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# REPORT ON THE CONSULTATIVE MEETING OF THE SOIL MANAGEMENT SUPPORT SERVICES (SMSS) TROPSOILS-CRSP

## May 7th and 8th, 1992, Lincoln, Nebraska

In 1991, the Soil Management Support Services (SMSS) {a project of AID implemented by the USDA Soil Conservation Service (SCS) and the Office of International Cooperation and Development (OICD)} and the Soil Management Collaborative Research Support Program (CRSP, known as TROPSOILS), were amalgamated into a larger program. The formal cohesion is expected to take place in 1994 and the period until then is the interim phase. The four TROPSOILS Universities are North Carolina State University (NCSU), Cornell University (CU), University of Hawaii (UH), and Texas A&M University (TAMU), with NCSU providing the Management Entity. For the current meeting, the University of Puerto Rico which has been an active collaborator of SMSS, was also invited.

### Purpose of the meeting

During the last ten years, SMSS has collaborated with each of these Universities and so with the formation of the expanded TROPSOILS, SMSS considered it appropriate to formalize the relationships. This was the basic purpose of the meeting.

The two specific purposes are:

1. to develop small collaborative projects between SMSS and the component TROPSOILS Universities to be implemented during the interim phase of TROPSOILS;
2. to explore areas of collaboration and major activities of SMSS in the new TROPSOILS commencing in 1994.

### Participants

| | |
|---|---|
| Dr. Hari Eswaran | SMSS/SCS, NHQ, Washington DC |
| Ms. Jo-Ann Throwe | OICD, Washington DC |
| Mr. Jim Ware | SCS, NHQ, Washington DC |
| Dr. John Kimble | SMSS/SCS/NSSC, Lincoln, NE |
| Dr. John Witty | SCS/NSSC, Lincoln, NE |
| Dr. Steve Holzhey | SCS/NSSC, Lincoln, NE |
| Dr. Ellis Knox | SCS/NSSC, Lincoln, NE |
| Dr. Armand Van Wambeke | Cornell University, Ithaca, NY |
| Dr. Stanley Buol | North Carolina State University, NC |
| Dr. Larry Wilding | Texas A&M University, TX |

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|---|---|
| Dr. Ike Ikawa | University of Hawaii, HA |
| Dr. Fred Beinroth | University of Puerto Rico, PR |
| Dr. Roger Hanson | Management Entity, TROPSOILS, NC |

Report of the Meeting

**A. Collaborative activities during the interim phase**

The meeting was opened with a welcome address by Dr. Steven Holzhey and Roger Hanson. Dr. Hari Eswaran gave a status report on SMSS (Appendix I). This was followed by reports of Dr. John Kimble on Soil Characterization and by Dr. John Witty, on Soil Taxonomy (Appendix II). These introductory talks were followed by proposals and discussions.

**1. Fertility Capability Classification**

Dr. Stan Buol elaborated on a proposal (Appendix III) to develop an 'expert system' on Fertility Capability Classification (FCC)'. This will be used as an adjunct to Soil Taxonomy classification of a soils to express its fertility constraints (and potentials). Dr. Van Wambeke informed the group that some aspects of FCC is already included in the Automatic Land Evaluation System (ALES) developed by CU. Dr. Buol will evaluate ALES and determine if there is a need to develop a separate expert system.

**2. Visual aids for teaching in LDCs**

Drs. Fred Beinroth and Ike Ikawa presented related proposals (Appendix IV and V) for developing slide sets for Oxisols and Andisols, respectively. There was general agreement that these were necessary and useful products for SMSS in its technical assistance programs in LDCs. They will work with SMSS staff on this.

**3. A pilot project for rehabilitation of degraded lands**

This was submitted by Dr. Ikawa (Appendix VI). The group felt that this would be a useful case study which could be extended to other parts of the world. However, this is a long term endeavor and it was suggested that perhaps TROPSOILS could consider it or other sources of funding be attempted.

**4. A study of crusting in soils of the tropics**

This well-conceived proposal (Appendix VII) was submitted by Dr. Van Wambeke. As the proposal was beyond the financial means of SMSS, it was deferred to TROPSOILS for consideration.

**5. Soil property algorithms for decision support systems**

This proposal from Dr. Beinroth (Appendix VIII) sparked a lively discussion on activities of SMSS. This resulted from the response of Dr. Eswaran that this activity could not be supported by SMSS because, (a) Another AID project --IBSNAT -- was working on the subject, (b) algorithms are model specific and so must be done by modelers, and (c) this is a research activity with no immediate pay-offs for SMSS. (This discussion will be elaborated later).

**6. Collating and distributing the soil data of SMSS for use by LDC scientists**

More than 900 soils with detailed characterization and data are available in the SMSS data base. Dr. Eswaran proposed that an effort be made to compile selected pedon descriptions and data and publish them according to soil Orders. The first part of each volume will contain a discussion of the structure of the Key to the Order, employing the descriptions and data to illustrate the rationale. There was general agreement to this. The following have agreed to volunteer:

| | |
|---|---|
| Oxisols | Dr. Beinroth |
| Ultisols | Dr. Buol |
| Vertisols | Dr. Wilding |
| Andisols | Dr. Shoji |
| Mollisols | Dr. Kimble |
| Aridisols | Dr. Eswaran |
| | |
| Alfisols | ??? |
| Entisols | ??? |
| Histosols | ??? |
| Alfisols | ??? |
| Inceptisols | ??? |

**B. The post-1994 period**

**1. A Benchmark sites network for monitoring environment and agricultural stresses**

Dr. Larry Wilding initiated a discussion on this subject based on a network already in operation in Canada (Appendix IX). There was general agreement that SMSS should explore this approach and perhaps initiate a pilot study. A larger network would require much more funding and may become a separate effort by itself.

**2. TROPSOILS Global Strategic Plan**

Dr. Roger Hanson presented this plan (Appendix XI) and explained the general thrust of the program. Dr. Eswaran introduced a

draft of the SMSS component of the plan for discussions. Some of the suggestions are included in the new draft (Appendix XI).

**3. Perceptions of the expanded TROPSOILS**

This was a highly spirited discussion which was useful and highlighted some important conceptual problems. These are summarized below:

**a. Concept and role of SMSS**

Three views emerged:

- SMSS has completed its tasks and there is no need for the old SMSS; the current SMSS funds should be distributed to the Universities to be used for 'soil research';
- Significant part of SMSS portfolio must be transferred to Universities;
- Retain SMSS in its old mode.

This discussion on the perception of SMSS is significant and indicates that there is a need to better conceptualize the expanded TROPSOILS.

**b. Activities of SMSS**

Currently these are determined by SMSS staff. It was suggested that TAC or some other mechanism must be developed for this.

**c. Support of 'soil research' by Universities**

There appeared to be a tacit assumption that SMSS was a kind of donor to support University research activities. SMSS indicated that this was clearly not its role.

**d. Legality of SCS not providing matching funds and charging salaries to project**

CRSP Universities are required to provide non-government source matching funds to become a partner. SCS does not provide this and so this was questioned. Also SMSS staff salaries was charged to project and this was also questioned. Indirectly, the basic question was that though a mechanism (Participating Agency Service Agreement -- PASA) was available for AID to access SCS services, why should the funds be channelled through TROPSOILS. This should be clarified by AID.

**e. University of Puerto Rico as a member of TROPSOILS**

A casual suggestion was made that UPR be invited to become a member of TROPSOILS. UPR, apart from UH, is the only other University located in a tropical country. Its Spanish language capabilities would enhance the contacts and linkages in the Latin countries.

