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MEMORANDUM TO: TAYLOR, B. L. LEON HARRIS  
ASSISTANT DIRECTOR

April 12, 1978

FROM: TAYLOR, RAYMOND B. [Handwritten initials]  
CHIEF, COMPLIANCE

SUBJECT: COMPLIANCE REPORT ON THE SUBJECT OF THE SECURITY  
OF 211(d) GRANT TO THE UNIVERSITY OF  
PRINCETON AND ON COMPLIANCE WITH  
[Handwritten: 4/11/78] [Handwritten: 128-2857]

Attached is the team report on the subject grant. Security  
five copies have also been sent to Dr. [Name] for  
Grant Project Officer. Distribution, in addition to that  
already made as indicated below, and following action  
should be taken by TAYLOR in accordance with paragraph 11,  
April 2, 1978 instructions and guidelines for the evaluation  
of all institutional grant proposals.

This completes the review of the five "outstanding"  
institutions, and recommended actions have been taken  
regarding each grant and the compliance [Name]. I would  
suggest a meeting of the [Name] [Name] [Name] [Name]  
Princeton [Name] and [Name] [Name] [Name] and [Name] [Name]  
statements are prepared. It is also suggested that the  
grant project [Name] be reviewed as a [Name] in a  
similar fashion to the grant [Name] by [Name], [Name]  
[Name] and [Name].

Please let me know if [Name] [Name] [Name] [Name] [Name] [Name]  
[Name] [Name] [Name] [Name] [Name] [Name] [Name] [Name] [Name] [Name]  
[Name] [Name] [Name] [Name] [Name] [Name] [Name] [Name] [Name] [Name]  
[Name] [Name] [Name] [Name] [Name] [Name] [Name] [Name] [Name] [Name]

[Handwritten signature]

DISTRIBUTION COPY WITH THIS MEMORANDUM

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AID TEAM REPORT  
Comprehensive Review of  
Institutional Development Grant

211(d)

16

UNIVERSITY OF MARYLAND

OR

COLLEGE PARK

i.	BACKGROUND	1
ii.	DISCUSSION OF ISSUES	7
iii.	FINDINGS AND CONCLUSIONS	13
	Performance to Date	
	Staff Composition	
	Rationale for Expansion and Restriction	
iv.	RECOMMENDATIONS	17
v.	APPENDICES	
	A. Issues Report	
	A-1 Original Data	
	B-2 Additional Response	
	C. Conclusions	

## ATU TEAM REPORT

SUBJECT: Comprehensive Review of the University of Puerto Rico (U.P.R.) Grant on Tropical Soils

### 1. BACKGROUND

On February 5 and 7, 1975, an inter-agency review team met with officials of the University of Puerto Rico to conduct a comprehensive on-site review as required in Handbook 13, Chapter 2. The team members consisted of: Henry Grupper, EA/RD; Raymond Kitchell, T/PM and Chairman; Donald Sturkardt, T/AG; and Frank Vitek, Consultant and Soil Expert. Rafael Gill, Grant Project Officer, served as Executive Secretary to the team. Charles Van Haeften, EA/RS, was invited to participate as a team member but was suddenly taken ill. The students were busy and several faculty members and students participated in or observed the review. The key UPR participants who participated throughout most of the review included: R. P. [Name], Chairman, Department of Agronomy; S. [Name], Director, Agricultural Extension; H. [Name], Director, [Name] Laboratory.

The morning session began with a welcome by the Chairman who until last year was Professor in the Agronomy Department and the UPR Director. He reviewed the original purposes of the grant as stated by the UPR with particular emphasis on soil fertility and plant nutrition. The Chairman then stated the objectives of the grant which were to: (1) evaluate the soil fertility and plant nutrition status of the UPR; (2) determine the causes of soil fertility and plant nutrition deficiencies; (3) develop and test soil fertility and plant nutrition management practices; and (4) disseminate the results of the grant to the UPR and other institutions. The Chairman then stated that the grant was to be conducted in three phases: (1) a diagnostic phase; (2) a research phase; and (3) a dissemination phase. He then stated that the grant was to be conducted in three phases: (1) a diagnostic phase; (2) a research phase; and (3) a dissemination phase. He then stated that the grant was to be conducted in three phases: (1) a diagnostic phase; (2) a research phase; and (3) a dissemination phase.

The grant has permitted UFF to increase the involvement of faculty in research and members of the experiment station into teaching. The grant has also been extremely useful to Puerto Rico in establishing linkages which are particularly strong with the University of Hawaii, Cornell University and Prairie View A&M University.

The recently appointed Grant Program Director, Dr. Fred Beierotb, discussed future plans of UFF and acknowledged that "utilization" is now the name of the game. He expressed his desire for new areas of concentration in soil classification and geography which will be viewed as one of the principal tools in land resource planning. He also emphasized the need to maintain and expand linkages both with the continent and other world-renowned institutions.

The remainder of the opening session was devoted to the discussion by faculty members of grant activities and accomplishments. In this process, some technical information as well as the relevance of current research to grant purposes and the problems were discussed which had not been included in previous annual reports.

The afternoon and following morning sessions were devoted to a discussion of issues developed by the sponsoring technical staff. UFF, in consultation with other interested parties, took issue with Appendix A. The original letter relative to the issue by the University of Puerto Rico was attached as Appendix B. Additional responses and data requested by the staff are attached as Appendix C.

1.1. ORGANIZATION OF UFF

The central objective of the grant to the University of Puerto Rico is to strengthen its capabilities in the field of soil science, to develop a center of excellence for teaching, research, technical assistance and consultation for increasing food and fiber production in the developing countries. UFF was established in the special program of tropical soils and agriculture directed towards the development and utilization of these resources. UFF is composed of several faculty members who are currently engaged in research and teaching in soil science.

The program is directed primarily to the development of the following areas:

and involvement. They were based on the Agency's understanding and impressions of the omission and/or commission of grant activities and of a sum total of the institutional capabilities as it corresponds to the LDCs needs in the problem area. Insofar as the on-site review was concerned, only those issues where inadequacies were noted or where discussion was specifically desired were reviewed. Non-problem subjects were not raised.

Issue #1 - Inability to measure impact of grant on the institutional and knowledge base and the achievement of grant objectives

In its follow-up material (Appendix B-2) UPR explained that at the time of the grant award the soils program at the agricultural experiment station was essentially being phased-out. The grant enabled the institution to retain a soil scientist from the experiment station whose contract was expiring. The grant succeeded in involving personnel from the Agricultural Extension Service in educational grant activities and there have been numerous efforts to involve effectively Extension Service participation in grant related activity. Given the present institutional situation, the response capacity which exists in the area of management of tropical soils at the College's Agricultural Experiment Station is not fully utilisable at this time. However, Chancellor Pietri is in the process of effectuating a complete integration of the College's three entities and favors a more direct involvement of Experiment Station personnel in AID supported and other international programs. If this takes place, UPR's response capability in the area of tropical soils would be increased considerably in the near future over and above the professionals already listed.

In discussing this issue, it was noted that the wording of the original grant was somewhat vague as to what was expected of the University of Puerto Rico. For example, the PID/77 includes the phrase "emphasis directed toward conservation and protection areas" while the text of the agreement stipulates "management and protection of tropical soils" as the areas of focus for UPR. In addition, because the annual reports submitted to date seemed to lack some pertinent data, AID has found it difficult to establish a reasonably accurate base against which to measure progress under the grant.

The staff responded to this issue by pointing out that they had in fact complied with most of the specific

requirements of the grant. With regard to personnel, UPR has added an Assistant Professor and an Associate Professor, both of whom hold tenured positions. Furthermore, staff quality has increased perceptibly through increased participation in the Visiting Professors Program, in which departmental research, and by collaboration with other institutions from the consortium universities. All above activities have been financed under the grant agreement. With regard to specialization, UPR has had the focus has been on soil classification, soil plant analyses. Chancellor Pietro accepted full responsibility for this interpretation and stated that UPR has concentrated only in the area of soil erosion control. He also noted that UPR graduates now return to top positions in the LDCs. He also noted that in 1971 there was only one graduate student in the Soils Department and currently there are six, with the annual number expected to increase rapidly. This has a complete turnaround from the situation at the beginning of the program when, in Chancellor Pietro's view, the soils program had come to a complete halt. However, there was still considerable room for improvement. For example, it still was not possible to obtain assistance from the University's Agriculture Experiment Station because of a lack of operational funds with which the station could assist in soils work pertinent to the LDCs.

