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TRIP REPORT

NATIONAL ACADEMY OF SCIENCES
NATIONAL RESEARCH COUNCIL

TRAVEL TO: Switzerland, Senegal, Mali, France

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DATES: November 16 - December 9, 1982

ITINERARY:

International Union for Conservation of Nature (IUCN), Morges and Gland, Switzerland	November 17 - 21
Dakar, Bambey, Bandia, and Sangalkam, Senegal	November 22 - 26
Bamako and Sotuba, Mali	November 26 - December 6
UNESCO and Institute de Recherches Agronomique Tropicales (IRAT), Paris and Nogent-sur-Marne, France	December 7 - 9

PURPOSE: The purpose of this trip was to discuss proposed IUCN efforts in urban-fringe rehabilitation and environmental planning in the West African Sahel; to evaluate the development of the West African Microbiological Resources Center (MIRCEN) in Senegal; to follow up on BOSTID's species trials currently being undertaken in the Sahel; to meet with Sahel Institute officials in Mali; and to discuss the progress of the MIRCEN program with UNESCO and IRAT officials in France.

INDIVIDUALS WITH WHOM DISCUSSIONS WERE HELD

Switzerland

Omar Draz, Desert Institute Council, Matarieh, Cairo, Egypt
Pierre Hunkeler, Former Executive Officer of the Commission on Environmental Planning, International Union for Conservation of Nature and Natural Resources (IUCN), Gland, Switzerland
John Kundaeli, Former Programme Officer for Africa, IUCN, Morges, Switzerland
Liberty Mhlanga, General Manager, Agricultural, Rural Development Authority (ARDA), Harare, Zimbabwe
David Munro, Former Director-General of the IUCN, Sydney, British Columbia, Canada
Daniel Navid, Executive Officer, Commission on Environmental Planning, IUCN
Peter Nowicki, French Ministry of the Environment, Neuilly-sur-Seine, France
Pierre Portas, Project Manager for Africa and Madagascar, IUCN
Murray Silberman, Dimension Cuatro Internacional, San José, Costa Rica
Thaddeus Trzyna, President, California Institute of Public Affairs, The Claremont Colleges, Claremont, California

Senegal

Claude Bailly, Institut Sénégalais de Recherches Agricoles, Centre National de Recherches Forestières (ISRA/CNRF), Dakar
François Cornet, Microbiologist, Laboratoire de Microbiologie des Sols, Office de la Recherche Scientifique et Technique Outre-Mer (ORSTOM), Dakar
David Diop, Livestock Program, U.S. Agency for International Development (USAID), Dakar
Emile Duhoux, Département de Biologie Végétale, Faculté des Sciences, Université de Dakar
Yvon Dommergues, Microbiologist, Laboratoire de Microbiologie des Sols, ORSTOM, Dakar
Peter Freeman, Environmental Advisor, USAID, Dakar
Francis Ganry, Agro-pedologist, ISRA, Centre National de Recherches Agronomiques (CNRF), Bambey
M. Cassama, ISRA, Laboratoire National de l'Elevage et de Recherches Vétérinaires (LNERV), Sangalkam
Mamadou Gueye, Microbiologist, Laboratoire de Microbiologie des Sols, ORSTOM, Dakar
Mamadou Jallow, USAID, Dakar
Lance Jepson, Agricultural Advisor, USAID, Dakar
Ernest Locher, Project Director, Swiss Development Cooperation (DDA), Dakar
Lewis Lucke, USAID Project Manager, Gambia River Basin Development Project, Dakar

SWITZERLAND

Follow-up was made on BOSTID's proposal that Nouakchott, Mauritania, be selected as a site for an IUCN-sponsored pilot urban-fringe rehabilitation project and that the IUCN cooperate with the Sahel Institute in formulating sound national and regional conservation strategies based on the IUCN's World Conservation Strategy. (The 15th General Assembly of the IUCN, held in 1981, passed a resolution concerning the importance of urban-fringe rehabilitation. The resolution supports coordinated action to ensure that land near cities remains available for the sustainable production of food and fuel wood; for the conservation of water supplies, plant and animal species, and habitats; and for recreation and environmental education.) While the BOSTID staff recognizes the difficulties involved in undertaking such a project, because of the progress made on the Nouakchott Greenbelt project, documented environmental response to protection, interest expressed by the Mauritanian government in establishing an environmentally protected area around the city, and the highly degraded nature of Nouakchott's periurban fringe, it is felt that further efforts in this direction should be made. Discussions will be held with Mauritanian officials during future visits to Mauritania.

