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Report to

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on

Soil Survey Activities

University of Azores

from

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Soil Survey and Support Activities
University of Azores

OBSERVATIONS AND RECOMMENDATIONS

Soil survey involves not only the field mapping of soils, but includes such support activities as the characterization of the soils in each mapping unit to determine their physical, chemical, mineralogical, and morphological properties. In addition, research activities related to map unit composition and variation, and plant adaptability and response to various management techniques on different mapping units are an important aspect of the interpretation component of a soil survey program.

Field Soil Survey

A good soil mapping program is the first step in developing a strong soils program in the Azores and will prove to be a valuable asset in improving agricultural production and in making other land use decisions. The soil scientists that have been assigned to the mapping program appear to be quite capable in carrying out the task. Edwardo Camara and Manuel Ferreira have considerable years of experience in mapping soils and Joao Madruga, although young and inexperienced, appears to be extremely bright and capable of doing an excellent job. Many of the soil survey techniques which they have utilized, such as digging a large number of pits, making descriptions

of the soils, and trying to draw lines around similar soils, is extremely cost inefficient and does not always result in an accurate soils map. However, Paulo Guerra, who has mapped soils throughout the world for FAO, has considerable knowledge and experience in the application of air photo interpretation in mapping soils and will lend a great deal of expertise in developing an excellent mapping program as soil survey leader. Jorge Pinheiro and Jaoa Sampaio both have considerable knowledge about the soils and landscapes in the Azores and will be a valuable component of a good soil survey program.

Soil Characterization

Laboratory support is a necessary component of a good soil survey program. Without it, the maps developed are an academic exercise and do not lend much support for interpretive purposes. One of the first tasks of the soil characterization laboratory is to determine what analyses are important for characterization, classification, and interpretive purposes. Many analyses are routine for all soil characterization laboratories, however, additional analyses may be required for volcanic soils and for the specific problems associated with Azorian agriculture.

As a first approximation, it is recommended that the following analyses be run on a routine basis: particle size distribution, organic matter content, cation exchange capacity, exchangeable cations (Ca, Mg, K, Na), exchangeable acidity,

free iron oxides, pH (H_2O, KCl, NaF), extractable P and K, and 1/3 and 15 bar water. It may not be necessary to run these analyses on all horizons, but they should be run on the major horizons (A, B, and C). Other analyses which may prove valuable on a selected number of samples include: clay mineralogy, extractable or amorphous aluminum, total nitrogen, extractable Ca and Mg, bulk density, available micro elements, and phosphorous adsorption isotherms.

One of the major problems that will have to be resolved is concerned with laboratory procedures. Many of the methods that have been developed in soil science and which are standard in most laboratories frequently are not suitable or applicable for soils of volcanic origin. In particular, textural analysis and cation exchange capacity methods give erroneous results on volcanic soils. It is recommended that a review of the methods utilized in other volcanic areas of the world be evaluated and that appropriate procedures be developed. The R.I.A.E.S. could perhaps lend some support in this area of research.

Following the identification and development of appropriate methods, personnel in the laboratory should be trained and well versed in the procedures utilized. They should analyze the same soil samples numerous times until their increased familiarity with methods and procedures has resulted in the desired level of precision and accuracy. This training will increase the credibility of the data obtained from the laboratory.

Initially, two or three representative soil profiles from each mapping unit should be described and sampled for laboratory characterization analyses. Soil samples should be obtained from every horizon to a depth of about one meter or bedrock if shallower. If the data obtained indicate a great deal of variability within a mapping unit, additional pedons should be sampled. Selected profiles from similar mapping units on other islands should also be sampled and analyzed for correlation purposes. The number of profiles sampled will depend upon variability of data and the degree of similarity to similar mapping units on other islands. This process insures similar soil properties and thus similar interpretations for the same mapping units on different islands. In addition, soils that present a problem to the surveyor should be analyzed by the characterization laboratory during the mapping process to insure correct map unit designation and classification.

Research and Interpretation

The ultimate goals of any soil survey or research programs should be the interpretation of the data for the user. Therefore, the types of information gathered should be directed towards the needs of the users and the interpretations must possess a high degree of reliability. One method of measuring soil variability will be to evaluate the laboratory data obtained from representative soil profiles within

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each mapping unit. In addition, map unit composition and variability can be estimated from observations conducted on soil-landscape transects.

It is strongly recommended that any research conducted on the soils be associated with the mapping units identified in the soil survey program. In addition, to further strengthen the extension component of the soil survey program, studies should be initiated to evaluate plant response to different soils and management practices. Both greenhouse and field correlation trials should be directed at assessing the major soils on the islands as determined by soil survey mapping units. Plant tissue analyses should also be correlated with soil test data. The soils laboratory at the University of Azores, Terceira has the capability of carrying on these types of research projects.

Cooperative Studies with the R.I.A.E.S.

Cooperative research between the University of Azores, Terceira and the R.I.A.E.S. should be developed as the soil survey program progresses and as needs are identified. Immediate studies could be initiated in the development of appropriate laboratory methods suitable for soils of volcanic origin. In addition, research associated with the correlation of routine characterization analyses to mapping units and to various soil properties which are more difficult to determine would be extremely valuable. For example, pH ($1\overline{N}$ NaF),

15 bar water, Fe, Al, or perhaps other analyses may be good indicators of the presence of allophatic minerals which have numerous land management implications. In particular, these types of minerals fix phosphorus in an unavailable form and if simple, routine procedures could be developed to predict this phenomen a major contribution would be made in the management of volcanic soils.