The discussion then turned to how UPR's knowledge base, teaching and research capacity had been improved since 1971. UPR has expanded areas in classification and production of starchy root crops in ultisols and other tropical soils courses have been added to the UPR program in addition to one new graduate teaching facilities have improved considerably by the purchase of better laboratory facilities, audio-visual equipment and increased library holdings. With regard to soil erosion control measures, the Soil Conservation Service had recently held a convention on this topic as far as the LDCs were concerned. UPR has not explored the state of the art on this subject in the LDCs because UPR felt it was not part of the grant purpose.

With regard to the strengthening of advisory capacities mentioned since the time of the grant award, UPR mentioned that the principal areas improved were:  
(a) production of starchy root crops and edible legumes

in the tropics; and (b) soil classification and analytical chemistry of tropical soils. The recent award of a contract for the Benchmark Soils Project was cited as evidence that UPR's advisory capacities had in fact improved as a result of the AID grant. However, there was some question as to the availability of some of the Soils Department staff, to in fact, capitalize on this strengthened advisory capacity.

Finally, under this issue, UPR was able to provide some data for measurement of increased capability against the 1971 base. Some sixteen publications or manuscripts have been prepared since grant inception with an additional four M.S. thesis now in preparation. Viable linkages have been established with the University of Hawaii and the University of Ghent, Belgium. Linkages with sister institutions in the consortium have also proved beneficial. Through personal contacts UPR has opened up informal relationships with the University of Goettingen, West Germany, the Soil Conservation Service of USDA, and the Food and Agriculture Organization of the United Nations.

Issue #2 - Grant fund usage on activities with low level relevance to subject grant objectives

In explaining this issue, TA/AGR had written:

The report on travel, new courses, research, publications, etc., shows concentration in areas such as soil fertility, soil classification and chemical analysis of soils and plants, suggesting continuation of pre-grant agronomic work of the department. The relation to soil conservation protection in LDCs seems to have been ignored which indicates an absence of mutual understanding regarding grant purpose and/or absence of an overall strategy regarding the grant activity.

In its written reply, UPR has stated that "...it should be noted that prior to the grant the Agronomy Department had practically no research program in soils nor did it have the capacity to conduct research in soil classification and analysis. The grant activities in the mentioned areas of concentration are, therefore, innovations rather than the continuation of the status quo.

UPR's response to the issue did not change substantially during the discussion. UPR staff insisted that this issue was not justified although conceding that perhaps their objectives needed some refining. They suggested that the work was oriented to cropping systems for small farmers which also prevents soil erosion. In a mixed debate, Dr. Viets expressed the opinion that to begin with UPR did not have a natural setting with which to work on erosion control. The staff emphasized that they are working on crops such as cassava, which are important crops to the small farmer, and that this, in effect, was their strategy. Some of the team members expressed the thought that UPR seemed to be caught in a bind in trying to build up its soils graduate program while at the same time developing and expanding a knowledge base applicable to LDCs.

Issue #3 - Lack of research strategy in terms of expanding the knowledge base

In its original response, UPR stressed two points: first, that its concept of soil conservation is one of measures which prevent physical and chemical soil degradation through production systems generating food and/or income of the farmer; and, second, that its policy has been to grant its staff members considerable freedom to pursue the general grant objective in concert with their respective interest rather than cause them to work in areas outside their field of specialization or competence. The combined effect of the broad concept of soil conservation and the academic freedom of investigators was a somewhat diffuse research strategy, Puerto Rico acknowledged, but given the vague nature of the original grant this was not thought to conflict with the grant purpose. In the absence of a concerted consortium research strategy, UPR said that it could not coordinate its research with those of other institutions and that no state-of-the-art reviews were carried out because the original grant did not require them.

The team requested a supplemental narrative on what the research strategy was and how it was arrived at. The strategy apparently was developed principally by the original Grant Program Director and, as further elaborated in Appendix B-1, consisted essentially of: (1) the use of oxisols and ultisols for field experimentation because these are highly weathered and therefore infertile soils that most people have found difficult to manage in the tropics; (2) excluding plantation crops and focusing on starchy and high protein crops that are the staple food

crops of the small LDC farmer; and (3) combining soil management and soil protection in field experiments.

UPR had little research activity or experience in the Mayaguez Department of Agronomy before the grant. Research activity was stimulated greatly by the 211(d) grant and, in that sense, it is obvious the grant had a significant impact on the University. On the other hand, the discussion did not develop any working research strategy related to the grant purpose. Research funds were expended mainly to support the Department's graduate students in the thesis research of their interest. There was little focus on soil conservation per se, except from the oblique approach of providing improved crop management to provide cover for the soil. In actuality, most of the thesis research supported by the grant was basically agronomic (in the crop management sense) rather than oriented toward soil research.

Except for the excellent classification work of Dr. Beinroth, UPR did not capitalize on their unique location in the tropics in their research program. They could have worked on some unique problems of soil conservation and soil management, especially with the aim of relating these to soil problems of Latin America. They did, however, work with root crops, and other crops of importance to small farmers of LDCs, for which they were commended by the Review Team.

Issue #4 - Related to Issue #2 above, expenditures of grant funds in certain categories indicate a less than optimal use

In the explanation of this issue, specific examples of travel and equipment expenditures were cited. In its written reply, Puerto Rico provided a detailed summary of travel expenditures to date which indicate that administrative travel accounted for about 20% of total travel expenses, a comparatively high expenditure "...because during the transition of grant management at UPR both the outgoing and incoming grant director attended the Executive Committee meetings. Moreover, the nature of the topics discussed at the last two Executive Committee meetings called for participation of a higher-echelon university representative." Regarding equipment, detail was also provided and it was claimed that "While some of these expenditures are of low relevance to grant objectives, they were necessary to implement the 211(d) program at UPR."

In discussing this matter, the Chancellor indicated that travel expenditure had been largely dependent consortium activities, including the Executive Committee and Council of Deans meetings. Depending on their availability, a number of people took the opportunity to attend these meetings. Puerto Rico admitted that almost everybody in the department had traveled and claimed that 80% of the travel was related to educational purposes, including visiting professors, etc. Pietri added that substantial expenditures were involved in attending meetings at the international centers, e.g., IITA and CIAT. The chairman pointed out the importance of relating travel to the grant purpose and reminded Puerto Rico that the grant has both restrictions and flexibilities toward travel. He also explained the new procedures which require prior clearance for international travel from both the sponsoring technical office, and as appropriate, field missions.

There was further discussion regarding student training and travel expenditures. The question of equipment expenditures and relevancy was also discussed. Dr. Beinroth agreed that perhaps some of the expenditures may not have been directly relevant to grant purpose but claimed that this could not be helped. Office equipment, air conditioners, duplicators, etc., were needed to do an efficient job in teaching, research and conducting workshops and so forth. Most of it was basic equipment and absolutely necessary. When questioned about the relevancy of a mercury analyser, Dr. Miro commented on UPR's interest in studies on soil pollution and this in combination with instrumental training required purchase of the analysis equipment. The discussions further revealed that the advisory committee had not been highly effective. All expenditures are approved by the department head and not by the Grant Project Director.

Issue #5 - The value of the "consortium" approach to tropical soil, knowledge base and the optimal role for UPR

In spite of the fact that the so-called consortium approach, at least to-date, has not generated a coordinated attack on tropical soils problems, UPR feels that this approach has attractive attributes and should not be abandoned. A redefinition of the subject matter for the five member institutions constitutes a first step in developing a new role for the consortium which could produce meaningful and utilization - oriented outputs. UPR supports the proposal for establishing a tropical soils resource center but believes consortium activity can be effectively continued on an informal basis and at very little cost. The university has found the consortium to be very difficult for

UPR to maintain operational linkages. There was agreement that expenses at the policy level can be reduced and redirected to the technical level with primary emphasis on state-of-the-art activity.

Issue #6 - Future direction and involvement

Regarding the availability of a response capability for utilization purposes, UPR pointed to the recently awarded research contract on "Crop Production and Land Potential of Benchmark Soils of Latin America" as an example of utilization made possible by the 211(d) grant. The response capability available in terms of the current staff is listed in Appendix B-2. At this point there was discussion on when the position vacated by the Chancellor and another senior position would be filled, and Puerto Rico explained the problems they had been having with recruitment, primarily because of salary levels. If the grant is extended within a revised focus of soil classification, UPR believes there will be a considerable demand for its services, particularly for assistance in analytical soil characterization and taxonomic purposes. It was pointed out that the ongoing research at UPR and the University of Hawaii will presumably establish a methodology for the utilization of soil classification data in the process of transferring agricultural experience.