The BOSTID recommendation that a cooperative relationship be established between the IUCN and the ecology/environment section of the Sahel Institute has been discussed with various Sahelian and IUCN officials: Ousseini Sidibé of the Sahel Institute; Moulaye Diallo and Lassana Coulibaly of the Interstate Committee for Drought Control in the Sahel (CILSS); the IUCN Regional Counselor El-Hadji Sène of Senegal; and Peter Jacobs and Daniel Navid of the IUCN's Commission on Environmental Planning. It has been generally agreed that the IUCN's experience in environmental planning could be most useful in reconciling the Institute's programs with the World Conservation Strategy. Possibilities for establishing a closer working relationship with the IUCN and the Sahel Institute are being examined, particularly the desirability of arranging for an IUCN consultancy to better integrate the World Conservation Strategy into the Institute's environment/ecology program.

Pierre Portas, the IUCN's Project Manager for Africa and Madagascar, described the IUCN's 1982-1984 Program on Conservation for Sustainable Development, current IUCN efforts in the Sahel, and a proposed project, "The Use of Fauna and Flora as a Contribution to Environmentally-Sound Development in the Sahel: Feasibility Study in the Niger Delta, Republic of Mali"--a project which would relate well to various BOSTID Sahel Program interests and recommendations concerning the utilization of periodically inundated regions and the better integration of wildlife resources into development projects. BOSTID's suggestions to exploit environmental dynamics, such as river fluctuations, wadi flow, effective winds, and animal movement in order to promote wider seed dissemination would relate well to the proposed Niger Delta study.

One serious obstacle to environmental rehabilitation in the Sahel has been that Sahelian governments and herders have not cooperated to

develop pastoral systems that are environmentally sound and economically viable. Omar Draz of the Egyptian Desert Institute Council explained how such cooperation has successfully taken place in Saudi Arabia and in Syria through the revival of the ancient hema system, a system that incorporates conservation measures, such as range reserves and controlled grazing, with the establishment of herder cooperatives. The environmental benefits of this approach have been substantial. In Syria, for example, pastoralists associated with the hema cooperatives have already revegetated some 7,000,000 hectares of rangeland with Atriplex nummularia and other browse species adapted to the Syrian steppes.

Elements of the hema approach are contained in various USAID projects in the Sahel, such as the Integrated Livestock Production Project in Niger. The BOSTID team believes that the approach is of immediate relevance to the problems of the Sahel, and that its application should be thoroughly explored.*

Liberty Mhlanga was associated with the BOSTID Sahel Program while working at the Environment Training Programme (ENDA) in Dakar, Senegal. The various activities currently being undertaken in connection with the Sahel Program and their relation to Dr. Mhlanga's present responsibilities in Zimbabwe were discussed. He asked if it would be possible for ARDA to undertake species trials, based on the USAID/NAS trials in the Sahel, in the relatively dry regions (Regions IV and V) of Zimbabwe and requested assistance from BOSTID in organizing a short course to train extension agents in evaluation methodologies in relation to revegetation programs. He further requested various BOSTID publications; information regarding the establishment of windbreaks and shelterbelts; seed, inoculum as appropriate, and planting instructions for drought-tolerant trees; and further information regarding the BOSTID and USAID research grants programs.

Jeffrey Gritzner of the BOSTID staff presented a paper on the cultural aspects of conservation in semiarid and arid biomes at the annual meeting of the IUCN's Commission on Environmental Planning (CEP). It was based on BOSTID's USAID-sponsored activities in the West African Sahel.

*For further information regarding the revival of the hema system in Syria, see Appendix A of this report or the FAO document, "Range and Fodder Crop Development," Syrian Arab Republic, National Range Management and Fodder Crop Production Programme, Consultant Report AG:DP/SYR/68/011; Rome, 1980.

SENEGAL

The BOSTID team was joined in Senegal by Deane Weber of the U.S. Department of Agriculture's Nitrogen Fixation Laboratory at Beltsville, Maryland. The visit was principally concerned with the progress of the West African Microbiological Resources Center (MIRCEN) based at Bambey and Dakar-Hann, with BOSTID's AID-sponsored species trials currently being undertaken at Bandia and Sangalkam, and with formal species elimination trials which will be initiated at Saint-Louis this spring.