Appendix I

# A REPORT OF ACTIVITIES OF THE SOIL MANAGEMENT SUPPORT SERVICES (SMSS)

## -- (A component Project of TROPSOILS) --

**Welcome speech of Dr. Hari Eswaran**

## Introduction

The Soil Management Support Services (SMSS) was created on October 1979 to provide services in the areas of soil survey, classification, and use and management of soils. It did not have a mandate to perform research or support research. It was a logical follow-up to the Benchmark Soils Project of the Universities of Hawaii and Puerto Rico and was conceived as a sister project of the International Benchmark Sites Network for Agrotechnology Transfer (IBSNAT) of the university of Hawaii. During its ten year mandatory period, there were no budgetary constraints and despite the normal handicaps of working in a government system, much was accomplished. The four external reviews praised the project for its innovative approaches, and its accomplishments beyond the requirements of the project document.

The success of the project was largely due to the support we received from institutions and persons around the world. At home, the success was largely due to your support. The five Universities -- University of Hawaii, Cornell University, University of Puerto Rico, North Carolina State University, and Texas A&M University -- have been an integral part of the project. SMSS has worked on this collaborative mode before AID discovered the need to work together. In fact, of the total $10 million of the project, about $4 million was used in collaborative activities with these Universities.

After the End-of-Project review in early 1991, we felt confident that AID appreciated our work, that AID was convinced that there is a demand for our services, and so we prepared ourselves for bigger and better things to come. The Soil Conservation Service (SCS) made a formal commitment to this effort by establishing the office of World Soil Resources (WSR) in late 1988 with SMSS as one of the projects of WSR. In retrospect, we note that this had little impact on AID and events were to show that the higher echelons of AID had little information on the project, its work and accomplishments. The project ended in 1989.

## The Winter of Discontent

The years 1990 and 1991 were a difficult period for us. We were operating on our savings which later we found from OICD did not exist. In January 1990, we presented a new proposal to AID which received no response largely because of the turmoil at the Office of Agriculture in S&T. At the end of 1990, we were summoned by the Director of the Office of Agriculture (Mr. Dave Bathrick) to a meeting to 'investigate the possibilities of linkage with the TROPSOILS CRSP. You have all heard of this fiasco.

In the summer of 1991, we became a part of the TROPSOILS CRSP. In 1994, TROPSOILS is to get a new lease of its life and by then another of R&D's projects -- NiFTAL -- will join the family. We are now in an interim phase. The annual budget of SMSS is about $550,000 of which about 33% is used for overheads by OICD and SCS. When we subtract another about $200,000 for salaries and benefits, we have $150,000 for operations. This is not much and with this kind of funding level, we cannot initiate the kind of workshops and training courses which you have all participated in the past. We cannot build up the global soils data base as we did in the past. We cannot have the publication program that we had in the past.

You must also be informed of the changes taking place in AID itself. Over the last few years, we hear that the agriculture portfolio has gradually decreased. Environment, private sector development, democratization, and family development are the current areas of emphasis. A large slice of the pie has been diverted to Eastern Europe and the Commonwealth of Independent States. Many Missions have reduced their portfolios and activities in agriculture research and development is less attractive. The implication of these is that the potential for Mission buy-ins is considerably reduced.

## The silver lining

The new Director of Agriculture in R&D, Dr. Pat Peterson, is very sympathetic to our cause but due to financial constraints, he does not have much flexibility.

In the light of this new situation, which as the Belgians would say, is serious but not critical, SMSS has to change its strategy. I will outline this new strategy for the immediate future in a few minutes. Prior to that, I must categorically state that we still wish to continue with our past modus operandi.

- we believe that there is still a very strong demand for the kinds of activities and services we had provided in the past;
- we believe that unless and until developing countries know their soil resources, all efforts in technology transfer,

enhanced management, sustainable agriculture, will be short lived or even in vain;

- we believe that if we do not persevere in our efforts of standardization and quality control in soil resource assessment, the current chaotic situation in developing countries will prevail;
- we believe that we can contribute to the development and provide some stewardship for global soils data bases and that such data bases are essential for all national and international efforts to enhance sustainability of agriculture and respond to the anticipated effects of global climate change;
- we believe that linkages and brotherhood we have developed among the soil scientists of the world will contribute to a better world;
- we also believe that the recent developments in computer technology can make our work more cost-effective, timely, and have greater impact.

Consequently in this financially strained environment, we are trying to continue our previous activities though at a much lower intensity and at the same time initiate new activities particularly those attractive to AID. Let me give you a few examples:

1. We try to maintain contact with AID Missions and Bureaus and their requests receive priority attention from us. This is one of the stated purpose of SMSS and in addition we like to build up the rapport with as many Missions as possible. Without buy-ins from Missions, we will be significantly constrained in our work. I have established contact with the Office of Environment of the Africa Bureau and they are interested in our soil data bases and maps. We are also discussing possibilities of developing training courses in GIS.

2. We have been given instructions to enhance our linkages with the International Agricultural Research Centers. To illustrate some activities:

   - we are planning a workshop with ICRISAT and ICAR on "Stressed Agro-ecosystems". We are awaiting GOI approval for this;
   - we are working with IBSRAM and others on 'Sustainable Land Management'. The workshop on the same subject held in Bangkok last years, was conceived by us.
   - we will be working with IFDC on its new project in Albania on fertilizer supply and nutrient management.
   - we are collaborating with IBSRAM and IFDC in their new project on water-sheds in West Africa.
   - we are collaborating with ICARDA in its soil fertility network.
   - we are collaborating with ICRAF in its AFRENA network.

- we are collaborating with IRRI and others on a proposed workshop on 'carbon sequestration and global climate change'.
- we are working with ICRISAT on GIS in the framework of its ASIAN Grain Legumes network.

3. As explained before, our efforts with national institutions is significantly less during this interim phase. We do not initiate activities but participate when we are invited and when there is a source of funds. Examples of some activities are:

- we will have a training course on Soil Taxonomy and soil survey in South India later this year;
- we are collaborating in a training course in Indonesia with major funding provided by the Belgian Technical Assistance. This will be in late 1993.
- we are negotiating a collaborative activity with Taiwan on forest soils. We had some initial snags but it appears that things are moving now. We are planning a major workshop on forest soils as part of this activity.

4. We have significantly reduced our activities with respect to improving Soil Taxonomy. We believe we have contributed enough to this and it is now left to SCS to continue. As I indicated previously, we will continue our assistance to developing countries to use the system.

5. We are gearing up in a big way in the use and application of data bases and GIS. This involves purchase of hardware and software, hiring new staff and educating ourselves. We believe this is a service we can provide as SCS has emerged a leader in this field.

6. There is still a great need in developing countries for teaching aids, audio-visual materials, and publications. We will continue to work on these.

## The new era

Now I want to turn to the period after 1994. Together with TROPSOILS, we are in the process of developing the strategic plan which we will discuss later. This is where we need your assistance and is the basic purpose of this meeting. I am and have always been an optimist. I believe that the budget situation will improve and so we have to present the best possible proposal to AID.

SO LADY AND GENTLEMEN, PLEASE HELP US TO ANSWER THE QUESTION, "WHERE DO WE GO FROM HERE".

Appendix II

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J. Witty
May 7, 1992
Lincoln, NE

# Short Term and Long Term Plans for *Soil Taxonomy*

## Short term

NSTH issue #16 -- The Soil Classification Staff has nearly completed issue number 16. My goal is to have it completed by the end of May. It includes the recommendations of 3 International Soil Classification Committees, e.g., ICOMERT, ICOMOD, and ICOMAQ. It is quite large, about 430 pages, before formatting to double columns, small print etc. Besides the recommendations from the international committees, it includes about 30 pages of miscellaneous amendments.

Keys to Soil Taxonomy -- As soon as we finalize NSTH issue #16 we will prepare the computer copy for the 5th edition of the Keys to Soil Taxonomy. I expect it will be printed by VPI but we do not have a contract ready yet. Our goal is to have the next edition ready for distribution by the middle of August so it can be used in classes next fall, however, things will have to go pretty smooth at the printers if they get it ready by this date. We are not giving them much lead time.

