PD-ABL-513

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U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT

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Section

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Dr. B.D. Okezie, Director
International Programs
Alabama Agricultural and Mechanical University
P.O. Box 1177
Normal, AL 35762

Subject: Grant No. PCE-5053-G-00-3044-00

Dear Dr. Okezie:

Pursuant to the authority contained in the Foreign Assistance Act of 1961 and the Federal Grant and Cooperative Agreement Act of 1982, as amended, the Agency for International Development (hereinafter referred to as "A.I.D.") hereby grants to Alabama Agricultural and Mechanical Universiy (hereinfter referred to as "Alabama A&M" or "the Grantee") the sum of $99,523 to provide financial support for the program described in Attachment 2 of this Grant entitled "Program Description."

This Grant is effective and obligation is made as of the date of this letter and shall apply to expenditures made by the Grantee in furtherance of program objectives during the period beginning with the effective date and ending September 30, 1995.

This Grant is made to the Grantee on the condition that the funds will be administered in accordance with the terms and conditions as set forth in Attachment 1 (the Schedule); Attachment 2 (the Program Description); and Attachment 3 (the Standard Provisions); all of which have been agreed to by your organization.

Please sign the original and all enclosed copies of this letter to acknowledge your receipt of this grant and return the original and all but one copy to the undersigned.

If you have any questions, please contact Ms. Karin Kolstrom of my staff at (703) 875-1189.

Sincerely,

Gary V. Kinney

Gary V. Kinney
Grant Officer
Chief, PCE Branch
Division B
Office of Procurement

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320 TWENTY-FIRST STREET, N.W., WASHINGTON, D.C. 20523

Attachments:

1. Schedule
2. Program Description
3. ~~Standard Provisions~~

ACKNOWLEDGED:

Alabama Agricultural and Mechanical University

BY: Jeanette Jones

TYPED NAME: Jeanette Jones, Ph.D.

TITLE: Vice President for Research and Development

DATE: 5/24/93

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FISCAL DATA

A. GENERAL

A.1. Total Estimated A.I.D. Amount: ~~$100,000~~ $99,523
A.2. Total Obligated A.I.D. Amount: $99,523
A.3. Cost-Sharing Amount (Non-Federal): $41,313
A.4. Other Contributions (Federal): $0
A.5. Project No.: 936-5053
A.6. A.I.D. Project Office: R&D/UC
A.7. Funding Source: A.I.D./W
A.8. Tax I.D. No.: 63-6001097
A.9. CEC No.: 07-013-154F
A.10. LOC No.: 72-00-____

B. SPECIFIC

B.1.(a) PIO/T No.: 936-5053-3692956
B.1.(b) Appropriation: 72-1131021.1
B.1.(c) Allotment: 341-36-099-06-20-31
B.1.(d) BPC: DDVA-93-16900-EG11
B.1.(e) Amount: $99,523

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ATTACHMENT 1

SCHEDULE

1A. PURPOSE OF GRANT

The purpose of this Grant is to provide financial support for the program described in Attachment 2 of this Grant entitled "Program Description."

1B. PERIOD OF GRANT

The effective date of this Grant is the date of the Cover Letter and the estimated completion date is September 30, 1995. Funds obligated hereunder (see Section 1C.2. below) shall be used to reimburse the Grantee for allowable program expenditures incurred by the Grantee in pursuit of program objectives during such period. Funds obligated hereunder are anticipated to be sufficient for completion by the Grantee of the program described in Attachment 2 of this Grant by the estimated completion date.

1C. AMOUNT OF GRANT AND PAYMENT

1C.1. The total estimated amount of this Grant for its full period, as set forth in Section 1B. above, is $99,523.

1C.2. A.I.D. hereby obligates the amount of $99,523 for the purposes of this Grant during the indicated period set forth in Section 1B. above, thereby fulfilling A.I.D.'s funding requirements. A.I.D. shall not be liable for reimbursing the Grantee for any costs in excess of the obligated amount, except as specified in paragraph (f) of the Standard Provision of this Grant entitled "Revision of Grant Budget."

1C.3. Payment shall be made to the Grantee in accordance with procedures set forth in the Standard Provision of this Grant entitled "Payment - Letter of Credit," as shown in Attachment 3.

1D. GRANT BUDGET

1D.1. The following is the Budget for the total estimated amount of this Grant (see Section 1C.1. above) for its full period (see Section 1B. above). The Grantee may not exceed the total estimated amount or the obligated amount of this Grant, whichever is less (see Sections 1C.1. and 1C.2., respectively, above). Except as specified in the Standard Provision of this Grant entitled "Revision of Grant Budget," as shown in Attachment 3, the Grantee may adjust line item amounts as may be reasonably necessary for the attainment of program objectives.