Considerable progress has been made in assuming salary payments by the university but this has been aggravated by the continuing vacancies mentioned above.

UPR was asked what would happen to their capabilities if the grant expired without any additional extension and funding. Dr. Beinroth responded that while improved teaching and research will continue, quality will gradually decrease for lack of linkages and involvement with other institutions. At another point it was stated that teaching would definitely continue but research as related to LDCs problems would cease and/or the quality would seriously diminish.

In response to the question as to whether or not UPR could meet the certification standards for a Master Degree in soils science, the answer was negative.

In preparation for a meeting with the Executive Committee held at Cornell University last December, Dr. Beinroth had prepared a tentative outline of a revision of their

grant which is included as Appendix B-1. The principal modification proposed is a shift from the subject matter area of "conservation and protection of soils of the tropics" to "classification, characterization and geography of soils of the tropics." The purpose is to identify within the consortium and institution responsible for developing and sustaining response capability in field of classification and geography of tropical soils which are essential prerequisites for land resource appraisal and land-use planning. Initial grant activities would be focused on:

- correlating units of systems of soils classification used in tropical LDCs with taxa of U.S. soils taxonomy;
- analytically characterizing key soils of the tropics;
- compiling soils maps and soil surveys reports of tropical countries;
- developing a storage and retrieval system for analytical data of important soils of the tropics (soil data bank).

Long term objectives of the revised grant should include:

- classification and characterization of the soils at the major agricultural experiment stations of the tropics;
- development of new and/or additional differentia for classifying tropical soils;
- correlation of soil analytical methods used in different tropical countries.

While recognizing that it is not necessarily the best institution to be entrusted with this subject matter, UPR proposes to serve as a focal point particularly on the basis of its professional experience related to classification, its instrumental capacity, and its geographical location. (See Appendix C for new grant foci agreed to by consortium members at the December Ithaca meeting of the Executive Committee)

In the discussion, Dr. Beinroth reiterated that the subject of soil classification is very broad. This factor, plus the present capabilities of Puerto Rico and the urgent need in the LDCs, led them to the conclusion that it would be preferable to narrow their future grant focus to areas of soil classification and geography, land planning, land-use evaluation, and technology transference.

He stressed the importance of this subject and UPR's competence to handle it, both in terms of facilities and geographical location.

The relation of this focus to Puerto Rico's work in soybean studies was also questioned and it was stated that soil classification provided the limitations and usage of soil for crop production. The work UPR has done in correlating Brazilian, French, FAO and U.S. soil classification systems was discussed. Regarding the demand for competency with in this focus, the Chancellor stated that Brazil needs hundreds of trained people in this field. Dr. Gill added that there are increasing numbers of requests from USAIDs in land-use and resource planning. TAB feels that resource evaluation and land-use planning is basic to LDC agricultural development projections and demands in this area are high. Puerto Rico also stated that it had the know-how and was in the position to develop "packages" of information on numerous crops.

In the supplemental material provided in Appendix B-1, and within the same desired change in the subject matter focus, UPR notes that the purpose of the purposed grant revision would be "...to sustain and strengthen UPR's response capacity in the area of classification of tropical soils as related to agricultural development in LDCs and as a part of a concerted effort by the Consortium for Soils of the Tropics to mobilize tropical soils knowledge for increased food production." The presumption is that soil classification is of critical importance to land resource development in tropical LDCs directly related to problem solving and knowledge transfer.

Contemplated activities would include:

(1) State-of-the-art reviews. This would include inventory and analyses of existing soil survey programs and the identification of needs.

(2) Research. Further studies are suggested on correlating the units of the various systems of soil

classification used in the LDCs with taxa of the U.S. soils taxonomy in order to facilitate the transfer of agro-technology. The emphasis would be on identifying soil parameters unique to tropical soils which could be employed in their classification. Further research is also suggested in correlating the different methods of analytical soil characteristics used in different tropical countries.

(3) Information systems. A collection of all available soils maps is proposed in order to establish a knowledge base with respect to what kind of soil occurs where in the tropics. As a parallel effort a storage retrieval system for analytical data of important tropical soils is also proposed.

Other contemplated activities include the establishment of new and strengthening of existing linkages, the development of operational skills in the subject matter area, and educational and training activities. It is implied that it is almost a necessity for these activities to be carried out with sister institutions of the soils consortium. UPR is willing to transfer from \$15 to \$20,000 of any grant award to building up a consortium structure which would expedite the utilization of expertise by AID and other donors and would coordinate the research activities of the cooperating universities.

In response to a specific question by the Chairman, the Grant Program Director estimated that if grant expenditures were limited to support of new staff, the central research, and participation in special training exercises, workshops and seminars, that a minimum annual grant of \$60 to \$70,000 would be adequate. This would depend, of course, upon the specific activities which AID is interested in financing,

### III. FINDINGS AND CONCLUSIONS

Despite the usual vagueness of early grant proposals and in recognition of the fact that the institutional base at UPR in soils was weak to begin with, accomplishments under the grant have been disappointing - particularly in terms of the focus on soil conservation originally envisioned, at least by AID. The team is curious as to why AID should have selected this focus in the first place, since Puerto Rico is not in an area with highly erosive soils and is not well cited to work on crop or soil management measures to control erosion. It is also disturbing that Puerto Rico did not recognize this at the start and ask for a change in its grant focus.







The "Handbook" also is limited in scope to give all  
 of the information needed for various cropping and soil  
 management alternatives, nor does it utilize all of the  
 natural resources of habitat offered by Puerto Rico.

In brief, the strength of UPR was needed in terms of  
 utilization of AID is its research potential, both in  
 terms of Experiment Station and ARS staff and in the  
 augmentation of its own staff with scientific expertise.  
 If the university is willing and able to work in these  
 areas on problem related subjects and can mobilize the scientific  
 expertise and manpower on the Experiment Station and in the  
 Extension Service, the team believes the grant should be  
 revised and extended to facilitate such a change-over within  
 the changed and redefined focus as proposed. As a quid pro  
quo for a continuing "grant" relationship there should be a  
 clear and demonstrated commitment to recruit promptly qualified  
 scientists for the two positions now vacant, with emphasis  
 on research, not teaching. A second condition should be the  
 delegation of effective control to the Grant Project Director  
 who should be held accountable, both by the university and  
 AID, for the effective use of grant funds in achieving the  
 purpose as proposed, that is, "to sustain and strengthen UPR's  
 response capacity in the area of classification of tropical  
 soils as related to agricultural development in LDCs  
 "...to mobilize tropical soils knowledge for increased food  
 production."

14. RECOMMENDATIONS

THE AID REVIEW TEAM BELIEVES THAT A WELL-THOUGHT-OUT  
REVISION AND EXTENSION OF THE UNIVERSITY OF TORONTO  
GRANT WILL BE OF GREAT VALUE TO THE UNIVERSITY  
AND TO THE CURRENT INTERESTS AND PRIORITIES OF THE AGENCY  
WILL, BUT ONLY ON THE BASIS OF THE MAJOR CHANGES AND SPECIFIC  
COMMITMENTS SET FORTH BELOW AND WITHIN THE GENERAL CONTEXT OF  
THE PROGRAM AND ACTIVITIES DESCRIBED ABOVE. THEREFORE,  
THE FOLLOWING SUMMARY RECOMMENDATIONS HAVE BEEN DEVELOPED  
FOR CONSIDERATION BY THE MANAGEMENT.

1. Grant purposes should be revised and
  - (a) change the subject focus to classification and geography of tropical soils as related to increased food production in the LDCs; (b) continue emphasis on the small farmer; and,
  - (c) support activity - primarily research - which has a direct bearing on the utilization of UFR's strength by AID and the LDCs.
  
2. The terms of such an extension should provide for the following changes and actions:
  - a) prompt recruitment-as a quid pro quo for extension-of two qualified scientists to fill the current vacancies in the Agronomy Department. If they will be used in terms of the revised grant purpose, with primary attention to research, initial salary support from the grant should be permitted.
  