The Keys to Soil Taxonomy, or *Soil Taxonomy* itself, has never been completely edited by an editor, other than technical editors. I have received a lot of complaints, mainly from our international users, about how the definitions and criteria are written. It is not always easy to understand the intent. For one reason or another our SCS editors have always been too busy with other work when I have asked for editorial assistance.

One of my goals has been to have the 5th edition of the Keys to Soil Taxonomy properly edited. My wife signed up as a volunteer for SCS and we are working together on the editing. Editing the keys has not been an easy one but it is nearly complete. We have tried to make it as grammatically correct as possible and clarify the intent. Other than the technical terms we tried to keep the English as simple as possible so our foreign colleagues who use English as a second language will have fewer problems understanding it. Nearly all the criteria has been rewritten to a certain extent but keeping the wording as uniform as possible. For example, criteria for lithic subgroups had been written several ways, e.g., "have a lithic contact within 50 cm of the soil surface", "have a lithic contact within 50 cm of the surface", "have a lithic

contact within 50 cm of the surface of the mineral soil." Do you measure from the soil surface whether an O horizon is present or not? or measure from the mineral soil surface? or some other undefined surface? Since most soil scientists measured from the mineral soil surface we use "have a lithic contact within 50 cm of the mineral soil surface" except for the soils (soils that essentially lacked O horizons) with an aridic or torric moisture regime where we used "have a lithic contact within 50 cm of the soil surface."

International Soil Classification Committees -- The next Keys will include the recommendations of 6 of the international committees. Of the 3 remaining committees, we have the final recommendations of ICOMID, but ICOMFAM and ICOMMOTR still have more work. We hope to the NSTH issue this calendar year incorporating ICOMID's recommendations into *Soil Taxonomy*. Ben Hajek plans to submit the recommendations of ICOMFAM within a year. It will probably be 2 or 3 years before ICOMMOTR completes their work.

Most of the major changes in *Soil Taxonomy* are from the recommendations of our international committees. But since they have involved specific kinds of soils that are regional in nature, the total impact on *Soil Taxonomy* and implementation of the amendments has been somewhat small. Implementation of ICOMAQ's recommendations, however, impacts throughout *Soil Taxonomy* but, at the same time, I do not believe that it will be a difficult amendment to implement. It will result in the reclassification of relatively few soils. Implementing the recommendations from ICOMOD and ICOMERT will probably be more difficult.

The Soil Classification Staff has spent little time in the past helping with the implementation of the amendments. We feel that by the time ICOMFAM's recommendations are approved there will be so many changes in classification of our soil series that we will have to spend a considerable amount of time working with the states to smoothly make the corrections. I do not know how much time this will take but probably the equivalent of 1 to 2 years.

<u>Long term</u>

There are two things that I have been emphasizing for long term plans. One is to republish *Soil Taxonomy* and the other is to computerize *Soil Taxonomy*.

For the last several years I have been saying that we plan to republish *Soil Taxonomy* by 1995. As we get closer and closer to 1995 that goal appears less and less achievable. Mainly because of not being able to maintain staffing levels. The way things look now we can't do it. The National Soil Survey Center's (NSSC) Technical Advisory Committee recommended adding another person to the Soil

Classification Staff to better assure republication within a reasonable amount of time but, with budget constraints, I have not been able to fill vacancies, let alone add another person to the staff. Unless we get increasing pressure from our cooperators outside SCS, republication of *Soil Taxonomy* will continually be delayed. It is a difficult way to do business but complaints have to reach some measurable level before budget people will listen, mainly because there is not enough money to go around!

We have a contract with Cornell University to make a feasibility study for computerizing *Soil Taxonomy*. We are quite optimistic that the study will turn out quite positive. Plans are to computerize all classes at the order level and to the family level of Alfisols by October 1, 1993. Input data will be good descriptions and lab data, if available. I believe the biggest challenge will be to program around missing data, that is, what can be used as substitute data. If, however, the computer has to make a choice that decision will be recorded so you can go back and manually examine the decision.

I believe this project is feasible but future budgets are somewhat unknown as to whether or not we will have the money to carry it to completion.

Appendix III



Draft

PROPOSAl TO: SMSS-TROPSOIL (SOIL RESOURCES TIC)

FROM: S. W. Buol - North Carolina State University

TITLE: Fertility Capability Classification (FCC)-
Soil Management Guides

GOAL: Provide guidelines for teaching and technology transfer of soil management practices according to soil properties.

PRODUCT: Software program, easily updatable, that allows the user to either input soil characteristics determined from soil characterization or classification or direct observations of the soil and receive management recommendations for upland agronomic practices, paddy rice management, agroforestry practices or pasture practices.

PROPOSAL:

During the last several years a system of classifying soils according to criteria directly related to soil management practices has been developed and tested by personnel in the TROPSOIL project at NCSU. This technical soil classification system is known as the Fertility Capability Classification (FCC). SMSS has actively utilized Soil Taxonomy, the National Cooperative Soil Survey developed natural soil classification system in many parts of the developing world.

Soil Taxonomy is now accepted as the standard classification of sufficient detail for site specific naming of soil although some countries utilize parochial soil classification systems and/or the very broad scale FAO system of naming map units.

The FCC system, being confined to criteria of soil properties of specific importance in soil management decisions, is compatible with all other systems provided they include the necessary measurements in their construct. It also provides for site specific use by soil management decision makers in the absence of any other soil classification by systematical instructing the user in what soil information should be considered for soil management decisions.

At present a format of the proposed software program exists for IBM compatible PC's. It is written in BASIC, and has been informally tested for several years in tropical areas. In this proposed project the FCC software will be expanded to include

Agroforestry recommendations, with the cooperation of ICRAF and Pasture recommendations with CIAT cooperation.

Alternative programming procedures will be explored with the objectives of increased user friendliness, and ease of updating recommendations in the four categories of recommendations, i.e., 1) Upland agriculture; 2) Paddy rice; 3) Agroforestry; 4) Pastures.

Also, a bibliographic section will be developed that will contain references of specific research publications on the kind of soil identified by the FCC criteria and direct programming to lime and fertilizer recommendation programs from TROPSOILS-Hawaii.

USES: The software program will be useful both as tool by soil management decision makers faced with site specific problems and as a teaching tool. Particular attention will be given to the incorporation of features that permit easy updating of the program to incorporate new soil management technology in the future without doing violence to the structure of the system.

Appendix IV



# OXISOLS

Formation, Properties, Classification, Distribution, Management

-- A Slide Set --

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An Idea for a Proposal to SMSS/TROPSOILS

The slide set will consist of 100 color slides and a companion booklet with narratives for each of the slides. The set will be similar in form and substance to the one on Aridisols produced by the University of Arizona. The slide set is intended to provide educators at universities with an aid for teaching soil science at the graduate level.

About one third of the slides will depict typical Oxisols landscapes and profiles; the balance will be computer generated and convey facts and concepts. The set will illustrate and describe the following subject matter areas in a comprehensive but concise manner.

**Definition**

**Formation**
Brief discussion based on the classic state factors

**Properties**
Explicative statements on the resulting physical, chemical, mineralogical properties, particularly those unique to Oxisols and important to agricultural landuse

**Classification**
Salient differentiae and taxa, nomenclature, structure of the Oxisol key, taxonomic equivalents in other classification systems (FAO, French, Brazilian, etc.)

**Distribution**
Geographic occurrence and worldwide distribution at the great group level

**Management**
Landuse, management for agriculture, nonagricultural uses (bauxite, etc.)

FHB/02May92

Appendix V



# CLASSIFICATION, PROPERTIES, AND MANAGEMENT OF ANDISOLS

H. Ikawa
University of Hawaii
Honolulu, Hawaii

A proposal for an audio-visual tutorial, a slide/tape program, for use as a teaching aid in the dissemination of knowledge about the classification, properties, and management of volcanic ash soils. The target audience is students, technicians, and professionals involved in the characterization and utilization of soils in developing countries of the world.