Moctar Touré of SERST arranged a meeting with officials directly involved in the development of the MIRCEN. It was attended by Mr. Touré, who serves as SERST's Officer-in-Charge of Agriculture and Agro-Industry; Mamadou Sonkho, Scientific Director of IRSA; Mamadou Gueye, of ORSTOM; Dr. Weber; and the BOSTID team. Mr. Touré summarized the status of the MIRCEN program, voiced his support for both the program and the planned six-month consultancy of Carlos Batthyány to the MIRCEN. (BOSTID has obtained funds for the consultancy from the Foundation for Microbiology.) Mr. Touré expressed the continued willingness of SERST and ISRA to cooperate in the implementation of the project. We stressed the importance of appointing a new MIRCEN director to replace the former director, Sitapha Diatta, who has accepted a position outside of Senegal. Mr. Touré agreed, indicating that Mr. Gueye of ORSTOM would be appointed Technical Director and that an Administrative Director would also be appointed. SERST will inform BOSTID and UNESCO as soon as the appointments are made.

Mr. Touré arranged for a field visit to the MIRCEN site at Bambey and asked Mr. Gueye to accompany us. Mr. Sonkho, who had recently returned from an orientation visit to the Nairobi-based MIRCEN, which was arranged by BOSTID and financed by UNESCO, said that the visit was productive and that his report was being completed. BOSTID provided the group with various publications related to microbiological research and described sources of funding for such research. ISRA expressed interest in BOSTID's USAID-sponsored Research Grants Program, particularly in the areas of grain amaranth and fast-growing, nitrogen-fixing trees. BOSTID will provide Mr. Sonkho with additional information regarding this program.

With Mr. Touré, we then met with P. Ibrahima Thiongane, Director-General of ISRA. We summarized the MIRCEN project, discussed the species trials, and explored future areas of cooperation. Dr. Thiongane was particularly interested in the possibility of BOSTID cooperation with SERST and Charles van Praett of the UNEP/FAO Pastoral Ecosystem Project in studying the applications of aerial seeding to range rehabilitation. Dr. Diouf of SERST has also expressed a strong interest in aerial seeding during meetings held earlier with USAID and BOSTID in Washington and Dakar. Given the initial results of the Commonwealth Scientific and Industrial Research Organization (CSIRO) efforts in aerially seeding legume-grass mixtures in semiarid regions of Queensland, as well as the broadcast seeding experiments conducted

by USAID in Cape Verde, there is reason to seriously consider the proposal. Dr. Thiongane arranged transportation for the visits to Bambeý and Bardia.

Meetings with Yvon Dommergues and François Cornet of ORSTOM focussed on research being conducted by ORSTOM on nitrogen-fixing plants and their associated microorganisms. Of particular interest was their work with stem nodulation in species such as Sesbania rostrata. We also visited trials involving Aeschynomene elaphroxylon, Acacia albida and A. holosericea.

The Acacia holosericea were being tested to determine the benefits of inoculation to leguminous trees and shrubs. The trials involved uninoculated trees, trees inoculated with Rhizobium, and trees inoculated with a combination of Rhizobium and mycorrhizal fungi. Those inoculated with both Rhizobium and mycorrhizal fungi were significantly larger and more vigorous than the controls or those inoculated only with Rhizobium. According to Dr. Cornet, the growth differentials persist for approximately two years. After that time, the growth rates for inoculated and uninoculated trees are similar. An initial conclusion drawn from the Acacia holosericea research is that, for certain species, inoculation with specific rhizobia and mycorrhizal fungi can measurably improve seedling establishment in semiarid regions. BOSTID has provided seed for similar trials, involving approximately 20 species, currently being undertaken in a USAID-funded program in biological nitrogen fixation at the University of Hawaii (NifTAL) and by USDA in Beltsville, Maryland.

We also discussed ORSTOM's recent success in isolating effective strains of Frankia for the inoculation of certain non-legumes, such as Casuarina spp., enabling them to fix nitrogen. This research introduces exciting possibilities for nitrogen fixation in a broad range of non-leguminous species.

In Bambeý, we met with Mahawa Mbodj, Director of CNRA; microbiologists Mamadou Ndiaye and Joseph Wey; and Francis Ganry, an IRAT agro-pedologist associated with the International Atomic Energy Agency's program in biological nitrogen fixation in Senegal. The MIRCEN program was discussed in detail. It was agreed that the microbiological laboratory, although very basic, is adequate for the initiation of the MIRCEN program. The CNRA staff members at Bambeý expressed their willingness to share laboratory facilities with the MIRCEN staff. However, a basic, uncomplicated freeze-dryer is needed, and a refrigerator would be useful. Because the CNRA staff is fully occupied, new staff will be needed to maintain the MIRCEN program. As the MIRCEN develops, more laboratory space will be required. The impending World Bank-sponsored reorganization of the Senegalese research infrastructure, including a proposed decentralization of research activities, may make more laboratory space available at the Bambeý center.*

*A more technical report on the Bambeý visit is being prepared by Dr. Weber of the USDA.