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1D.2. Budget

Cost Element	A.I.D.	Cost-Sharing Non-Federal	Total
Salaries	$16,133	$22,373	$38,506
Fringe	$3,930	$930	$4,860
Travel	$31,704	$2,000	$33,704
Non-Exp. Equip.	$7,000	$0	$7,000
ODC	$13,226	$16,000	$29,226
Overhead	$27,530	$0	$27,530
Total:	$99,523	$41,303	$140,826

1D.3. Inclusion of any cost in the budget of this Grant does not obviate the requirement for prior approval by the Grant Officer of cost items designated as requiring prior approval by the applicable cost principles (see the Standard Provision of this Grant set forth in Attachment 3 entitled "Allowable Costs") and other terms and conditions of this Grant, unless specifically stated in Section 1I. below.

1E. REPORTING

1E.1. Financial Reporting

1E.1.(a) Financial reporting requirements shall be in accordance with the Standard Provision of this Grant entitled "Payment - Letter of Credit," as shown in Attachment 3. If a Standard Form 269 is required by the aforesaid Standard Provision, the "Long Form" of said form shall be used.

1E.1.(b) All financial reports shall be submitted to A.I.D., Office of Financial Management, FA/FM/CMPD/DCB, Room 700 SA-2, Washington, D.C. 20523-0209. In addition, three copies of all financial reports shall be submitted to the A.I.D. Project Office specified in the Cover Letter of this Grant, concurrently with submission of the Quarterly Technical Reports (See Section 1E.2. below).

1E.1.(c) The frequency of financial reporting and the due dates of reports shall be as specified in the Standard Provision of this Grant referred to in Section 1E.1.(a) above.

1E.2. Program Reporting

1E.2.(a) Annual Workplan

1E.2.(a)(1) The Grantee shall submit an annual workplan for this Grant which shall contain the following:

1E.2.(a)(1)(A) An action-oriented workplan describing planned activities for the next year, delineated by calendar quarter, and linked to the project goals and objectives, which describes the individuals to be involved, the activities to be

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conducted, and where and when they will be conducted. Planned activities shall be grouped by subject category, and then related to project objectives;

1E.2.(a)(1)(B) A projected budget, utilizing the same budget line items as are set forth in the budget of this Grant, for each calendar quarter, corresponding to the workplan; and

1E.2.(a)(1)(C) Publications, reports, workshops, seminars, and other information dissemination activities planned, by calendar quarter.

1E.2.(a)(2) The Grantee may develop the annual workplan in consultation with the A.I.D. Project Officer for this Grant.

1E.2.(a)(3) Five (5) copies of the annual workplan shall be submitted to the designated A.I.D. Project Officer for this Grant and one copy submitted to the Grant Officer. The annual workplan shall be submitted by the Grantee not later than sixty (60) days from the effective date of this Grant (see Section 1B. above).

1E.2.(b) Quarterly Reports

The Grantee shall submit five (5) copies of brief quarterly program performance reports, which coincide with the financial reporting periods described in Section 1E.1. above, to the A.I.D. Project Office specified in the Cover Letter of this Grant. In addition, two copies shall be submitted to A.I.D., POL/CDIE/DI, Washington, DC 20523-1802. These reports shall be submitted within 30 days following the end of the reporting period, and shall briefly present the following information:

1E.2.(b)(1) A comparison of actual accomplishments with the goals established for the period, the findings of the investigator, or both. If the output of programs can be readily quantified, such quantitative data should be related to cost data for computation of unit costs.

1E.2.(b)(2) Reasons why established goals were not met, if applicable.

1E.2.(b)(3) Other pertinent information including the status of finances and expenditures and, when appropriate, analysis and explanation of cost overruns or high unit costs.

1E.2.(c) Special Reports

1E.2.(c)(1) Within 30 days following the completion of each international trip, the Grantee shall submit 3 copies of a trip report summarizing the accomplishments of the trip to the A.I.D. Project Officer specified in the cover letter of this

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Grant. If several individuals are travelling together to one site, a single report representing the group will suffice. The report shall include the purpose of the trip, technical observations, suggestions and recommendations, overall impressions of the site situation (if appropriate), and a list of persons visited with their title and organization affiliation.