A. Introduction

B. Occurrence and Distribution of Andisols

C. Diagnostic Horizons, Properties, and Behavoir

D. Classification of Andisols

E. Management and Use of Andisols

F. References

## Budget

| | | |
|---|---|---|
| Personnel: | Casual-hire to read script to prepare the master audio tape | $200 |
| Operations: | Duplicate about 80 slides and an audio tape to prepare each of three "original" teaching aids | $200 |
| Supplies: | Kodachrome and Vericolor films and cassette tapes | $100 |
| Travels: | Air fare from Honolulu to island of Hawaii, car rental, and per diem for three days to photograph landscapes, profiles, and land use of Andisols | $500 |
| | Project Total: | $1,000 |

Remarks: Two copies of the audio-visual tutorial will be submitted to the TROPSOILS/-SMSS for further duplication and distribution.

Appendix VI



# A PILOT PROJECT IN DATA ASSEMBLY AND INTERPRETATION FOR RESTORATION OF NATIVE TREES AND WILDLIFE

H. Ikawa and R. S. Yost
University of Hawaii
Honolulu, Hawaii

Introduction--The proposed project will take selected soil survey data including soil descriptions and laboratory data and (1) use a database that can conveniently be utilized and (2) use a GIS system as a management tool. The output, therefore, is an example in data management and interpretation for a specified kind of use.

Justification--Soil survey and other environmental data are sometimes not in the format that can readily be utilized by the user. A database with a convenient input/output format for uses such as crop modelling, for example, will be highly desirable. Sometimes, insufficient yield or performance data exist and it is necessary to make approximations in the early stage of data interpretation. A systematic approach such as with the expert system may be possible in making such approximations.

Approach--A section of a 2000-acre Hakalau National Wildlife Refuge was recently examined for the establishment and growth of native forest trees which would in turn serve as protective habitat for some of the endangered bird species in Hawaii. In cooperation with the US Fish and Wildlife Service, Soil Conservation Service, and Forest Service, field work was initiated to delineate the shallow and deep soils associated with the closed forests, open woodlands, and grasslands.

Initial plantings of *Acacia koa* by the USDA Forest Service showed that the survival of the native tree species was not always successful. Such a performance has been attributed to the soil factor and/or climate factor. The initial study, therefore, is to examine the soil factor.

Using the growth requirements of koa and soil and climate data, the expert system will be used to determine the suitability of the different soil map units for the establishment of koa. A base map of the survey area will be digitized and soil, climate, tree survival, and other appropriate data will be used in a GIS system. The GIS system will be utilized not only in forest establishment in the different areas but also in the management of the refuge in native bird establishment.

This project will provide an example of a useful product for TROPSOILS institutions as follows: (1) promote interpretation of existing SMSS soil data; (2) provide a prototype for linking soils data with GIS systems; (3) begin to address the question of uncertainty in GIS applications through fuzzy set theory and first-order uncertainty analysis of errors in predictions resulting from propagated error of input data.

Appendix VII



March 17, 1992

**SHORT TERM ACTIVITY PROPOSAL**
SMSS-Tropsoils-Cornell
*A. Van Wambeke*

This proposal is submitted to SMSS-TROPSOILS-TIC following Dr. Eswaran's memo of February 26, 1992.

## 1 Summary

Crusting of Alfisols is a major constraint in West Africa. Mr. Charles Bielders, a PhD candidate with Tropsoils support, is conducting investigations on this phenomenon in several soils of Togo in cooperation with national institutions. SMSS's contribution would consist of characterizing the experimental sites, and compare several alternative management practices to alleviate the constraint from the standpoints of economic returns and soil conservation. Farming system surveys and land resources studies would be needed to achieve these objectives.

The activity would provide a case study for inclusion in monographs, or other teaching materials (manuals, guidelines, slide sets, or visual aids) on soil survey interpretation methods (computerized or not) for small or medium sized regional projects. The monographs could be considered for production in the "1994-2000 SMSS in Tropsoils" context.

## 2 Site description

The region belongs to the "Terres de Barre" area that is mainly characterized by Kandiustalfs and Kanhaplustalfs. Population density averages 130 inhabitants/$Km^2$. Soils have mainly coarse-textured surface horizons. Crusting is interpreted as being the result of low organic matter contents. The problem is not new and was already researched in 1964.

Crusting is an impediment to water infiltration and seed emergence. Given the frequency of dry spells at the beginning of the growing season, its avoidance leads to substantial benefits for farmers.

The actual experimental sites are at ORSTOM-Lome-Davie and surrounding area.

## 3 Linkages

Linkages are actually operational with the *Institut des Sols* at Lome through Dr. S. Worou (Directeur de la section de cartographie des Sols). Orstom is also giving support (Dr. Brabant)

## 4 Workplan

The research will develop, validate and test expert systems able to advise farmers or other decision makers how to select the most profitable land-use alternatives (soil management practices to alleviate the effects of crusting)) for the set of land

types in the study area. The practices would also be evaluated on their suitability for preserving the resource base.

The tentative workplan includes the following:

1. Selection of a number of sites. The criteria for selection, among other criteria, will be the availability of inventories and maps on *natural resources* (climate, soils, water, vegetation, etc.) and *human resources* (farming systems, technology, socio-economic components).

2. Identification and selection of a number of cropping or farming systems that include the seed bed preparation alternatives that are considered most adapted to the region. It would include a detailed description of their agronomy, economic and social components. The activities in this diagnostic process would include:

   a. Identification of the physical constraints to satisfactory performance of the selected land management alternatives (cropping systems) on the available land resources.

   b. Identification of the economic constraints that reduce the sustainability of the practice.

   c. Identification of the deterioration that the natural resources suffer under the selected set of land-uses.

3. Physical and economic evaluation of the land-use alternatives by several land resources interpretation techniques.

## 5 Schedule

1. **Year 1: September 1992-December 1992** - Collection of existing data and preparation of research methodology *on campus, at Cornell.*

2. **Year 1: January 1993-August 1993** - Sampling of experimental sites and farming systems surveys *in Togo.*

3. **Year 2: September 1993-December 1993** - Preliminary interpretation of data *on campus at Cornell.*

4. **Year 2: January 1994-May 1994** - Collection of supplementary data *in Togo*

5. **Year 2: June 1994-September 1994** - Final report *at Cornell*

## 6 Budget[1]

| | YEAR ONE | YEAR TWO |
|---|---|---|
| *Stipend & Fees- G.R.A.* | $17600 | $17600 |
| *Internat.Travel* | | |
| G.R.A. | $5000. | $5000. |
| P.I. | $5000. | $5000. |
| *U.S. Travel* | | |
| P.I. | $1000. | $1000. |
| *Allowance Togo* | | |
| P.I. | $1000. | $1000. |
| G.R.A. | $8000 | $5000 |
| *Transportation Togo* | $750. | $450 |
| *Labor Togo* | $800. | $400. |
| *Communications* | $500. | $500. |
| *Equipment-Vehicle(*)* | $15000 | $2000. |
| *Maintenance* | $500. | $500. |
| *Supplies* | $1000. | $2000. |
| *Overhead* | $19703 | $15905 |
| **Totals** | **$75,853** | **$56,355** |

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1. (*) The expenses for the vehicle could be lower depending on the availability of vehicles at the research site, and cooperation from other agencies (USAID, ORSTOM, etc.