  - b) commitment by the university to tie in Experiment Station staff more closely with grant activity and AID-sponsored agricultural research, (i.e., the benchmark soils and soybean projects);
  
  - c) discontinue further general support for soil educational programs at both the undergraduate and graduate levels. Instead, when research results justify, use grant funds to develop special-purpose training programs, on-campus or on-site, and related to grant purpose;

- d) the work-plans for activities to be financed by a two-year grant extension should be prepared along with the revised proposal/agreement and emphasize mutually acceptable priorities, e.g.,
- . correlating units of soil classification systems used in tropical LDCs with U.S. soil taxonomy.
  - . analytically characterizing key soils of the tropics.
  - . developing a soil data bank
  - . preliminary work on the classification and characterization of the soils at major agricultural experiment stations of the tropics.
  - . developing "packages" of production information on management requirements for maximizing yields on selected LDC crops within given energy and cost constraints, identification of crops that produce well in low-input systems, etc.
  - . other state-of-the-art reviews.
- e) A more significant involvement of appropriate university officials (including the Experiment Station and Extension Service Staff) in developing grant policies, priorities, etc; and
- f) Complete delegation of day-to-day grant management responsibility to the Grant Program Director.
3. The Team agrees with the conclusions and recommendations included in the report of the AID Review Team on the University of Hawaii Tropical Soils 211(d) Grant regarding the soil consortium, i.e.,
- a) Grant funds should not be made available at this time for any consortium

super-structure, although the need, purpose and form should be reviewed again after joint experience has been gained in state-of-the-art studies;

- b) The proposals of the soils consortium members for grant extensions should be considered on their individual merits. However, where appropriate and useful, grant terms should encourage and facilitate including flexibility in the use of grant funds - joint endeavors, particularly at the technical level.

Recommendation (b) is both appropriate and necessary for the UPR, and the terms and conditions should be drafted to favor collaborative work at the technical level, particularly on state-of-the-art studies and similar activity.

## ISSUES PAPER

University of Puerto Rico  
 Comprehensive Review--211(d) Grant  
 February 6 and 7, 1975

The central objective of the grant to the University of Puerto Rico (UPR) is to strengthen in a coordinated effort U.S. institutional competence in soil science of the tropics for teaching, research, technical assistance and consultation for increasing food and fiber production in the developing countries. UPR was to concentrate on the special problems of tropical soils with emphasis directed towards their conservation and protection.

TA/AGR believes that UPR is endowed with some favorable features that can make it an outstanding resource to serve the Agency's objectives in the developing countries. UPR seems to be well committed to the international community.

The issues raised hereunder relate primarily to the management and accomplishment of the grant and UPR's future direction and involvement with AID and the developing countries. These issues are based on the Agency's understanding and impressions of the omission or commission in the grant activities and of a sum total of the institutional capability due to the grant as it corresponds to the LDC needs and the problem area. In as far as the present grant review is concerned only those issues where inadequacy was noted or discussion is desired are mentioned. Issues on non-problem area are not raised.

The issues must be considered in the context of level of tangible achievements (output or impact) vis-a-vis funds spent and not in enumeration of activities of resources used (inputs). They have been prepared in consultation with TAB Grants Coordinator and are within the requirements of comprehensive review included in Grant Handbook 13, App. 2C, and in consideration of the Agency policies recently established by the Administrator in PD-62 (referred documents provided).

While these issues will be used by the panel chairman to structure the review, they do not preclude other issues which the panel and UPR may wish to raise during the review period.

Issue 1 -- Inability to measure impact of grant on the institutional and knowledge base and the achievement of the grant objectives:

H.G  
 Given the vague nature of the original grant, the lack of pertinent data in the annual reports submitted to-date, and the lack of appropriate base line data relevant to the pre-grant level competence in the UPR, we are unable to measure or evaluate competencies developed or the effect of the grant on the knowledge base.

Specific data is needed on:

*operational plan*

*Effort*

- (a) How has staff competence been strengthened in terms of (i) quantity, (ii) quality, and (iii) specialization?
- (b) How has UPR's knowledge base, education and research capacity been improved, strengthened and/or enlarged since 1971?
- (c) What advisory capacities exist now which did not exist at the time of grant award by subject matter, e.g., soil erosion and by function, e.g. problem identification and analysis?
- (d) Data measurement against 1971 base, on: publications, library capacities, linkages, etc.

Data on the above should be related directly to the grant areas of specialization, i.e., in special problems of tropical soils with emphasis directed towards conservation and protection as related to LDC situations.

The final measurement of grant success is recognition of UPR as a leading institution in the subject grant field by its peers and the utilization of its competence by the LDCs and other donors. UPR's effort in this direction appears limited in both content and impact.

Issue 2 -- Grant fund usage on activities with low level relevance to subject grant objectives.

6. The report on travel, new courses, research, publications etc., shows concentration in areas such as soil fertility, soil classification and chemical analysis of soil and plants, suggesting continuation of pre-grant agronomic work of the department. The relation to soil conservation and protection in LDC's seems to have been ignored which indicates an absence of mutual understanding regarding grant purpose and/or absence of an overall strategy regarding grant activities.

Issue 3 -- Lack of research strategy in terms of expanding the knowledge base.

D.P. The reported research appears either unrelated or marginal in terms of LDC problems in soil conservation and protection. No state-of-the-art work or resource evaluation has apparently been undertaken or contemplated. Visiting professorships, consortium activities, etc., do not reflect any concerted plan on the part of UPR itself or as a participant in a consortium plan and strategy.

Issue 4-- Related to Issue #2 above, expenditures of grant funds in certain categories indicates a less than optimal use.

For example:

- (a) Travel is an important means for increasing competence but it is not apparent that it has been used to forward grant purpose. A significant amount of travel appears to be (i) administrator and non-technical, (ii) involve the same people, (iii) involve three or more when one representative would be sufficient and (iv) bear remote relationship to soil conservation and protection.
- (b) Equipment expenditure under 211(d) grants are usually deemed as a less effective means of increasing competence and should be, in any case, directly related to the grant purpose. Reports indicate that \$55,000 has been expended up to June, 1974 on equipment, materials, supplies and services, including: (i) nine air conditioners, (ii) a camera, (iii) duplicating machines, perforator, binder, etc.

Issue 5 -- The value of the 'Consortium' approach to tropical soil knowledge base and the optimum role for UPR.

There is little evidence that a comprehensive and coordinated attack on the tropical soil problems has evolved to-date from the so-called "Consortium" approach envisioned in the original grant proposal. There is apparent uneasiness on the part of the cooperating institutions as to the division of labor and areas of specialization originally developed. On the part of AID, there is uneasiness regarding the lack of meaningful joint programs to date. Various alternatives have been proposed, e.g., establishing a tropical soils center, redefining areas of specialization, concentrating on jointly-proposed state-of-the-art efforts, or simply dropping an interdisciplinary approach and dealing directly with soil institutions on an ad hoc or geographical basis. An expression of UPR's current conception, desires and suggestions is requested.

Issue 6 -- Future direction and involvement:

In view of UPR's competence, to-date, and its stated intention for grant extension, an explanation of the following items will be in order:

- (a) Present and future availability of response capability for utilization purposes.

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- (b) UPR and AID's projection on potential demands for its services in LDCs.
- (c) Grant supported activities that are, or will be, assumed by UPR or funded from other sources.
- (d) Perception of UPR for an end-of-the-grant status.
- (e) Salient points of the proposal for grant extension, e.g., purpose, need, activities contemplated, relation to other AID-funded activities relationship to the 'Consortium' structure, etc.

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*Section 406*

**UPR's RESPONSE TO ISSUES PAPER**

**Issue 1 - Inability to measure impact of grant on the institutional and knowledge base and the achievement of the grant objectives.**

**a) Staff competence**

As a direct result of the grant the staff of the soils section of the Agronomy Department was increased by two. The appointments were for an Assistant Professor and an Associate Professor both of which now hold tenured positions.

Although the assessment of staff quality is somewhat intangible, we believe that it has been improved significantly. We attribute this mainly to educational travel in the U. S. and abroad, to our Visiting Professors program, to reactivated department research, and to collaboration with scientists from Consortium universities and institutions overseas. All of these activities were stimulated and facilitated by the 211 (d) grant. We consider the development of new perspectives of tropical soils as related to LCD situations by the faculty an important grant accomplishment. Prior to the grant limited financial resources did not allow extensive travel which resulted in a certain degree of provincialism.

Staff competence has been strengthened considerably in the areas of soil classification and soil and plant analysis. These areas of specialization were not adequately represented in the department

prior to 1971.

b) Knowledge base, education and research capacity

UPR's knowledge base has been expanded significantly in the areas of classification and geography of tropical soils and crop and soil management, particularly production of starchy root crops in Ultisols and Oxisols.