1E.2.(c)(2) Between the required program performance reporting dates, events may occur that have significant impact upon the program. In such instances, the Grantee shall inform the A.I.D. Project Officer as soon as the following types of conditions become known:

1E.2.(c)(2)(A) Problems, delays, or adverse conditions that will materially affect the ability to attain program objectives, prevent the meeting of time schedules and goals, or preclude the attainment of work units by established time periods. This disclosure shall be accompanied by a statement of the action taken, or contemplated, and any A.I.D. assistance needed to resolve the situation.

1E.2.(c)(2)(B) Favorable developments or events that enable time schedules to be met sooner than anticipated or more work units to be produced than originally projected.

1E.2.(c)(3) If any performance review conducted by the Grantee discloses the need for change in the budget estimates in accordance with the criteria established in the Standard Provision of this Grant entitled "Revision of Grant Budget," the Grantee shall submit a request for budget revision to the Grant Officer and the A.I.D. Project Officer specified in the Cover Letter of this Grant.

1E.2.(d) <u>Environmental Impact</u>

If it appears that the outputs of this project will result in an adverse environmental impact, the Grantee shall notify the A.I.D. Project Officer prior to implementation, in order to allow for orderly preparation of an environmental impact statement. The Grantee shall assure that appropriate U.S. Government and/or host country procedures are followed.

1E.2.(e) <u>Care of Laboratory Animals</u>

If the Standard Provision entitled "Care of Laboratory Animals" applies to this Grant, the Grantee shall include the certificate required by paragraph (c) of said Standard Provision in all of its reports which pertain to the use of laboratory animals.

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1E.2.(f) Final Report

Within 90 days following the estimated completion date of this Grant (see Section 1B. above), the Grantee shall submit five (5) copies of a final report to the A.I.D. Project Office specified in the cover letter of this Grant. In addition, two copies shall be submitted to A.I.D., POL/CDIE/DI, Washington, DC 20523-1802. It will cover the entire period of the Grant and include all information shown in Sections 1E.2.(a) and 1E.2.(c) above.

1F. SPECIAL PROVISIONS

1F.1. OPTIONAL STANDARD PROVISIONS

The following Optional Standard Provisions for U.S., Nongovernmental Grantees, as listed in Attachment 3 of this Grant, are hereby deleted as follows:

Provision	Page
Payment - Periodic Advance	13
Payment - Cost Reimbursement	15
Local Cost Financing	33
Patent Rights	35
Negotiated Indirect Cost Rates - Provisional	46
Participant Training	48
Voluntary Population Planning	49
Protection of the Individual as a Research Subject	56
Care of Laboratory Animals	57
Title To and Care of Property(U.S. Government Title)	63
Title To and Care of Property(Cooperating Country Title)	67

All other Optional Standard Provisions are hereby incorporated into this Grant and have been checked off on page 9 of Attachment 3.

1F.2. Limitations on Reimbursement of Costs of Compensation for Personal Services and Professional Service Costs

1F.2.(a) Employee Salaries

Except as the Grant Officer may otherwise agree in writing, A.I.D. shall not be liable for reimbursing the Grantee for any costs allocable to the salary portion of direct compensation paid by the Grantee to its employees for personal services which exceed the highest salary level for a Foreign Service Officer, Class 1 (FS-1), as periodically amended.

1F.2.(b) Consultant Fees

Compensation for consultants retained by the Grantee hereunder shall not exceed, without specific approval of the rate by the Grant Officer: either the highest rate of annual compensation received by the consultant during any full year of the

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immediately preceding three years; or the maximum rate of a Foreign Service Officer, Class 1 (FS-1) (as periodically amended), whichever is less. A daily rate is derived by dividing the annual compensation by 2,087 and multiplying the result by 8.

1F.3. Defense Base Act (DBA) and Medical Evacuation Insurance

Pursuant to Section J.16. of OMB Circular A-21 (for educational institutions) or Section 18 of Attachment B of OMB Circular A-122 (for nonprofit organizations other than educational institutions), the Grantee is authorized to purchase DBA and/or medical evacuation insurance under this Grant. If DBA insurance is purchased, it shall be purchased from the insurance company or agent with which A.I.D. has a contract to provide DBA insurance for A.I.D. contracts. The Grant Officer will provide the name, address, and telephone number of such insurance company or agent upon request.