Appendix VIII



# ESTIMATION OF SOIL DATA

A Tentative Idea for a Research Proposal

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**Rationale**
A rapidly growing number of crop and soil simulation models, expert systems, and decision support systems require detailed site-specific soil data. In the absence of such data, models and systems are often run with erroneous data resulting in flawed outputs. The situation is particularly serious in countries of the developing world which frequently lack adequate soil resource inventories. A reliable default methodology should alleviate this dilemma.

**Objective**
To develop a surrogate methodology that generates soil data required by agricultural decision software.

**Approach**
Sources of information for estimating soil properties are the following locally available and generic data:

1. Soil information: soil profile and site descriptions, soil analytical data, soil maps, reports;

2. Environmental information: geologic and topographic maps, climate records, vegetation maps, satellite imagery; and

3. Generic data from the USDA/SCS/WSR soil database.

Evaluating the information compiled under (1) and (2) above and data gathered through interviews and, if possible, field visits, experts can deduce the classification of the soils of the area under consideration. The taxonomic placements should be accurate for the great group level and, depending on the specificity of the information available, at lower levels.

Once the classification has been established, the SCS/WSR database can be accessed and mean values for parameters that are taxonomically meaningful at the hierarchical level employed can be obtained. Many data required by the models, such as horizon thickness, soil color and texture, cannot be derived from the database. However, properties used as differentiae at or above the taxonomic level in question, such as base saturation or bulk density, or accessory properties highly correlated with these data, can be estimated by taxonomic analogy. It is proposed, therefore, that a database containing these parameters be established for all great groups recognized in Soil Taxonomy for use by the modeling community.

The proposed methodology thus consists of local information, data derived from a global soil database, and expert knowledge. Although far from perfect, this approach should nevertheless help reduce the model error caused by inaccurate soil input data.

FHB/03May92

Appendix IX



Agriculture
Canada

Research
Branch

# Benchmark Sites for Agricultural Land in Canada

## Centre for Land and Biological Resources Research (CLBRR Contribution No. 92-28)

### Why Benchmark Sites?

There have been numerous studies conducted and statements prepared pertaining to the decline in the quality of the agricultural land resources of Canada. The decline in soil quality is caused by degradation processes such as erosion, compaction, salinization and acidification. Although most of these are natural processes, the rate of deterioration can be accelerated by some conventional farming practices. A national network of benchmark sites,that serve as reference points is an ideal way to quantitatively monitor changes in soil quality and identify environmental degradation indicators for major agricultural practices.

### Objectives

1. To provide a baseline data set for assessment of change in soil quality and biological productivity (yields, etc.) of representative farming systems.
2. To provide a means of testing and validating predictive models of soil degradation and productivity.
3. To provide a means of evaluating agricultural sustainability of current farming systems in major agricultural regions of Canada.
4. To provide a network of benchmark sites at which integrated multi-disciplinary research programs can be developed.

### Benchmark Site Selection Criteria

Each benchmark site should:

1. represent a major soil zone and/or ecological regic
2. represent a typical physiographic region (landscap and/or broad textural grouping of soils;
3. represent a major (or potentially major) farming sy tem within a region;
4. complement provincial priorities and opportunities
5. provide potential impact of a susceptible degradati process(es);
6. cover about 5 to 10 ha. in size, or a small watersh in some cases;
7. be located on cultivated agricultural land, as part actual farming system.

By using the above criteria, 22 sites were identifi (Figure 1, Quebec's two sites are split). A brief descri tion of the general characteristics of these sites a outlined in Table 1.

### Deliverables

1. Initial characterization of 22 benchmark sites whic includes: selected chemical, physical, mineralogic and morphological properties; detailed soil and co tour maps.
2. Recommendation of suitable environmental degr dation indicators for major agricultural regions.
3. Data that can be used to validate predictive mode for various soil degradation processes.
4. After 5 and 10 years of monitoring, comprehensiv analysis and report of soil quality changes in Car ada, part of State of Environment Report.

### Project Plans

A network of 22 monitoring sites (Figure 1) will be estat lished across Canada and these sites are to be mon tored for at least 10 years. These have been selected t represent various agro-ecosystems. It is anticipate that by using regional soil climatic information and expe systems, we will be able to make general statements o soil quality trends regionally and nationally. Monitorin

selected soil variables of the landscape under typical farm production systems for 5 or more years may be adequate to demonstrate changes in soil quality.

Each benchmark site will be characterized by detailing specific chemical, physical, mineralogical and morphological properties. A detailed soil map and contour map of the site will be prepared and climatic data will be collected at some of the sites. In many instances the data collected from the benchmark sites will be used to validate predictive models for various soil degradation processes. In addition, it is hoped that other research groups may become interested in establishing long term integrated research programs at these sites.

**Site Characterization**

1. All sites will be approximately 5 to 10 hectares in size so that they represent all segments of the targeted landscape.
2. A detailed soil map will be prepared at a scale of about 1:1,500.
3. A detailed contour map will be developed with a 0.5 m or 0.25 m interval, depending on relief.
4. Two pedons representing the major soils at each benchmark site will be sampled and described in detail.
5. Baseline information will be collected to characterize the spacial variability at these sites. Surface (Ap horizon) and subsoil (50-60 and 90-100 cm) samples will be collected and described. Routine chemical analyses will be carried out; e.g. pH, total inorganic and organic C, total N, exchangeable cations, CEC, available P and K, etc. In addition, particle size distribution, clay mineralogy, surface area, and total elements will be determined on selected samples. These benchmark sites will be resampled periodically and the analyses repeated to monitor changes.
6. Where applicable, sampling programs may be established to characterize specific degradation processes. For example, $^{137}Cs$ analyses may be carried out at some sites to estimate surface soil movement by erosion and cultivation.
7. Climatic data will be extrapolated from nearby meteorological stations or measured by equipment located on the site.
8. Aggregate stability will be monitored for most of the sites to evaluate soil structure stability and for modelling wind erosion.

**In Situ Field Measurements**

A number of physical parameters will be measured at each site every year. These may vary somewhat from site to site depending on the characteristics of the area. In most cases they will include:

1. Saturated hydraulic conductivity measurements (Guelph Permeameter) as an indication of soil infiltration and permeability.
2. Penetrometer measurements to estimate soil penetration resistance as an indication of soil tilth or relative density.
3. EM 38 conductivity measurements to monitor soil salintiy.
4. Crop yields (harvest) as an productivity indicator on how soil landscape positions and other soil quality characteristics are interacting.
5. Root and bio-pore counts as indicators of soil compaction.
6. Earthworm counts to monitor earthworm activities as influenced by various farming systems.

**Need More Information?**

Please contact the appropriate site manager(s); their names and addresses are listed in Table 2.

**Acknowledgement**

This study is part of the Soil Quality Evaluation Program of CLBRR. It is partially funded by the National Soil Conservation Program.