In Bandia, we visited the CNRF trials with Claude Bailly. We were shown the various accessions provided by BOSTID for evaluation. Of particular promise for low rainfall areas (the CNRF site receives approximately 350 mm) were the Prosopis hybrids PC 004 and PC 005, the P. alba accessions, P. velutina, P. glandulosa var. glandulosa, Acacia ligulata, A. aneura, A. victoriae, and A. cambagei. Although planted late in the season, survival rates were extremely high and no backfilling was necessary. Several other BOSTID accessions being tested by CNRF were also seen. Of these, Sesbania grandiflora demonstrated especially rapid initial growth--but may not survive the extended dry season. BOSTID performance evaluation forms were distributed, and initial results will appear in a BOSTID report to be issued during the spring of 1983. Soil samples will be taken according to BOSTID specifications and will be analyzed by USDA/Beltsville.

Upon our return to Dakar, we met with Emile Duhoux, an applied botanist at the Université de Dakar. Dr. Duhoux's work was discussed and his laboratories were visited. Particular attention was given to Dr. Duhoux's research on the stem nodulation of Sesbania rostrata and on the reproduction of Acacia albida through tissue culture. The relevance of tissue culture to the preservation of endangered plant species in the Sahel, the rapid multiplication of desirable species, and the selection of desirable traits, such as salt tolerance, were also discussed.

BOSTID has provided several accessions of forage species to LNERV for evaluation. The trials, being conducted at the LNERV research station at Sangakam, were visited and discussed with François de Rochambeau and his associates at the station.

The accessions provided by BOSTID include Centrosema sp. (Centro), C. brasilianum, C. pascuorum, Desmanthus virgatus, Leucaena leucocephala ("Cunningham" forage cultivar), Macroptilium atropurpureum (two accessions), M. martii (two accessions), Phaseolus filiformis, P. acutifolius, Stylosanthes hamata, S. scabra (three accessions), and S. sympodialis. Other accessions provided by BOSTID, including Atriplex nummularia, A. canescens, and Tylosema esculentum, are being evaluated elsewhere. Although the trials were planted by direct seeding less than two months before our visit, several of the accessions had already produced seed--notably the P. acutifolius. As the current trials were planted in heavy, bottom soils, the seed produced this season is being collected for trials on better drained, sandy soils. BOSTID will provide additional seed for expanded trials. Species performance forms were left with the LNERV staff. Although most of the forage crops being tested by the LNERV are legumes, none have been inoculated. Dr. de Rochambeau agreed that it would be interesting to experiment with inoculation, and we agreed to provide inoculum if it is not locally available through the West African MIRCEN or ORSTOM. Finally, Dr. de Rochambeau requested information regarding the BOSTID and USAID research grants programs.

At a meeting with Ernest Locher of the Swiss Development Cooperation, Mr. Locher explained why the BOSTID-sponsored species trials had not been conducted this year and discussed plans for undertaking them in 1983. Mr. Locher will inventory the seed received from BOSTID and inform us of any necessary replacements. BOSTID will arrange for a second shipment of inoculum for the trials. The nursery phase of the trials will be undertaken by Christian Dering of the German Forestry Mission at Saint-Louis. The seedlings will then be outplanted at the DDA/Union Mondiale ORT-operated Ecole des Agents Techniques de l'Elevage de Saint-Louis.

Discussions were held with El-Hadji Sène and Amadou Ndiaye of Eaux et Forêts concerning the utilization and ultimate rehabilitation of the salt flats around Fatik. Packets of seed were left with Peter Freeman of USAID for Mr. Sène. They included trial quantities of Acacia linarioides, A. salicina, Argania spinosa, Geoffroea decorticans, and Tarchonanthus camphoratus.

A brief meeting was held at the USAID mission with Lewis Lucke concerning the Gambia River Basin Development Project. Information was left with Mr. Lucke regarding mangroves, Gambian environmental law, and the development of the Gambia River Basin. In Larry Harms' absence, a brief meeting was also held with David Diop concerning the relevance of the hema system of range management to the Schel and forage-crop research in Senegal. Trial quantities of Tylosema esculentum, Centrosema pascuorum, C. brasilianum, Atriplex canescens, and A. nummularia were left with David Diop, along with a listing of seed available through the BOSTID Sahel Program. Finally, a meeting was held with John McMahon concerning BOSTID activities in Senegal under the current grant.

Before our departure, summary briefings were given to Samuel Rae and to Peter Freeman and Lance Jepson of the mission. A packet of terra-sorb, a commercially available superabsorbent, was left with Mr. Freeman for testing. The substance seems to hold some promise in better assuring the survival of newly outplanted seedlings in areas of irregular precipitation.