1G. INDIRECT COST RATE

1G.1. Pursuant to the Standard Provisions of this Grant entitled "Negotiated Indirect Cost Rates - Predetermined" and "Negotiated Indirect Cost Rates - Provisional (Nonprofits)," a predetermined indirect cost rate or rates shall be established for each of the Grantee's accounting periods which apply to this Grant. Payments on account of allowable indirect costs shall be made on the basis of such predetermined rates. The rate(s) for the initial period and the base(s) to which it is (they are) applied is (are) as follows:

Type	Rate	Base	Period	Applicable To
On-Campus	40.4%	1/	7/1/92-6/30/95	Rsch/Agr*
Off-Campus	26.0%	1/	7/1/92-6/30/95	Rsch/Agr*

* includes international programs

1/ Base of Application: Modified total direct costs consisting of salaries and wages, fringe benefits, materials and supplies, services, travel, and subawards up to $25,000 each.

1G.3. Rates for subsequent periods shall be established in accordance with the Standard Provision of this Grant entitled "Negotiated Indirect Cost Rates - Predetermined."

1H. PROPERTY REQUIREMENTS

1H.1. Title to Property

Title to property acquired hereunder shall vest in the Grantee subject to the requirements of the Standard Provision of this grant entitled "Title To and Use of Property (Grantee Title)" regarding use, accountability, and disposition of such property.

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1H.2. Equipment Purchases

Equipment purchases under this Grant must be made in accordance with the Standard Provisions entitled "Procurement of Goods and Services" and "AID Eligibility Rules for Goods and Services" included in Attachment 3 of this Grant. Inclusion of costs in the budget of this Grant for the purchase of nonexpendable equipment does not obviate the requirements of Section J.13. of OMB Circular A-21 (for educational institutions) or Section 13 of Attachment B of OMB Circular A-122 (for nonprofit organizations other than educational institutions) for prior approval of such purchases by the Grant Officer, nor any other terms and conditions of this Grant, unless specifically stated in Section 1H.2.(a)(3) below.

1H.2.(a) Requirement for Prior Approval

Pursuant to Sections 1D.3. and 1G.3. above and the Standard Provisions of this Grant entitled "Allowable Costs" and "Revision of Grant Budget," and by extension, Section 13 of Attachment B of OMB Circular A-122, the Grantee must obtain A.I.D. Grant Officer approval for purchases of the following:

1H.2.(a)(1) General Purpose Equipment, which is defined as an article of nonexpendable tangible personal property which is usable for other than research, medical, scientific or technical activities, whether or not special modifications are needed to make them suitable for a particular purpose (e.g., office equipment and furnishings, air conditioning equipment, reproduction and printing equipment, motor vehicles, and automatic data processing equipment), having a useful life of more than two years and an acquisition cost of $500 or more per unit); and

1H.2.(a)(2) Special Purpose Equipment, which is defined as an article of nonexpendable tangible personal property, which is used only for research, medical, scientific, or technical activities (e.g., microscopes, x-ray machines, surgical instruments, and spectrometers), and which has a useful life of more than two years and an acquisition cost of $1,000 or more per unit).

1H.2.(a)(3) Approvals

In furtherance of the foregoing, the Grant Officer does hereby provide approval for the following purchases, which shall not be construed as authorization to exceed the total estimated amount or the obligated amount of this Grant, whichever is less (see Section 1C. above):

- one Landsat thematic mapper

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1H.2.(a)(4) Exception for Automation Equipment

Any approval for the purchase of automation equipment which may be provided in Section 1H.2.(a)(3) above or subsequently provided by the Grant Officer is not valid if the total cost of purchases of automation equipment (e.g., computers, word processors, etc.), software, or related services made hereunder will exceed $100,000. The Grantee must, under such circumstances, obtain the approval of the Grant Officer for the total planned system of any automation equipment, software, or related services.

1I. RESOLUTION OF CONFLICTS

Conflicts between any of the Attachments of this Grant shall be resolved by applying the following descending order of precedence:

Attachment 1 - Schedule
Attachment 3 - Standard Provisions
Attachment 2 - Program Description

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AGENCY FOR INTERNATIONAL DEVELOPMENT
RESEARCH GRANT PROGRAM
FOR
HISTORICALLY BLACK COLLEGES AND UNIVERSITIES

Submitted by:

Alabama Agricultural and Mechanical University
Office of International Programs
Post Office Box 1177
Normal, Alabama 35762

Title: Integrating Remote Sensing and GIS for Natural Resource Management in Botswana

Principal Investigator: Dr. T. L. Coleman
Associate Professor/Director of ACARS
Dept. of Plant and Soil Science
Alabama A&M University
Normal, AL 35762
Telephone: 205/ 851-5463 Facsimile: 205/ 851-5429

Collaborators: Dr. M. D. Nellis
Professor, Head
Geography Dept.
Kansas State University
Manhattan, KS 66506

Dr. C. E. Bussing
Professor/Director of International Studies
Geography Dept.
Kansas State University
Manhattan, KS 66506

Dr. Musisi Nkambwe
Senior Lecturer
Dept. of Environmental Science
Univ. of Botswana
Gaborone, Botswana

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Date of Submission: March 26, 1993

Signatures:

T. L. Coleman
Principal Investigator

B. O. Okezie, Director
International Programs

* This proposal has not been submitted to another funding organization.