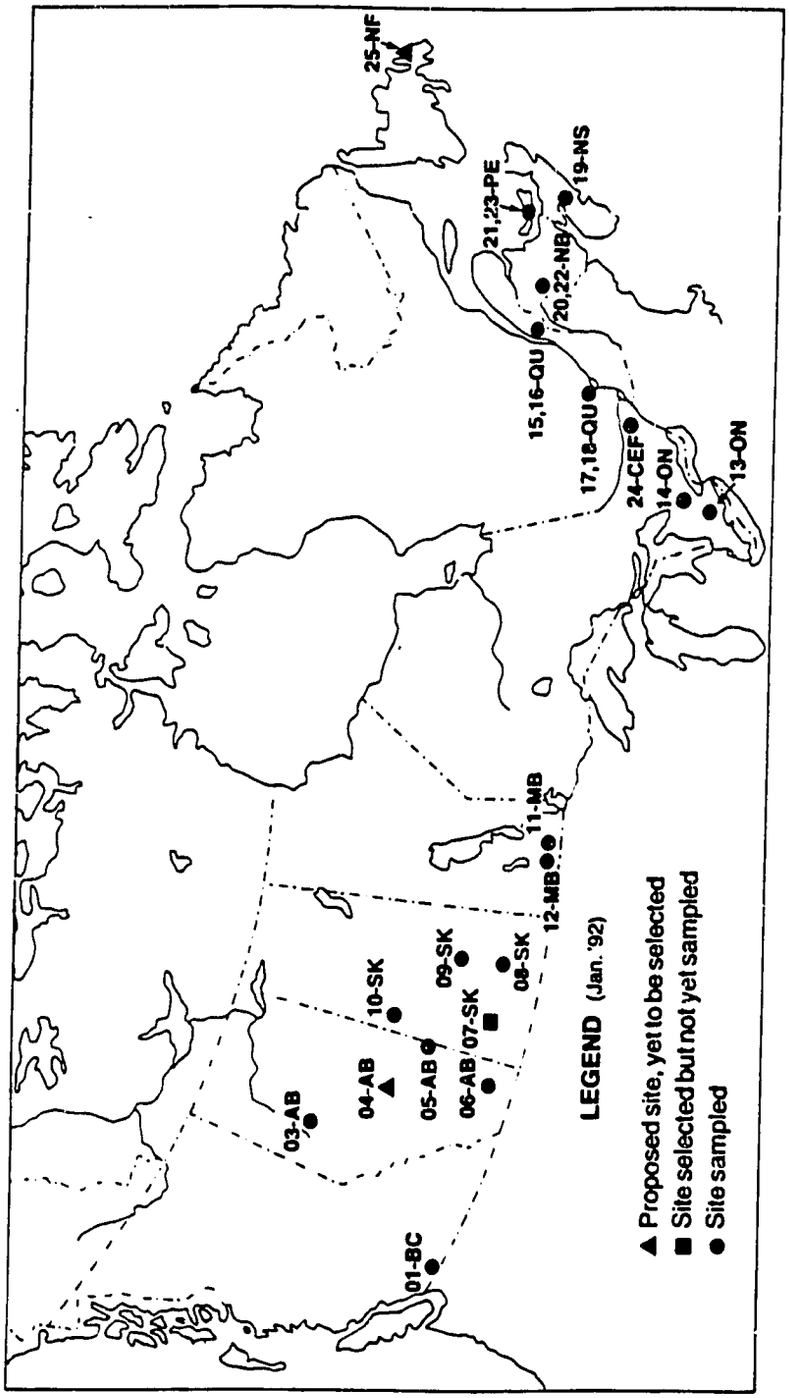


**Figure 1. Location of Benchmark Sites.**

**Table 1. Brief Description of Sites**

| SITE NO.* | ECOLOGICAL SETTING AND SOILS | PARENT MATERIAL AND SURFACE FORM |
|---|---|---|
| 01-BC | South Coastal Pacific, Humic Gleysols | Medium textured fluvial. Level |
| 03-AB | Parkland-Boreal Transition, Dark Gray soils | Fine textured lacustrine. Level |
| 04-AB | Northern Parkland, Black soils | Medium textured lacustrine. Undulating |
| 05-AB | Prairie-Parkland Transition, Dark Brown soils | Medium textured fluvial over till. Hummocky |
| 06-AB | Southern Prairie, Brown soils | Medium textured lacustrine over till. Undulating |
| 07-SK | Southern Prairie, Brown soils | Medium textured till. Undulating, dissected |
| 08-SK | Mixed grass Prairie, Dark Brown soils | Fine textured lacustrine. Undulating |
| 09-SK | Prairie-Parkland Transition, Black soils | Medium textured till. Hummocky |
| 10-SK | Southern Boreal, Gray Luvisols | Medium textured till. Undulating |
| 11-MB | Eastern Parkland, Humic Gleysols | Fine textured lacustrine. Level |
| 12-MB | Eastern Parkland, Black soils | Medium textured lacustrine. Level |
| 13-ON | Southern Temperate, Gray Brown Luvisols | Fine textured lacustrine. Level and hummocky |
| 14-ON | Mid Temperate, Gray Brown Luvisols | Medium textured till. Rolling |
| 15-QU | Northern Temperate, Dystric Brunisols | Medium textured till. Rolling |
| 16-QU | Northern Temperate, Dystric Brunisols | Medium textured till. Rolling |
| 17-QU | Mid Temperate, Humic Gleysols | Marine clay. Level |
| 18-QU | Mid Temperate, Humic Gleysols | Marine clay. Level |
| 19-NS | Atlantic Temperate, Gray Luvisols | Medium textured till. Undulating |
| 20-NB | Mid Temperate, Humo-Ferric Podzols | Coarse textured till. Rolling |
| 21-PE | Atlantic Temperate, Humo-Ferric Podzols | Coarse textured till. Undulating |
| 22-NB | Mid Temperate, Humo-Ferric Podzols | Coarse textured till. Rolling |
| 23-PE | Atlantic Temperate, Humo-Ferric Podzols | Medium textured till. Rolling |
| 24-ON | Mid Temperate, Humic Gleysols | Medium textured fluvial. Level |
| 25-NF | Atlantic Boreal, Podzolic soils | To be determined |

* Site 02-BC was proposed but not selected.

| CROPPING SYSTEM | TILLAGE SYSTEM |
|---|---|
| Silage corn | Tiled drainage, conventional tillage |
| Cereals - canola - forage | Conventional tillage |
| Barley - forage - oilseed | To be determined |
| Canola - wheat - fallow | Conventional tillage (cultivators) |
| Wheat (seed) - beans - sugar beets | Irrigated conventional tillage |
| Wheat - fallow | To be determined |
| Extended rotation, mainly wheat | Conventional tillage |
| Extended rotation, continuous cereal | Conventional tillage |
| Barley - oilseed | Conventional tillage |
| Continuous cereals | No-till |
| Wheat - canola | Minimum tillage |
| Corn - soybean - wheat - forage | Minimum tillage |
| Corn - forage | Minimum tillage |
| Silage corn - forage | Conventional tillage |
| Silage corn - forage | Conventional tillage |
| Corn - forage | Conventional tillage |
| Corn - wheat - soybean - barley | Minimum tillage |
| Corn - forage | Spring disked |
| Potato - grain | Chisel plow |
| Potato - grain - forage | Conventional (plowdown of forage) |
| Potato - potato - grain | Chisel plow, grassed waterway, diversion terraces |
| Continuous potato (started 1991) | Conventional tillage |
| Corn - soybean - alfalfa | Conventional & no-till |
| To be determined | To be determined |

**Table 2. Benchmark Sites Managers***

| SCOPE | MANAGERS | ADDRESS | TELEPHONE |
|---|---|---|---|
| National | Dr. C. Wang | CLBRR<br>Central Experimental Farm<br>Ottawa, Ontario K1A 0C6 | 613-995-5011 |
| Western Region | Mr. B.D. Walker | Terrace Plaza Tower, 6th F<br>4445 Calgary Trail South<br>Edmonton, T6H 5R7 | 403-495-6122 |
| Eastern Region | Mr. H.W. Rees | Research Station<br>P.O. Box 20280<br>Fredericton, E3B 4Z7 | 506-452-3260 |
| BC | Ms. E.A. Kenney | Research Station<br>6660 N.W. Marine Dr.<br>Vancouver, V6T 1X2 | 604-224-4355 |
| AB | Mr. B.D. Walker | Terrace Plaza Tower, 6th F<br>4445 Calgary Trail South<br>Edmonton, T6H 5R7 | 403-495-6122 |
| SK | Dr. L.M. Kozak | Dept. of Soil Science<br>University of Saskatchewan<br>Saskatoon, S7N 0W0 | 306-975-5637 |
| MB | Dr. W. Michalyna | Dept. of Soil Science<br>University of Manitoba<br>Winnipeg, R3T 2N2 | 204-474-6122 |
| ON | Mr. D. King | Ontario Inst. of Pedology<br>70 Fountain Street<br>Guelph, N1H 3N6 | 519-766-9180 |
| QU | Mr. M.C. Nolin | Complexe Scientifique<br>2700, rue Einstein, C.<br>Ste-Foy, G1P 3W8 | 418-648-7749 |
| NB | Mr. H.W. Rees | Agriculture Canada<br>P.O. Box 20280<br>Fredericton, E3B 4Z7 | 506-452-3260 |
| NS | Mr. K.T. Webb | N.S. Agr. College<br>P.O. Box 550<br>Truro, B2N 5E3 | 902-893-6724 |
| PE | Mr. D.A. Holmstrom | Research Station<br>P.O. Box 1210<br>Charlottetown, C1A 7M8 | 902-566-6800 |
| NF | Mr. E.F. Woodrow | Agriculture Canada<br>P.O. Box 7098<br>St. John's, A1E 3Y3 | 709-772-5964 |

*All affiliated with Centre for Land and Biological Resources Research (CLBRR), Research Branch, Agriculture Canada.