The education capacity was increased through the grant-supported appointment of two new staff members who developed and taught three new tropical soils courses. An additional new graduate course was stimulated by the grant. Three graduate students supported with grant funds have revised and taught the laboratories for several soils courses. Teaching conditions improved considerably on account of better laboratory facilities, availability of audio-visual equipment and an increase in library holdings, all of which were acquired with grant funds. The grant thus has resulted in the improvement of both quantity and quality of UPR's teaching program in soil science. The strengthening of education capacity is also reflected in the increase in the number of graduate students majoring in soil science from one in 1971 to six at present.

UPR's research capacity has been enlarged mainly in the area of soil and plant analysis through the expansion of the

instrumental capacity and the training of a junior staff member in this field. Our present research capacity in the field of classification of tropical soils was non-existent at grant initiation.

c) Advisory capacity

Advisory capacities developed since the time of grant award exist in the areas of production of starchy root crops and edible legumes in the tropics, soil classification and analytical chemistry of tropical soils.

d) Data measurement

A total of sixteen publications or manuscripts have been accomplished since grant initiation and four M.S. theses now in progress will be completed before grant termination (see attached listing).

Viable linkages have been established with the University of Hawaii and the University of Ghent, Belgium. Both of these institutions cooperate with UPR in grant-supported research. Linkages with the other sister universities of the Consortium were less formal but proved very beneficial in the area of soil classification. Through personal contacts UPR maintains further linkages with the University of Goettingen, West Germany, the Soil Conservation Service of the USDA and FAO.

Publications and Manuscripts Accomplished under the  
211(d) Grant AID/csd 2857

- Abrams, R., L. Cruz Pérez, R. Pietri, and F. J. Julia. 1974. The Influence of different levels of N, P, K, Mg, Ca, and Si on yield of tomatoes in an Oxisol. Paper presented at 22nd annual meeting Amer. Soc. Hort. Sci. Trop. Region.
- Beinroth, F. H., 1972. The Natural Environment of Puerto Rico. Univ. Puerto Rico, CAAM, Agronomy Dept., 30 pp. (mimeo).
- Beinroth, F. H., 1972. Field Guide to the Soils of Puerto Rico. Univ. Puerto Rico, CAAM, Agronomy Dept., 120 pp. (mimeo).
- Beinroth, H. and V. A. Snyder, 1973. General Pedology of Tropical Savannas. Proc. 1st Int. Symp. on Soils of Trop. Savannas, Santo Domingo, D. R.; Prairie View A & M University, Prairie View, Texas, pp. 20-38.
- Beinroth, F. H., 1973. Oxisols - Highly Weathered, Red Soils of the Tropics. In: Soils of the Southern States and Puerto Rico. S. W. Buol, editor. South. Coop. Ser. Bull. No. 174, North Carolina State University Press, pp. 87-91.
- Beinroth, F. H., H. Ikawa and G. Uehara, 1974. Classification of the Soil Series of Hawaii in Different Systems. USAID, Techn. Ser. Bull. No. 10.
- Beinroth, F. H., G. Uehara and H. Ikawa, 1974. Geomorphic relationships of Oxisols and Ultisols on Kauai, Hawaii. Soil Sci. Soc. Amer. Proc. 38: 128-31.

- Beinroth, F. H., 1975. Relationships between U. S. Soil Taxonomy, The Brazilian Soil Classification System and FAO/UNESCO Soil Units. Proc. Sem. Soil Management and the Development Process in Tropical America, Cali, Colombia (in press).
- Beinroth, F. H., 1975. Some general aspects of soil formation in the tropics. In: Teaching Tropical Soils. Univ of Hawaii (in preparation).
- Beinroth, F. H. Some considerations on soil classification and "Soil Taxonomy" in particular. Proc. Workshop on Experimental Design. Univ. Hawaii Agr. Exp. Sta. (in press).
- Beinroth, F. H., 1975. Soil classification and the transfer of agrotechnology. AID Soil and Water Management Workshop (in press).
- Beinroth, F. H. A study of highly weathered soils of Puerto Rico. Part I: Formation, morphology and classification. To be submitted to Geoderma (Manuscript completed, 127 pp.)
- Daniels, R. B., F. H. Beinroth, L. H. Rivera, and R. B. Grossman, 1975. Landscape and soils in an area of east-central Puerto Rico. U. S. Dept. Agr., Soil Cons. Serv., Soil Survey Inv. Report (in press).
- Fassbender, H. W. and F. H. Beinroth. 1975. Bodenentwicklung und Eigenschaften von Ultisolen und Oxisolen von Puerto Rico. Proc. Tropentagung Deutsche Bodenkundl. Ges. (in press).
- Pietri Oms, R., 1973. Changing patterns in land use. Paper presented at Soils Workshop, Prairie View A & M Univ. (mimeo, 42 pp)

Master of Science Theses in Soil Science Conducted  
by Students Supported with 211(d) Funds

R. A. Barahona

**Title:** The Effect of Various Fertilizer Treatments on the Chemical Composition of Aerial Tissue and Roots of Guinea Yams (*Dioscorea* sp.) Grown in an Oxisol

**Objectives:** To correlate soil fertility and management with the nutritional quality of yams, to determine optimum levels of N, P, K for yam production in Oxisols and to study related soil chemical processes.

**Started:** November 1972

**Expected  
Completion:** May 1975

R. Caudales

**Title:** The Effect of *Neurospora* sp. on Nitrification and Organic Matter in Tropical Soils

**Objectives:** To study the effect and role of the fungus *Neurospora* on nitrification and mineralization of organic matter in an Ultisol and Oxisol, and to determine the function of molybdenum in this metabolic process.

**Started:** January 1975

**Expected  
Completion:** May 1976

B. Name-Tuñon

**Title:** Correlation of Soil Units of the FAO/UNESCO Legend with Taxa of U. S. Soil Taxonomy

**Objectives:** To correlate the 106 soil units of the FAO/UNESCO Legend for the Soil Map of the World with taxa of the U. S. Soil Taxonomy at the lowest categoric level possible, and to

compare the FAO/UNESCO Legend and U. S. Soil Taxonomy for differences and similarities as regards basic rationales structure and applicability for various uses.

Started: September 1974

Expected  
Completion: June 1974

V. A. Snyder Sevits

Title: Size Distribution and Porosity of Water-Stable Aggregates in Three Tropical Soils and their Effect on Soil -Water Characteristics

Objectives: To study the variation of size-distribution and porosity of water-stable aggregates in three similarly -textured but mineralogically different soils common to tropical regions, and to investigate the effect of these factors on soil-water characteristics.

Started: January 1975

Expected  
Completion: December 1975

Issue 2 - Grant fund usage on activities with low level relevance to subject grant objectives.

It is argued on the part of AID that UPR's concentration in areas such as soil fertility, soil classification and chemical analysis of soils and plants constitutes a continuation of pre-grant agronomic work of the department. However, it should be noted that prior to the grant the Agronomy Department had practically no research program in soils nor did it have the capacity to conduct research in soil classification and analysis. The grant activities in the mentioned areas of concentration are, therefore, innovations rather than a continuation of the status quo.

Inasmuch as the original grant called for the strengthening of institutional competence, engagement in these activities was regarded as conforming to the grant purpose. They were further considered as essential prerequisites to cope with both the teaching and research aspects of the grant. While it is true that grant activities were not focused narrowly on soil conservation per se, this subject matter has not been totally ignored. As this point relates to UPR's interpretation of soil conservation, it is discussed more fully under Issue 3.

Issue 3 - Lack of research strategy in terms of expanding the knowledge base.

Two points need to be stressed in this context:

1. UPR's concept of soil conservation is one of measures that prevent physical and chemical soil degradation through production systems generating food and/or income for the farmer, and
2. UPR's policy has been to grant its staff members considerable freedom to pursue the general grant objective in concert with their respective interests rather than to coerce them to work in areas outside their fields of specialization or competence.

The combined effect of the broad concept of soil conservation and the academic freedom of investigators was a somewhat diffuse research strategy, but given the vague nature of the original grant this was not thought to conflict with the grant purpose.

However, the research conducted under the grant is considered directly related to LDC problems in soil conservation and protection.