MALI

Current BOSTID activities in the Sahel, as well as possible future program directions, were discussed with Ambassador Parker Borg. Particular attention was given to BOSTID efforts to increase biological diversity and productivity through species trials, aerial seeding, the harnessing of natural systems to serve project objectives and the development of the West African MIRCEN. The possibility of holding a sand dune stabilization demonstration in Mali was also discussed.

Meetings with Jon Anderson of the USAID mission covered a broad range of subjects: species trials (both formal and unstructured), grant programs which could support forestry research in Mali, Peace Corps involvement in the forestry sector, the proposed sand dune

stabilization demonstration, and other topics of mutual interest. Mr. Anderson provided us with forestry-sector documents for orientation and comment. We left various BOSTID documents with Mr. Anderson, as well as a small quantity of terra-sorb for experimentation.

A brief meeting was held with John Diller, Teresa Ware, and Debbie Kreutzer of USAID to bring the BOSTID team up-to-date on developments at the Sahel Institute.

Discussions with Peace Corps officials, John Zarafonitis and Bertrand Laurent, dealt with a number of issues: Peace Corps forestry sector activities, agroforestry, soil stabilization in the OMVS project area, new crops, and other interests. BOSTID has supplied seed to the Peace Corps over the years for trials related to their agricultural and forestry interests. We expressed our hope that information regarding species performance could be retrieved from these trials and recorded on BOSTID reporting forms. Mr. Laurent agreed with the importance of obtaining such information and offered to follow up. We agreed to continue to provide the Peace Corps with seed and publications relevant to their programs. Simmondsia chinensis (jojoba) seed was requested by Mr. Laurent, and we left trial quantities of Adansonia digitata, Anogeissus leiocarpus, and Balanites aegyptiaca seed for volunteer Michael Ahearn's work at Fatoma--partially in response to anticipated problems connected with the inclusion of Calliandra calothyrsus and Sesbania grandiflora in the current trials. The risk of failure of such species in dryland trials is high and could affect local confidence in the researchers and agencies involved. BOSTID will provide seed for fast-growing, dryland species upon request. We also agreed to provide Mr. Laurent with further information regarding windbreaks/shelter-belts and agroforestry appropriate for Malian conditions.

Discussions with George Taylor of USAID's Office of Development Planning for the Sahel were particularly far-ranging. We summarized the status of the formal BOSTID species trials under way in the Sahel; discussed the forage-species trials being conducted by ISRA/LNERV, ILCA, ICRISAT, and various USAID missions with seed provided by BOSTID; discussed the West African MIRCEN program; and reviewed the status of the current BOSTID studies concerning environmental change and the potential of agroforestry in the Sahel. "Natural" forestry management was also discussed, as were innovative approaches to the large-scale rehabilitation of forests and rangelands. Future BOSTID program possibilities were discussed, including: utilization and rehabilitation of saline environments; the proposed dune stabilization demonstration; establishment of a Sahelian germ plasm collection (possibly linked with the MIRCEN program to facilitate the shipment of seed with inoculum if appropriate); creation of a regional botanical garden to better assure the survival of important native species and promote botanical research; an expansion of the current BOSTID species trials; and a possible BOSTID role in promoting scientific exchange between Sahelian and American scientists.

Information concerning the revival of the hena system of range reserves in the Middle East was left for SDPT Livestock Advisor James

Dickey. As noted earlier, the successful revival of this system seems to have important implications for range rehabilitation and management in the Sahel.

The meeting with Salif Kanouté, Assistant Director-General of Eaux et Forêts, dealt with the possibility of undertaking the formal BOSTID species trials (according to the May, 1982 BOSTID protocol) in 1983. He requested a letter summarizing our discussions to enable Eaux et Forêts to confirm formally its interest in the trials. The letter was prepared as requested. The seed sent in 1982 to the USAID mission should be adequate for these trials, but BOSTID will provide supplementary seed and inoculum if necessary. As Mr. Kanouté also expressed an interest by Eaux et Forêts in sand dune stabilization, we described the dune stabilization activity proposed by BOSTID to USAID. He felt that such an activity would be appropriate for Region V of Mali and suggested various sites for the demonstration workshop. We provided Mr. Kanouté with several accessions of Eucalyptus for current Eaux et Forêts research efforts: Eucalyptus torquata, E. melanopholia, two accessions of E. microtheca, E. occidentalis, E. oleosa var. oleosa, E. terminalis, E. intertexta, three accessions of E. camaldulensis, E. brockwayi, and E. tessellaris. He requested seed for Phaseolus acutifolius (teparty bean) and Simmondsia chinensis (jojoba). Several BOSTID reports and publications related to Eaux et Forêts interests and activities were left with Mr. Kanouté.