Appendix V



# GLOBAL PLAN OUTLINE 1994-99

## I. RESEARCH AND DEVELOPMENT SERVICES

### A. Natural Resource and Environmental Management

- Inadequate Resource Inventory and Information Base
- Internal/External Production-Demand Pressures
- Deficiencies in Programmatic Natural Resources-Agriculture-Environmental Continuum

### B. Soil Management Technologies for Sustainable Agriculture

- Soil Biological, Chemical and Physical Inadequacies
- Degradation, Rejuvenation and Econometric Dynamics
- Biogeochemical, Environmental and Ecohealth Managemen

## II. COMMUNICATIONS AND TECHNOLOGY TRANSFER

### A. Outreach, Networking, Training, Technical Backstopping

- Institutional-Clientele Gap
- Natural Diversity of Agriculture/Environmental Ecosystems
- Sociological, Economic, Cultural, and Geographical Diversity of Users

## III. IMPACTING AND EVALUATIONS

### A. Policy, Family and Development

- Policies as Products of Research and Development
- Resource and Environmental Enhancement Verifications
- Family Food Security and Nutritional Improvements

### B. Entrepreneurial Development and Services

- The Technology Base for Sustainable Development
- Development Strategies for Micro and Macro Units
- Paybacks, Primary and Secondary Benefits

PRELIMINARY DRAFT

TROPSOILS EXTENSION PROPOSAL 1994-99

GLOBAL PLAN - THE EXPANDED FAMILY

APPROACH

The TROPSOILS goal is to conduct collaborative research and provide development services to ensure that environmentally, ecologically and agronomically sound soil management technologies can provide the foundation for economic sustainability in developing countries. This will provide the expanded family the flexibility for programs to be updated periodically to reflect progress made, new priorities identified, acceptance of new challenges, and changing financial conditions. The guiding principles to TropSoils plan are to:

1. Collaborate with demand-driven research based on sound principles of environmental and economic sciences to over come soil and water constraints to agriculture sustainability that will enhance the natural resource base in developing countries.

2. Conduct these studies with our peer host country scientists, regional and international centers and private enterprize sector so as to make the best use of available knowledge and resources, ensure that the research is adapted to both user and setting, link programs to active network systems.

3. Deploy the research and development activities according to agroecological regions that share many common economic, climatic and soil and water resources constraints, so as to focus the programs to maximize global impact of these activities.

4. Establish in the collaborative mode, long-term research and development sites in key agroecological regions as needed to develop new technologies, verify sustainability of management options, generate impact criteria and afford educational opportunities in soil and water resources management.

5. Provide cost sharing soil management development services to develop soil resource inventories and characterization databases to effectively serve IARCs, NARS, commodity CRSP and improvement programs, the crop and global change modelers and land-use policy makers in their program needs.

6. Collaborate in interCRSP opportunities by providing the leadership in soil and water resources conservation, options in land-use management and the integration of appropriate technologies for agriculture sustainability for family ecohealth improvement.

7. Generate and put to the test econometric indicators that can be employed by natural resources use planners to simulate long-term impact as would be effected by the adoption of appropriate or inappropriate soil and water resources technologies.

8. Encourage the broadest possible exchange and use of technologies generated from these efforts through sharing of unified publications, technical conferences, seminars and other means of communications.

PRELIMINARY DRAFT

TROPSOILS EXTENSION PROPOSAL 1994-99

GLOBAL PLAN - THE EXPANDED FAMILY

## PROGRAM STRATEGY

The program strategy for the TropSoils expanded family global plan is in three broad-based initiatives into which researchable soil-water management constraints will focus, technologies can be communicated, impacting and evaluations assessed for feedback to future planning. In view of the grant goal, the three global initiatives of the Soil Management CRSP are: 1) Research and Development Services; 2) Communications and Technology Transfer; and 3) Impacting and Evaluations. The objectives for the 1994-99 global plan are:

- to develop sustainable land management systems and practices
- to develop soil and resource information systems
- to develop a global training network for soil management and conservation
- to enhance the knowledge base

Within these three initiatives, TropSoils has identified five global thrusts in which the programmatic collaboration can be focused to provide environmentally, ecologically and agronomically sound soil management technologies to support economic sustainability in developing countries. The plans of work are multidisciplinary developed along very strong lines of bilaterally identified programmatic needs.

PRELIMINARY DRAFT

# GLOBAL INITIATIVE ONE: RESEARCH AND DEVELOPMENT SERVICES

The TropSoils expanded family will focus their research and developmental services initiatives into the two global thrusts: 1) Natural Resource and Environmental management; and, 2) Soil Management Technologies for Sustainable Agriculture.

## NATURAL RESOURCE AND ENVIRONMENTAL MANAGEMENT

Sustainable economic development requires the environmentally sound management, utilization and conservation of those natural resources which are most critical to providing the food, fiber, fuel and construction materials requirements of rural and urban families, while still preserving genetic diversity and attenuating global climatic change. Three broad program areas on which the expanded TropSoils program will focus their research and developmental services are:

1) Inadequate Resource Inventories and Information Bases

2) Internal/External Production-Demand Pressures

3) Deficiencies in the Programmatic Natural Resources-Agriculture-Environmental Continuum

## SOIL MANAGEMENT TECHNOLOGIES FOR SUSTAINABLE AGRICULTURE

Every country has an endowment of soil, water, mineral, plant and animal resources. Sustainability agriculture, with soil and water as the resource base, is the foundation upon which every country depends to achieve continuous economic development. History has demonstrated that when the soil and water resources have been degraded below the level to sustain a civilization, the results are catastrophic. TropSoils research and development services focuses on developing technologies for the successful management of soil and water resources for agriculture to satisfy changing human needs while maintaining or enhancing the natural-resource base and avoiding environmental degradation. Three broad program areas are:

1) Soil Chemical, Physical and Biological Inadequacies

2) Degradation, Rejuvenation and Econometric Dynamics

3) Biogeochemical, Environmental and Ecohealth Management

PRELIMINARY DRAFT

# GLOBAL INITIATIVE TWO: COMMUNICATIONS AND TECHNOLOGY TRANSFER

Achieving sustainable agriculture and natural-resource preservation based on sound environmental practices requires the effective validation, extrapolation and translation of scientific information that can be transferred to and used by very diverse user groups. In the TropSoils expanded family, communications and technology transfer includes those activities and interventions of extrapolation, communications, training, networking, and decision-support activities which translate research into useful knowledge and practiced technologies.

