shandong Normal University
Enock Nelson	Shandong Normal University
Yang Yujian	Shandong Normal University
Zhang Haitou	Huazhong Agricultural University
Ren Yi	Huazhong Agricultural University
Li Heping	Institute of Ecology and Geography, CAS, Xinjiang
Bao Xinkui	Institute of Plateau Biology, CAS, Xining
Zhang Min	Institute of Geography, CAS, Beijing
Lui Youzhao	Nanjing Agricultural University
Zhang Guoshu	Institute of Applied Ecology, CAS, Shenyang
Zhao Yuguo	Shandong Agricultural University
Chen Xuehua	Institute of Mountainous Disasters, CAS, Chengdu
Gong Zitong	Institute of Soil Science, CAS, Nanjing
Shi Hua	Institute of Soil Science, CAS, Nanjing
Zhang Ganlin	Institute of Soil Science, CAS, Nanjing
Chen Zhicheng	Institute of Soil Science, CAS, Nanjing
Chen Hongzhao	Institute of Soil Science, CAS, Nanjing
Chen Jie	Institute of Soil Science, CAS, Nanjing
Lu Chengwen	Anhui Normal University
Huang Chengmin	Institute of Soil Science, CAS, Nanjing
Wu Jicheng	Institute of Soil and Fertilizer, Henan Acad. Agric. Sciences
Zhang Dingxiang	Institute of Soil Science, CAS, Nanjing
Lu Ying	Hunan Agricultural University
Yang Jinling	Institute of Soil Science, CAS, Nanjing
Li Tao	Huazhong Agricultural University
Wang Hui	Huazhong Agricultural University
Zhao Wenjun	Institute of Soil Science, CAS, Nanjing
Vincent van Engelen	ISRIC, Wageningen, The Netherlands

## Appendix 2

### Summary of SOTER developments outside the Hainan SOTER project

#### *Shenyang Province (Mr. Zhang Guoshu)*

The SOTER area in this province covers a zone of 500 by 500 km at a scale of 1:500,000. Landforms have been derived from the 1:100,000 topographical maps, lithology from the geological map and soils information from existing soil maps. So far 576 polygons have been delineated, representing 124 SOTER units. Unfortunately, soil profile information is limited. Only 20 complete profiles are available. This forms a major limitation in the compilation of the database and will hamper interpretations. Until now data entry forms have been filled and map delineations have been made on overlays. No digital version of the data has been produced yet.

#### *Xinjiang Province (Mr Li Heping)*

Also for this province the aim is a 1:500,000 SOTER database but taken into account the lack of soil data it seems a too ambitious goal. Landforms are based on the 1:100,000 topographical maps. Soils information originates from existing soil maps and 47 profiles. The high salt content of some of the soils gives soluble salt data that are too large to be accommodated by the current SOTER input program. Below sea level altitudes occurring in the Turfan depression cannot be accommodated too.

#### *Sichuang Province (Mr Chen Xuehua)*

In this province the establishment of a 1:500,00 SOTER database is well advanced. For some counties in the SE of the province the relief and slopes of the SOTER units have been delineated with the help of a DEM (in ILWIS). Lithology has been taken from the geological map. However, the lack of sufficient soil profile data is also in this part of China a serious problem for the completeness of the database. Attribute data of terrain and terrain components as well as soil components have been put in the database.

An interesting development is compilation of a Chinese input program (in FoxPro) for SOTER attributes, together with querying and reporting facilities. Moreover, a link to the ArcView file of the digitized SOTER map is available. Copies of this program should be made available to other participants. This program is a possible alternative for the new Windows version of SOTER data management which seems to have some problems when installed on Chinese computers.

#### *Beijing east plains (Mr. Zhang Min)*

This work also concerns the compilation of a SOTER database at a scale of 1:500,000. A major technical problem was faced in this area, but it has been noted in other SOTER studies too. The boundaries derived from existing soil maps seem to be in contradiction with the landform

boundaries as determined by the topography. It was concluded that in this particular case relief information should be taken as more reliable than soil map boundaries.

*Sunan area in Jiangsu Province (Mr. Zhang Ding Xiang)*

A SOTER database at scale 1:200,000 is being compiled for a part of Jiangsu Province. It will be used for soil productivity assessment and for defining of research domains. Until present, the landforms have been delineated on the basis of the topographical maps at scale 1:100,000. Through an overlay with the geological information within Arc/Info, the combined landform/lithology units have been identified. Research is concentrated in the plain area and therefore only soils information of this landform has to be integrated with the landform/lithology units. Attribute data of terrain and terrain components have been collected.