At the request of Mr. Kanouté, we met with Mamadou Ouattara, the Assistant Director-General of the Institut National de Recherche Forestière et Hydrobiologique at Sotuba. We discussed appropriate sites for formal species trials in Mali and agreed to provide him with seed and inoculum for informal research. Various BOSTID publications, the 1982 species trials protocol, listings of available seed, reporting forms, and other materials were left with Mr. Ouattara.

BOSTID has provided ILCA with seed of grain legumes and forage species for trials in the Sahel. We met with the agronomist in charge of the trials, Pierre Gosseye. Mr. Gosseye described the trials and indicated that technical reports would be sent to BOSTID. As Mr. Gosseye is returning to Belgium to continue his studies, we left reporting forms and other relevant materials with him to forward to his replacement, Herve Hulet, at Niono. Innovative approaches to range rehabilitation and possibilities for establishing a West African germ plasm collection were also discussed.

Meetings were held with John Scheuring, Philip Serafini, Abdoulaye Sow, and Youssouf Boré of the ICRISAT research station at Sotuba. We discussed ICRISAT's research efforts and the performance of the various accessions forwarded to ICRISAT by BOSTID for evaluation. Of particular interest were ICRISAT's work with Eleusine coracana as a grain crop and with wild cereals such as Echinochloa colona, E. staghina, Panicum lactum, and Cenchrus bifloris. ICRISAT has found that by mixing Eleusine coracana flour with 10 percent tuber flour (y. or sweet potato) they can produce traditional foods of acceptable consistency. This is something of a breakthrough, as the Eleusine yields are high, but the flour was previously unmarketable.

ICRISAT is now working on Eleusine spp. for the drier regions of the Sahel (the limiting factor for E. coracana in lower rainfall areas is its susceptibility to orthopteran insects). MM. Sow and Boré showed us some 19 species of native grasses which are important sources of grain for rural populations. These grasses are of interest not only as sources of food, for human populations as well as livestock, but for their role in precipitation interception and groundwater infiltration, erosion control, and as a possible source of fuel through densification. The possibility of utilizing grasses as fuel in areas with a relatively limited range of fuel alternatives should be explored more thoroughly. Some seed of Tylosema esculentum, Geoffroea decorticans, and Tarchonanthus camphoratus was left with Mr. Sow for evaluation in relation to his research, as were lists of other seed available through BOSTID.

At the Sahel Institute, we met with Ousseini Sidibé, Director of Research, and Modibo Sidibé, who is associated with the Institute's Ecology/Environment Program. George Taylor of SDPT also participated in the meeting. We were briefed on the directions and focus areas of the Institute, particularly with regard to its environmental program. We described our efforts in environmental rehabilitation in the Sahel under our current USAID grant and possible projects under future grants. New crops were also discussed, and the Institute asked that we provide them with seed for 60-day maize, cowpeas, tepary beans, winged beans, morama beans, and grain amaranth for distribution to Sahelian researchers.

The Institute reaffirmed its interest in receiving and disseminating the results of the BOSTID-sponsored species trials in the Sahel. The possibility of the Institute's eventually assuming responsibility for the collection, interpretation, and dissemination of the trial information when the Academy's involvement ends was also discussed, but no decision was made.

The desirability of the Institute's collaboration in the proposed BOSTID-sponsored dune stabilization demonstration (probably in Mauritania, Mali, or Niger) was discussed, and the Institute was supportive and enthusiastic.

The BOSTID team and George Taylor had discussed the desirability of bringing together some of the older, knowledgeable Sahelian botanists and foresters, perhaps within the framework of an Institute/BOSTID workshop, to take advantage of their long experience and wealth of knowledge for use in project planning. This idea was discussed with the Institute, and it was agreed that BOSTID will write a proposal to AID under its next contract.

FRANCE

Meetings were held with Edgar DaSilva of UNESCO regarding the development of the West African MIRCEN in Senegal. Dr. DaSilva was briefed on the BOSTID/USDA visit to Senegal and the current status of the MIRCEN. He suggested that the grant from the Foundation for Microbiology for the support of Dr. Batthyany's consultancy be

disbursed directly through a personal contract rather than through UNESCO. It was agreed that as soon as the Senegalese authorities appoint a technical director for the MIRCEN, the consultancy could begin. We confirmed that the journals provided for the MIRCEN by UNESCO had arrived at CNRA/Bambey and recommended that future shipments be directed to Mamadou Ndiaye to avoid confusion. We discussed the need for a simple, easily maintained and repaired freeze-dryer for the MIRCEN. Dr. DaSilva said that a standard, uncomplicated model had been provided for other MIRCENs, and that he would gladly respond to a request for such a freeze-dryer from the West African MIRCEN. UNESCO has also offered to make funds available for microbiological research in the Sahel. BOSTID agreed to work with the Sahel Institute in identifying appropriate projects but asked that UNESCO manage the financial aspects of the program.