## OUTREACH, NETWORKING, TRAINING, TECHNICAL BACKSTOPPING

The communications of research results that can be transferred and adopted as useable technology is a lengthy process that includes research data collection, interpretation, peer reviews, publication and verification before it comes into applications. Often times, widespread application and adoption of environmentally sound natural resource management practices for sustainable agriculture can be hastened by formulation of technology-driven policies and synthesized with agribusiness investments. TropSoils identified three programmatic areas in communications and technology transfer that need to be addressed to hasten the adoption on sustainable technologies:

1) Institutional/Clientele Gap

2) Natural Diversities of Agricultural/Environmental Ecosystems

3) Sociological, Economic, Cultural and Geographical Diversity of Users

PRELIMINARY DRAFT

# GLOBAL INITIATIVE THREE: IMPACTING AND EVALUATIONS

Sustainable economic development is built on an agriculture foundation that is fueled by ever increasing demand for scientific technologies that will impact environmentally sound management of the available natural resources. Food security and improved nutrition are fundamental to obtaining the increase in productivity needed to drive economic development that can enhancen the quality of life. TropSoils has learned that demands for environmental and resource management technologies increases as agriculture is demanded to produce more to sustain economic development. Short-term gains in agriculture productivity cannot be at the expense of long-term environmental degradation and permanent destruction of the natural resource base. Policies that will sustain the increasing demand on agriculture productivity, without environmental degradation and permanent loss to the natural resources endowments, must be based on sound scientific and economic principles. TropSoils, working through the ever changing process of assessing technology impacts followed by evaluations through feedbacks, can implement programmatic changes through user demand-driven research and development. TropSoils has identified: 1) Policy, Family and Development; and 2) Entrepreneurial Development and Services as two basic thrusts to ensure adequate programmatic impacting and feedback evaluation.

## POLICY, FAMILY AND DEVELOPMENT

Policies can serve as the legislative foundation upon which equitable sustainable development of nations are built. Those policies that most impact the degradation or the preservation of a nation's natural resource endowments also will impact the sustainablility of the agriculture, the quality of the environment and the ecohealth at the basic family unit level. Nations that increase agriculture productivity, while lacking sound environment, ecological, agronomic and economic policies that are equitable, have often traded short-term gains for the long-term sustainability. TropSoils research and development services target the impacting and evaluations thrust for policy, family and development in three programmatic areas:

1) Policies as Products of Research and Development

2) Resource and Environmental Enhancement Verifications

3) Family Food Security and Nutritional Improvements

## ENTREPRENEURIAL DEVELOPMENT AND SERVICES

The individual farm unit, small shopkeeper, cooperative

managers, as well as the medium and large businesses, are entrepreneurs that can mobilize agriculture productivity necessary to fuel sustainable economic development. The continuous generation, translation, extrapolation and applications of research and development technologies are the very foundation upon which entrepreneur driven agriculture productivity and economic development can be sustained. TropSoils views the need to narrow the institutional-clientele gap through impacting and evaluations activities in entrepreneurial development and services. The three programmatic areas of focus are:

1) The Technology Base for Sustainable Development

2) Development Strategies for Micro and Macro Units

3) Paybacks, Primary and Secondary Benefits

Appendix XII

## GLOBAL INITIATIVE ONE

## NATURAL RESOURCES ASSESSMENT, MONITORING, AND MANAGEMENT

### The Issue

With increasing populations and population pressures in many countries, agriculture competes and even invades fragile ecosystems. In many of these countries, a large part of the population is already caught in the poverty trap and this forces them to eke out their livelihood at the expense of the natural resource base. For the first time in the history of mankind, the finiteness of the land resource has become a crucial element in the population supporting capacity of land. In addition, due to the agricultural invasion of fragile-lands and the misuse of land, other resources are degrading, biodiversity has emerged as a critical issue, and the ability to sustain food and fiber production is being questioned.

Technologies for sustainable agriculture are available and continuously being tested or developed and this is the basis for Global Initiative Two, elaborated later. Appropriate technologies and the matching of technologies to environment are important and relevant issues, which have not received due attention. Basic soil resource information is lacking or is not utilized adequately to provide the basis for environmental assessment or monitoring, and for planning appropriate country policies for sustainable land management. Information currently available is fragmentary, of questionable quality, and/or not in a format readily useable by national planners and other clients such as extension workers for assisting farmers in land management.

An inventory of soil resources is necessary for country, regional, and farm level planning for agriculture. A knowledge of soil resource characteristics is fundamental for optimal selection of sites and research, experimental station setting, interpretation of research results, and technology transfer. Soil resource inventories and characterization databases serve as the only meaningful basis for linkage among IARCs, NARS, Crop and Livestock CRSPs, and the Soils CRSP.

Soil resource information provides the basis for integrating agronomic management in the context of socioeconomic and socio-political reality into sustainable agricultural systems. This same information on a global basis is vitally essential to the prediction of response to interventions for production, of climate change response, the negative impacts of soil degradation, and the quality of life in general. Principles of application are site-specific and dependent on soil resource information.

**ACTIVITY AREAS**

1. **Resource base information on research and transfer sites.** There is a need to work more closely with the IARCs, CRSPs, NARS and other regional and international groups to obtain more detailed mapping and soil characterization of their research sites for more effective agrotechnology transfer and to make the resultant information more available globally. Resource base information is the main basis for transfer of research results from the IARCs, national and international experimental stations, to farmers.

2. **Institutional strengthening and human resource development.** There is a need to provide assistance and training to developing country scientists and planners and their institutions in obtaining and utilizing land and soil resource information for inventories and maps to enable more appropriate policy decisions, and for the design and implementation of development programs.

3. **National and international data bases and data base management systems.** There is a need to develop greater access and commonalty among the various international soil databases developed by institutions in their national and international work. There is a need to obtain more information on the existing soil databases to make the total agronomic information more useful for input to production system analyses and global change scenarios.

4. **Monitoring degradation.** Technologies are being developed to reduce degradation of the soil resource base. However, technologies are needed to monitor degradation so that unsustainable agricultural practices are identified and modified before onset of degradation. Costs of rehabilitation of degraded ecosystems are hundred to thousand times more expensive than investments in soil management technologies. Rapid appraisal technologies that could be used by PVOs would be useful to assist the resource poor farmers and need to be developed.

5. **Monitoring soil resource resilience and enhancement.** This is designed to monitor dynamics of management systems.

# GLOBAL INITIATIVE TWO

## TECHNOLOGIES FOR SUSTAINABLE AGRICULTURE

The Issue

**ACTIVITY AREAS**

To develop methodologies to have economic evaluations of land quality so that we can communicate with farmers and decision makers. Also there is a need to develop and test appropriate methodologies that correctly alerts or signals of impending collapse of agricultural or environmental systems.

# GLOBAL INITIATIVE THREE

## OUTREACH

The Issue

**ACTIVITY AREAS**

1. **Institution strengthening and human resource development.** These provide the greatest impact. Techniques in soil survey, quality assurance, utilization of soil survey information, and techniques to monitor degradation are required by developing country scientists. Through regional training courses, and regional or international correlation meetings, they can be strengthened. Further, technical assistance to institutions is a viable mechanism for a cost-effective transfer of information.

# GLOBAL INITIATIVE FOUR

## PRIVATE SECTOR DEVELOPMENT

The Issue

**ACTIVITY AREAS**

1. **Utilization of resource information by farmers.** Translating the technical resource information and assisting the use of this information by farmers is a private sector responsibility. Assistance can be provided to private sector to provide this service.

# GLOBAL INITIATIVE FIVE

## POLICY DETERMINATIONS AND FAMILY AND DEVELOPMENT

The Issue

**ACTIVITY AREAS**

1. **National policies on resource allocation and use.** Many countries need assistance to formulate policies for discriminatory use of the soil resource, and the sustainable management of these resources. Information on the resource base is a prerequisite and based on this and other issues and concerns, assistance to formulate policies similar to the U.S. Resource Conservation Act, Wetlands Regulations, etc., will be made available to collaborating countries.