Part of the agronomic field work was performed in the subsoil of an Oxisol which had been levelled to simulate conditions of severe erosion. In other experiments plots with plant densities providing complete soil coverage and thus protection of the soil from direct rain impact were included. The indicator crops in all experiments

were important food crops of LDC small farmers, such as yams, tanniers, cassaba, and beans. Soil classification provides the link between these experiments and there extensive application in LDCs.

No state-of-the-art reviews were carried out because the original grant did not indicate that these should be an important grant output.

In the absence of a concerted Consortium research strategy, UPR could not coordinate its research with that of the other institutions. We have, however, initiated a joint research project with the University of Hawaii.

**Issue 4 - Expenditures of grant funds in certain categories**

indicate a less than optimal use.

a) **Travel**

The attached tables provide a detailed summary of the travel expenditures to-date. As indicated there, administrative travel accounted for about 20 percent of total travel expenses or 2.2 percent of total grant expenditures. Travel costs in this category have been comparatively high because during the transition of grant management at UPR both the outgoing and the incoming grant director attended the Executive Committee Meetings. Moreover, the nature of the topics discussed at the last two Executive Committee Meetings called for participation of a higher-echelon university representative.

Educational travel accounted for about 75 percent of the total travel costs and involved seven UPR staff members in addition to one graduate student. With the exception of one staff member, all professors of the soils section of the Agronomy Department have travelled on 211 (d) funds.

b) **Equipment**

The expenditures for equipment and materials are detailed in the attached table. While some of these expenditures are of low relevance to grant objectives, they were necessary to

implement the 211 (d) program at UPR. As absolutely no departmental funds were available, grant funds were expended to equip two offices. Duplicating equipment was purchased and proved to be essential for conducting the Tropical Soils Institute held in Puerto Rico in 1972. Equipment for preparation and utilization of visual aids was also acquired for this purpose and for the improvement of our teaching program. Several airconditioning units were needed for the classroom where the Institute was held, for two offices, and for laboratories with valuable electronic equipment. Without the laboratory equipment bought with grant funds it would have been impossible to strengthen our teaching and research programs.

## 211(d) Grant -- AID/csd 2857

**SUMMARY OF TRAVEL EXPENDITURES**  
for the period of  
**MARCH 4, 1971 to DECEMBER 31, 1974**

**I. Nature of Travel and Individuals Involved**

Name	Amount \$	Percent of	
		Total Travel Expenditures	Total Grant Expenditures
<b>A. <u>Administrative Travel</u></b>			
R. Pietri	4 357.29	}	-
S. Alemañy	1 943.20		
R. Abrams	1 698.71		
F. H. Beinroth	371.01		
M. Lugo Lopez	315.00		
subtotal	8 685.21	19.9	2.2
<b>B. <u>Educational Travel</u></b>			
1. <u>Domestic</u>			
M. Miro	3 119.86	<i>workshops remuneration</i>	
F. H. Beinroth	3 065.48		
R. Pietri	1 629.49		
V. Snyder	1 248.66		
R. Abrams	338.45		
subtotal	9 401.94		
2. <u>International</u>			
F. H. Beinroth	6 760.02		
R. Pietri	5 400.05		
R. Abrams	3 640.98		
M. Miro	2 927.19		
J. Colom	1 463.30		
G. L. Spain	1 330.80		
J. Badillo	1 330.30		
V. Snyder	260.66		
subtotal	23 113.30	53.1	6.6
Total Ed. Travel	32 515.24	74.7	8.4
C. Visiting Professors	2 314.36	5.4	0.6
<b>TOTAL</b>	<b>43 514.81</b>	<b>100.0</b>	<b>11.8</b>

Summary of Travel Expenditures (cont'd)

II. Travel Expenditures by Individuals

Name	Adm. Travel \$	Ed. Travel \$	Total \$	Percent of Total Travel Exp.
R. Pietri	4 357.29	7 029.54	11 386.83	26.2
F. H. Beinroth	371.01	9 825.50	10 196.51	23.3
M. Miró		6 047.05	6 047.05	13.9
R. Abrams	1 698.71	3 979.43	5 678.14	13.0
S. Alemañy	1 943.20		1 943.20	4.5
V. Snyder		1 509.32	1 509.32	3.5
J. Colom		1 463.30	1 463.30	3.4
G. L. Spain		1 330.80	1 330.80	3.1
J. Badillo		1 330.30	1 330.30	3.1
M. Lugo Lopez	315.00		315.00	.7
Visiting Professors		2 314.36	2 314.36	5.3
<b>TOTAL</b>	<b>8 685.21</b>	<b>32 515.24</b>	<b>43 514.81</b>	<b>100.0</b>

211(d) Grant -- AID/csd 2857

**EXPENDITURES FOR EQUIPMENT, MATERIAL AND SUPPLIES**  
for the period of  
MARCH 4, 1974 to DECEMBER 31, 1974

1. Equipment

a) Laboratory Equipment

Burner kit for atomic absorption unit	742.50	
Digital read-out for atomic absorption unit	2 000.00	
Olivetti microcomputer	5 725.00	
Water still	495.00	
pH meter	415.00	
Shaker	605.00	
Dry bath block	197.75	
Portable D. T. A. unit	802.50	
Cathode lamp	374.00	
Centrifuge head	232.10	
Spectrophotometer	495.00	
Vacuum cleaner	275.00	
Mercury analyzer	1 136.06	
Freezer	399.95	
Miscellaneous equipment	972.75	
Subtotal Laboratory Equipment	14 867.61	14 867.61

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**Expenditures (cont'd)**

**b) Office Equipment**

Typewriter	585.00	
Credenza	169.00	
Desk	214.00	
Desk	159.00	
Duplicating machine	1 490.00	
Paper folder	380.00	
Paper collator	375.00	
Paper cutter	185.00	
Photocopier	1 450.00	
Electronic scanner, Gestefax	2 505.00	
Flat File	260.00	
Copier cart (2)	300.00	
Electronic perforator	1 295.00	
Electric ring binder	695.00	
File	209.00	
Subtotal Office Equipment	<u>10 271.00</u>	\$ 10 271.00

**c) Teaching Equipment**

Kodak projector	207.21	
Polaroid photo lab	1 631.04	
Relief maps	488.30	
3M vertical projector	269.00	
Kodak overhead projector	195.74	
Lettering set	125.00	
35mm camera <i>unaid</i>	982.50	
	<u><del>3 898.79</del></u>	3 898.79

**TOTAL EQUIPMENT** **\$ 31 609.92**

**2. Material, Supplies and Services**

**TOTAL** **\$ 35 291.18**

Issue 5 - The value of the "Consortium" approach to tropical soils knowledge base and the optimum role for UPR.

In spite of the fact that the so-called Consortium approach has to-date not generated a coordinated attack on tropical soils problems, UPR feels that this approach has attractive attributes and should be invigorated. Obviously this implies a partial departure from past grant policies and practices. The redefinition of subject matter areas for the five member institutions, as in principle agreed upon at the recent Executive Committee Meeting, constitutes a first step in this direction. Under this agreement UPR is to concentrate on classification and geography of soils of the tropics. UPR is confident that it can produce meaningful and utilization-oriented outputs in this area and that close and efficient cooperation with the sister universities can be implemented.

In concert with the other Consortium members UPR supports the proposal for establishing a Tropical Soils Resource Center. This proposal is being prepared by North Carolina State University on behalf of the Consortium and will be submitted to AID for initial funding under a Basic Ordering Agreement. UPR feels, however, that eventually the Center should become a Consortium activity and the necessary provisions will be made in our proposal for grant extension. Although UPR is committed to the cause of the Center,

our commitment is subject to the development of a structure and administrative mechanism that provide proper representation and participation of UPR in Center affair.

Issue 6 - Future direction and involvement

a) Availability of response capability

As a result of staff competencies, laboratory facilities and linkages developed under the 211 (d) grant, UPR could propose a research project to AID and subsequently was awarded a research contract. UPR staff and facilities are being made available to initiate this utilization-oriented research on "Crop Production and Land Potential of Benchmark Soils of Latin America" which relates to the process of agrotechnology transfer.

b) UPR's projection on potential demands for its services in LDCs

It is anticipated that in our revised subject matter area of soil classification there will be a considerable demand for UPR's services, particularly for assistance in analytical soil characterization for taxonomic purposes. It is presumed that ongoing research at UPR and the University of Hawaii will establish the methodology for the utilization of soil classification data in the process of transferring agricultural experience.

c) Grant supported activities assumed by UPR or funded from other sources

Since the initiation of agronomic field research in 1971, UPR has provided the salary of Dr. J. Badillo who dedicated 50 percent

of this time to the 211 (d) grant. The salary of Dr. H. Lugo, who conducted soil management experiments for the grant program, came from departmental funds. As of July 1974, UPR assumed 20 percent of Ms. Miró's salary. Since his appointment in the Agronomy Department Dr. Beinroth has been paid with grant funds but effective immediately only 25 percent of his salary are charged against this account.