A meeting was held with Claude Charreau at IRAT in Nogent-sur-Marne. Dr. Charreau has long been involved with agricultural research at Bambey, Senegal, and elsewhere in the Sahel. As virtually all of the applied microbiological research at CNRA/Bambey is funded by IRAT, we discussed the status of the MIRCEN program and its relation to IRAT activities and interests. Dr. Charreau acknowledged the importance of the MIRCEN and offered IRAT support in further developing the MIRCEN program.

Within the French research context, IRAT is associated with several other tropical research agencies in the Groupement d'Etudes et de Recherches pour le Développement de l'Agronomie Tropicale (GERDAT). Dr. Charreau explained the mandates and interrelationships of the various agencies (IRCT, IRCC, IRHO, IRFA, IRCA, CTFT, and IEMVT) and how they differ from other French research organizations active in the tropics, such as ORSTOM. We described the "new crops" element of our current Sahel Program, which is of particular relevance to IRAT, and agreed to provide seed of short-cycle maize and beans for their research in the Sahel. Finally, Dr. Charreau provided us with the names of French researchers active in areas of BOSTID interest in tropical Africa with the hope that cooperation between our programs could be increased.

We also met with Louis Berlinguet, formerly with the International Development Research Centre (IDRC) in Ottawa and currently Science Attaché at the Canadian Embassy in Paris, to discuss our activities in the Sahel and IDRC efforts in the Region.

APPENDIX A

Summary of the Syrian Experience in the Field of Range Management Based on Revival of the Hema System of Range Reserves* by Omar Draz

The discovery of facts and principles of "Hema" inspired (during 1967) the suggestion to put it under trial, as an approach to obtain Bedouin cooperation in the reintroduction of range protection and conservation practices in replacement of present exploitation and misuse. It was thought that this could be of some help in overcoming certain difficulties encountered in previous efforts which, as indicated by an FAO/WFP Evaluation Mission Report (1968), did not realize their objectives, mainly because measures to develop and maintain controlled grazing on the steppe were incomplete and no attempt was made to organize Bedouins into groups.

It was also thought that if the previously claimed grazing rights of Bedouin tribes were restored, it could result in a change in the prevailing destructive attitude towards the range, which is considered as common land open for free grazing by the first flocks to arrive.

The successful establishment of the First Range Cooperative in 1968 at Hama offered the chance for the formulation of the National Range Development Programme, which included a series of internationally assisted projects. (UNDP/FAO/SYR/68/011 and several WFP assisted projects have materially contributed to this Programme.)

Rangeland donated by the Government to "Hema Cooperatives," once officially established, was declared (according to newly passed legislation in 1973) land under a "controlled system of grazing management" where grazing is prohibited except for flocks owned by Cooperative members.

The eight Hema Cooperatives that were established during 1968-1972 paved the way for expansion of this system to cover the Syrian steppe.

More than 150 cooperatives have already been established or were in the course of establishment up to 1981, covering more than 5 million hectares of rangeland.

Abstract prepared by Dr. Draz from a paper on Remote Sensing in Range Management and Conservation. Int. Symp. on Remote Sensing of Environment, Cairo, Egypt, 1981.

Government "Hema" Range and Sheep Production Centres

These are Government experimental training and demonstration centres for range and sheep production purposes.

The area under control of the eight centres already established is around 120,000 ha, which provides an excellent means of training staff and demonstrating the beneficial effects of proper grazing management. This also offered a good chance to start a selection and breeding programme for native Awassi sheep. Two more centres are now being established.

Sheep Fattening Cooperatives

These have been established to induce sheep offtake from the range. Successful establishment of the first Fattening Cooperative through WFP incentives stimulated rapid expansion of this activity. A total of 55 Fattening Cooperatives have already been established.

The establishment of a network of feed warehouses, through project activities and utilization of supplemental feed, have provided more lambs of higher weight at a younger age to produce more per unit of feed.

Prohibition of Ploughing and Cultivation of Land Within the Steppe Region Through Legislation

The ancient inhabitants of the Arabian Peninsula were aware of the destructive role of the plough on the natural vegetation in arid areas. One of the early records in this respect is referred to by Mohammed the Prophet, who although a supporter of agriculture, has "warned those who encroach with their ploughs on boundary lines of land not permissible for cultivation"; emphasizing that ploughing under such conditions would bring forth "humiliation."