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d) Perception of UPR for an end of the grant status

Grant termination will not entail a reduction in staff since all of the staff members presently engaged in grant activities hold tenured positions. The competence and expertise developed through the grant will, therefore, be retained in the Department. This guarantees the continuation of our enhanced teaching program in tropical soil science.

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Given the critical financial situation currently afflicting UPR, it is uncertain at this time if the University can provide the operational funds needed to ensure continuation of ongoing grant-supported research activities.

e) Salient points of the proposal for grant extension

The major points of UPR's proposal for grant extension are stated in the attached document entitled "Revision of the University of Puerto Rico's 211 (d) Grant". This outline also

contains the activities contemplated and their justification.

A major change is proposed concerning UPR's primary subject matter area from soil conservation to classification and geography of tropical soils. This proposal was discussed at the recent Executive Committee Meeting and met with general agreement. The revised area of concentration is well coordinated with those of the other Consortium institutions

The budget for UPR's extension proposal will include \$20,000 earmarked as UPR's share for supporting the proposed Tropical Soils Resource Center.

The activities contemplated for the grant extension are closely related to UPR's and the University of Hawaii's Benchmark Soil Projects. Soil classification knowledge will enhance the utilization of the transfer methodology which is expected to materialize from the mentioned AID research contracts.

## Revision of the University of Puerto Rico's 211(d) Grant

### A Tentative Outline

by F. H. Beinroth

This document concerns a preliminary proposal for a modification of the University of Puerto Rico's subject matter area under 211 (d) grant AID/csd 2857. It is submitted to the member institutions of the Consortium and AID for consideration and intended as a basis for discussion at the Executive Committee Meeting at Cornell University on December 16 and 17, 1974.

### Introduction

Under grant AID/csd 2857 the University of Puerto Rico has been charged to strengthen its capabilities and to develop expertise in the field of "Conservation and Protection of Soils of the Tropics". In assigning this subject matter, AID and the Consortium have recognized a problem area of considerable magnitude and of legitimate concern.

No specific topics have been identified in the terms of the grant, but its title may be construed to include primarily soil erosion and its associated effects on crop production, and the maintenance of soil productivity under conditions of continuous cropping. While this in itself is a complex and multi-faceted matter, comprehensive treatment of the stated grant subject should further encompass soil degradation through salt and alkali, infectious

soil organisms, aggregate deterioration, cultural systems, radioactive fall-out, etc. Another aspect could relate to legislation.

In view of the complexity of this subject matter area probably any institution would encounter professional and facility constraints in developing the broad knowledge base envisaged in the grant. This predicament also prevails at the University of Puerto Rico. Although UPR can cope effectively with certain aspects of soil conservation, it would be unrealistic to consider these efforts adequate to accomplish the ambitious grant objectives. The University of Puerto Rico is, therefore, suggesting a modification of the originally assigned subject matter area.

### Proposed Modification

The University of Puerto Rico is proposing a shift of its main grant activities from the subject matter area of "Conservation and Protection of Soils of the Tropics" to "Classification, Characterization and Geography of Soils of the Tropics".

The objective of this proposed change is to identify, within the Consortium, an institution responsible for developing and sustaining response capability in the field of classification and geography of tropical soils. This response capability would be utilization-oriented and would be developed with respect to (1) major systems of soil classification used in the tropics, (2) occurrence and distribution of tropical soils, and (3) chemical, physical and mineralogical characterization of key soils of

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the tropics.

In order to generate this response capability, the University of Puerto Rico would focus initial grant activities on

- correlating units of systems of soil classification used in tropical LDCs with taxa of U. S. Soil Taxonomy;
- analytically characterizing key soils of the tropics;
- compiling soil maps and soil survey reports of tropical countries;
- develop a storage and retrieval system for analytical data of important soils of the tropics (Soil Data Bank).

Long-term objectives of the revised grant could include

- classification and characterization of the soils at the major agricultural experiment stations of the tropics;
- development of new and/or additional differentia for classifying tropical soils;
- correlation of soil analytical methods used in different tropical countries.

### Justification

Soil survey and classification have historically been recognized as essential prerequisites for land resource appraisal and land use planning. Clearly, U. S. interests in education and land resource development worldwide require knowledge of this subject. In spite of this fact, soil

classification is, at present, not identified as an area of emphasis in the Consortium program.

This appears to be somewhat paradoxical as the pooled expertise existing within the Consortium in the field of classification of tropical soils is probably unexcelled in the U. S. It would, therefore, seem logical that this subject matter be given more visibility as a major area of competence of the Consortium.

Although it is not suggested that the University of Puerto Rico is necessarily the best qualified institution to be entrusted with this subject matter, UPR's proposal to serve as a focal point for this topic is not without justification. Since the implementation of UPR's 211(d) program, the institutional policy has been to support studies related to classification of tropical soils. Furthermore, laboratory facilities have been and continue to be expanded with the objective to establish a functional soil characterization laboratory. On the basis of this professional experience and instrumental capacity and in view of its geographical location, the University of Puerto Rico is considered competent to achieve the outputs indicated above.

#### Coordination within the Consortium

It is realized that all of the member institutions are, to varying extents, involved in soil classification and related issues. As a consequence, the University of Puerto Rico's proposed program stands

to benefit from close collaboration with the other Consortium universities. Conversely, the information to materialize as grant activities progress at UPR should prove valuable to the fellow institutions.

Judging from past experience, the existing institutional linkages and the excellent personal relations among pedologists of the Consortium provide an efficient basis for smooth cooperation. However, for the purpose of identifying coordinated efforts in the individual extension/revision proposals, the kind and extent of collaboration and respective commitments should be specified.

### Conclusion

The University of Puerto Rico feels that a program thrust focused more exclusively on classification of soils of the tropics would allow a more effective involvement of existing staff competencies and laboratory facilities and invigorate its 211(d) grant. A concentrated effort in this area on the part of UPR with assistance from the member institutions is believed to accomplish utilization-oriented outputs of importance to agricultural development in LDCs. A viable grant program at the University of Puerto Rico should also reflect favorably on the Consortium as a whole.

UPR's Further Response to Issues Paper

The following statements intend to provide the additional information on certain items related to the Issues Paper as requested by the Chairman of the Review Team.

Reference Issue 1 -- Impact of Grant on UPR's College of Agricultural Sciences

As most land-grant institutions, the College of Agricultural Sciences of the University of Puerto Rico is composed of a teaching, research and extension component. These are the Faculty of Agriculture at Mayaguez, and the Agricultural Experiment Station and the Agricultural Extension Service both of which are headquartered in Río Piedras. Historically, these three entities have functioned rather independently and the process of their integration, as called for by a University law, has been slow. The grant through its then director, Professor Pietri, strived to promote this integration and has been instrumental in sustaining and furthering the soils program for the benefit of the College of Agriculture as a whole.

At the time of grant award the soils program at the Agricultural Experiment Station was essentially phasing out. The grant enabled the Institution to retain a soil scientist from the Experiment Station whose contract was expiring. This staff member was hired with grant funds and transferred to Mayaguez. He was allowed to continue to work on two collaborative research projects with the Soil Conservation Service of the USDA and the Land-Grant Universities of the Southern Region,

respectively. Without the grant the College of Agriculture would not have been able to comply with these commitments by the Experiment Station. The grant has further engaged an agronomist of the Experiment Station in field research.

The grant has succeeded in involving personnel from the Agricultural Extension Service in educational grant activities. Grant executives pursued the Extension Service Director to release three of his staff from their duties and to allow them to attend the 4-weeks Tropical Soils Institute held in Mayaguez in 1972. The three Extension Service participants considered this Institute a highly worthwhile professional experience of direct relevance to their extension jobs in Puerto Rico.

Reference Issue 1 (c) -- Response capacity

The following lists the field of specialization and response capacity relative to LDC situations for all staff members of the Soil Science Section of UPR's Department of Agronomy.

F. H. Beinroth, Ph. D.: Associate Professor

Field of specialization : Classification, formation and survey of tropical soils

Response capacity

a) Subject matter area : Systems of soil classification used in the tropics; soil survey

b) Functions : Problem identification and analysis  
Education and training

Advisory capacity

c) Availability : Limited availability for short terms

J. Colom-Avilés, Ph. D. Professor

Field of specialization : Microbiology, mineralogy and chemistry of tropical soils

Response capacity

a) Subject matter area : Microbiology, mineralogy and chemistry of tropical soils

b) Functions : Education and training  
 Problem identification and analysis  
 Research  
 / dvisory capacity

c) Availability : Limited, as fully committed in academic affairs

H. Lugo Mercado, Ph. D., Assistant Professor

Field of specialization : Mineralogy and chemistry of tropical soils

Response capacity

a) Subject matter area : Soil-plant relationships in tropical soils;  
 soil management (tillage)

b) Functions : Education and training  
 Research  
 Problem identification

c) Availability : Limited availability for short terms between semesters

M. Miro (Ms.), M. S., Assistant Professor

Field of specialization: Instrumental chemistry

Response capacity

- a) Subject matter area : Analysis of tropical soils
- b) Functions : Operational skills  
Education and training  
Advisory capacity
- c) Availability : Limited availability for short terms  
between semesters

Given the present institutional situation, the response capacity which exists in the area of management of tropical soils at the College's Agricultural Experiment Station is not fully utilizable at this point in time. However, Chancellor Pietri is in the process of effectuating a complete integration of the College's three entities. Chancellor Pietri is further favoring a more direct involvement of Experiment Station personnel in the College's AID-supported and other international programs. UPR's response capability in the area of tropical soils should, therefore, be increasing considerably in the near future.

### Reference Issue 3 -- Research Strategy

#### a) Agronomic field research

The original grant document specified UPR's area of primary concentration as "Management and Protection of Tropical Soils". In conceiving a strategy for research in this field, UPR considered the

following points: (i) the kinds of soil used for experimentation should be important "tropical soils", (ii) the crops selected should be important food crops of subsistence farmers in the tropics, and (iii) the experiments should relate to the economic decision environment of small LDC farmers.

On the basis of these rationales, Oxisols and Ultisols were selected for field experimentation. These are the highly weathered and therefore infertile soils that most people have found difficult to manage. Oxisols and Ultisols occupy some 1,500 million hectares in the tropics and comprise about one third of the total land area in the tropics. --Regarding crop selection, UPR deliberately excluded plantation crops of interest to "latifundistas" but focused on the starchy and high protein crops that are the staple food crops of small LDC farmers. Thus yams, tanniers, cassava, and beans were employed. In spite of the importance of these crops to masses of small tropical farmers, they have been neglected by the International Centers. --With respect to the economic decision environment, the experiments were designated to provide information on low fertilizer and energy inputs.

The field experiments combined soil management and soil protection. For example, one set of experiments was conducted in the subsoil of an Oxisol which had been previously levelled to simulate conditions of erosion. Another experiment included trials with dense plant populations to provide complete soil coverage and thus prevent erosion.

Pigeon peas were included in the crops investigated because previous studies indicated that they do not respond markedly to fertilization. This was substantiated in our experiments. Tillage experiments were conducted to study how yields of starchy root crops can be increased through more appropriate land preparation but without increasing fertilizer inputs. It was shown that yields can be nearly doubled through proper tillage.

Professor Pietri conceived and planned all of the field experiments which provided for a coherent strategy for the agronomic work conducted under the grant.

b) Pedologic research

UPR's statement referring to "academic freedom" in our original response to Issue 3 needs to be qualified. It should not be construed as to imply that grant-supported staff members could engage in whatever happens to be of intellectual interest to them. Rather, it was meant to indicate that such interest could be pursued provided they were related to the subject matter area of the grant. Thus Dr. Beinroth was allowed to continue to work in his chosen field of soil classification and formation because this area is closely related to both soil management and conservation. The approach taken by Dr. Beinroth was pragmatic rather than purely academic and focused on the utilization of soil classification in the process of agricultural development in the tropics.

Reference Issue 6 -- Salient points of the proposal for grant extension

The subject matter area of UPR's proposal for grant revision will be "Classification and Geography of Soils of the Tropics".

The purpose of the proposed grant revision is to sustain and strengthen UPR's response capacity in the area of classification of tropical soils as related to agricultural development in LDCs and as part of a concerted effort by the 211(d) University Consortium for Soils of the Tropics to mobilize tropical soils knowledge for increased food production.

The need for adequate U. S. expertise in the field of land resources development in tropical LDCs is clearly indicated by AID's current areas of program concentration directed to problem-solving and knowledge transfer. Soil classification is of central importance to this proposition.

Historically soil surveys have been recognized as an essential pre-requisite for land resource appraisal and development. Soil classification is a key element of soil surveys because it provides the scientific framework according to which soils are grouped into the units identified on soil maps. Soil classification further provides the information on chemical, physical, mineralogical and environmental soil properties which are the basis for evaluating soil potential for crop production and other soil uses.

Cognizant of the need and pay-off of soil surveys, most LDCs are engaged in some kind of soil survey activities. However, in order to be useful for agricultural development purposes soil surveys must have reasonable scientific standards, particularly as regards soil classification.

There is considerable scope for improvement in this regard in most LDC soil survey programs.

Contemplated activities comprise :

1) State-of-the-art reviews. These will include field and literature surveys on the extent and adequacy of soil survey programs conducted in tropical LDCs, analyses of the kind of soil classification systems applied in this process, an evaluation of the soil survey programs with respect to their usefulness for agricultural development, and the identification of knowledge gaps.

2) Research. Studies will be conducted to correlate the units of the various systems of soil classification used in LDCs with taxa of the U. S. Soil Taxonomy in order to facilitate the transfer of agrotechnology. Because the classification of tropical soils has lagged behind that of temperate region soils it is still incomplete. Research will, therefore, be carried out to identify soil parameters unique to tropical soils which could be employed in their classification. Further research may be initiated to correlate the different methods of analytical soil characterization used in different tropical countries.

3) Information systems. A collection of all available soil maps of the tropics will be built up in order to establish a knowledge base with respect to what kind of soil occurs where in the tropics. Parallel to this, a storage retrieval system for analytical data of important tropical soils will be developed (Soil Bank).

Other contemplated activities include the establishment of new and the strengthening of existing linkages, the development of operational skills in the subject matter area, and educational and training activities.

The relationship to the Consortium is expected to be twofold. At the technical level there exists an already agreed upon coordination of the subject matter areas which will be the primary areas of concentration of the five member universities. UPR's established linkages with these institutions are particularly viable in the area of soil classification.

With respect to a new Consortium structure, UPR favors the establishment of an adequately staffed coordinating office, or secretariat, for Consortium affairs. The function of this office should be to expediate the utilization of Consortium expertise for AID and other donors, to coordinate the research activities of the sister universities, to organize seminars and workshops, and to handle aspects of public relations for the Consortium. In concert with the other Consortium universities, UPR will include an amount of \$15,000 - 20,000 in the budget of the proposal for grant revision earmarked for the suggested office.

Further details regarding the proposal for grant revision are contained in UPR's original response and in the document entitled "Revision of UPR's 211(d) Grant".

ATTACHMENT A

Consortium Title: MOBILIZING TROPICAL SOILS KNOWLEDGE FOR INCREASED FOOD PRODUCTION

Consortium Objective: To develop, sustain and utilize the response capability for identifying and evaluating soil problems related to food production in the tropics and to recommend remedial management practices

Expected Outputs in Primary Subject Matter Areas:

1. Knowledge base
2. Training capacity
3. Research capacity
4. Advisory capacity
5. Linkages and networks

<u>Institution</u>	<u>Primary Objective</u>	<u>Secondary Objective</u>	<u>Ultimate Objective</u>
Cornell University	Soil Resource Inventory	<u>Soil-water relations</u> <u>Biological N-fixation</u>	Alternative Management systems for given soil use
Univ. of Hawaii	Soil Mineralogy and <i>micro</i> Biology	Soil physics & chemistry Biological N-fixation	Relate soil mineralogy and biology to management systems
NC State University	Soil Fertility	Soil physics Biological N-fixation	Soil fertility related to management systems
Univ. of Puerto Rico	<u>Soil Classification and</u> <u>Geography</u>	<u>Soil characterization</u>	Soil potential for management systems
Prairie View A & M Univ.	Delivery Systems for Soil Technology	Savanna/Prairie eco- systems	Adapting soil management systems for delivery