Expansion of ploughing and grain production in the heart of the Syrian steppes during the last 50 years has destroyed the vegetation in the best third of this large area. Introduction of mechanical equipment, instability of social and economic situations, and increased need for grain has accelerated this process, and the need to control ploughing in the steppes was discussed and supported by many previous workers.

Through project doctrines, a series of Legislative Orders have been passed to be endorsed by the Syrian Parliament in 1973 through passing of a special act for "Prohibition of Ploughing and Cultivation of Rangelands within the Syrian Steppe."

Plantation of Perennial Palatable Shrubs in the Marginal Areas

The results of the experimental plant introduction trials during 1968-1972 indicated high adaptability of the Australian old-man salt bush, Atriplex nummularia, to local dryland conditions of the marginal areas of the Syrian steppe region.

Although establishment of this shrub from seeds has been experimentally successful, the scheme incorporates the production and distribution of seedlings to Bedouins who would agree to grow, maintain, and properly utilize these plants. Provision of initial incentives for planting has been made available through WFP assistance.

Nurseries have already been established for production of seedlings of adapted species which produced 5 million seedlings during the 1980 season. About 7,000,000 ha have already been planted, whereas the plan for 1981-1985 is to plant 45,000 ha with these shrubs for production of additional feed reserve for the dry season.

Most interesting is the fact that Bedouins who are always considered as enemies of trees and shrubs, have been put (once given a proper chance) in charge of a plantation and conservation programme.

Restoration of Ruined Water Cisterns

Thousands of ruined water cisterns are seen in many parts of the Syrian steppe. These, when restored, collect enough water to refill in most years, which would indicate that, probably no change in rainfall is responsible for the deterioration of these areas.

Restoration of 2,800 cisterns has already been completed through WFP assistance. An objective which has already been accomplished in three years.

National Feed Revolving Fund (NFRF)

The NFRF was created, in which sales proceeds of WFP assistance and Government-supplied feed is to be deposited, to be utilized for support of project activities. Through careful planning and utilization as well as an \$11.5-million World Bank loan, the fund's capital has now grown to around LS. 100 million, mostly revolving in support of the project activities:

- 1) Sheep Fattening Cooperatives
- 2) Government Range and Sheep Station
- 3) Sheep and Range Cooperatives
- 4) Dairy Cooperatives
- 5) Credit Facilities for Establishment of Cooperative Feed Warehouses
- 6) Stimulation and Creation of a Buffer Stock of Feed Reserve to Maintain a Steady Feed Supply.

NFRF makes available to members of project cooperatives short-term loans for feed purchases and long-term loans for the construction of feed warehouses. Medium-term loans are also available for purchase of equipment.

The real value of this unique pioneer experience, the NFRF, is not so much in its present capital as it is in the socioeconomic activities it initiated and the number of projects that have been stimulated.

A further historical development step in the structure of the NFRF has been included in the World Bank loan agreement with the Syrian Government where the US \$11.5-million loan and collected interest rates would go back to the Revolving Fund for the following year's operations.

Early in 1979, with the expanding activities of the NFRF, it was found necessary to reorganize the NFRF toward specific specialized subdivisions: NFRF (A) the original fund to cover most of the project activities; (B) to cover credit requirements for purchase of food for cooperative members; (C) for animal health requirements; (D) to support a development-oriented research programme; and (E) for development of dairy industry and milk production. It is expected that, once the loan assistance requested from the Federal Republic of Germany to this project becomes effective, the following subdivisions will be established; (F) a sheep marketing programme; (G) plantation of forage shrubs; and (H) a wool marketing programme.

Pilot Project for Wildlife Protection

FAO assisted the project in the formulation of a pilot project for wildlife protection. Yet, lack of qualified trained staff and financial support for procurement of the native wild species has been limiting the experience.

Regionalization of Syrian Project Experience

The approaches and achievements of SYR/68/011 Project have recently attracted the attention of a number of scientists and authorities of different disciplines from Jordan, Sudan, Saudi Arabia, North and South Yemen, four North African countries, and Kenya. Authorities and trainees from most of these countries visited activities of the Project. Three separate reports have been prepared (in Arabic) for the first three countries for development of their rangelands along approaches similar to those of the Syrian programme.

During 1979 and 1980, the UNDP Regional Bureaux of Arab Countries took the lead in support of this project's activities with the result that two Regional Projects (RAB/79/019 and RAB/80/006) have already been formulated along the lines developed through the Syrian Project, the

first for Maghreb, Algeria, Tunisia, and Libya (already started) and the second for Syria, Jordan, and Iraq with possibilities of other countries in North African and the Middle East joining these projects at a later stage. (The second project has not yet been started, possibly for financial reasons.)

APPENDIX B

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