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II. Need(s) for the Proposed Research:

Statement of the Problem:

The relationship between the environment and development in Botswana has attracted attention for many years (Arntzen and Veenendal, 1986; Arntzen et al., 1988). Three major factors have stimulated this interest. First, the economy of Botswana has a very high dependence on natural resources. Mining, which accounted for 45.2 percent of the Gross Domestic Product (GDP) in 1987/88, has been between 80 and 90 percent of the value of the country's exports for many years (Central Statistics Office, 1989). Although agriculture was only 3.5 percent of GDP in 1987/88, it is the major source of livelihood for over 80 percent of the country's population. Second, in recent years there has been increased pressure on the country's natural resources with increasing population numbers and a consequently greater demand for production from the land (Republic of Botswana, 1985). Botswana's brittle environment has recently shown signs of strain from these demands (Cooke, 1987). Third, it has been realized that the future of a sustainable development effort will have to depend more on renewable resources and less on mining (Perrings et al., 1988).

Given the current level of development in Botswana, the land provides the most important of all renewable resource alternatives for development. Increased production to raise the contribution of the land and to employ more people is required if the land is to provide any significant solution.

For nearly ten years the government has been concerned about issues involving growth, development, and the environment. Growing awareness of environmental problems and the desire to achieve sustainable development of the Nation's resources were major motivating factors in undertaking the development of a National Conservation Strategy (BNCS) program. In summary, the BNCS advises a rational utilization of natural resources that accounts not only for current costs of use but also for additional costs that will ensure the resources used will not degenerate but will be maintained for future generations (Perrings et al., 1988).

Objectives:

This project proposes to use remote sensing and geographic information systems technology to

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analyze and document land use issues to improve long-term use of resources. These new technologies can provide low-cost information on the location, amount, and type of resources available for development. In particular, remote sensing and geographic information systems can provide valuable information for mineral exploration, agricultural research, forestry, water management, and land use planning. A major advantage of the use of this technology is that it will lead to more interchange with individual resource managers and ultimately to an integrated and sound resource policy. The specific objectives of the proposed research to be undertaken are:

a. To collect and analyze baseline resource data which is essential for planning and implementing sound, long-term natural resource development.

b. To use remote sensing and geographic information systems to document and analyze land use conflicts and resource problems.

III. HBCUs International Characteristics and International Capibilities Related to Proposal:

Institutional Administrative Policy Commitment:

Alabama A&M University Office of International Programs (OIP) has the sole responsibility for administrative activities related to international projects. The office is comprised of a full-time Director, Administrative Assistant and a Secretary. In addition to the full-time personnel faculty members of the five academic schools take part in research and teaching opportunities available through projects administered through the OIP. These faculty members serve as project coordinators who oversee the logistical and technical operations of projects. Typically, the project coordinators in cooperation with the Administrative Assistant assist the Director of OIP in management and administrative activities such as travel arrangements, travel clearance and health matters of personnel going overseas; placement of participants in appropriate universities and their supervision; providing support materials and other project-related logistical activities so that technical field personnel receive adequate support immediately upon arrival in the host country and

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throughout the assignment. They also assist in organizing and conducting orientation programs for faculty going overseas. This project will have a similar administrative structure.

Faculty Commitment:

Alabama A&M University has a cadre of experienced and highly-trained (most with Ph.D. degrees) teaching, research, and extension faculty and staff who have guided a large number of research projects, both domestically and internationally in collaboration with scientists in other countries around the world. Many members of the University faculty have lived and/or worked in the less developed countries. Alabama A&M has had a long-standing international involvement, particularly in the training of international students, most of whom are from less developed countries of Africa, the Caribbean, and Asia. Thus through the years, the University has gained a considerable insight and understanding of the problems and aspirations of these students and their people.

Resource Commitment and Academic Programs:

Alabama A&M University possesses research and training facilities specially suited to support many identified needs of less developed countries. Specifically, the School of Agriculture and Home Economics is organized into three divisions (Cooperative Extension, Resident Instruction and Research, and Home Economics); four departments (Agribusiness Education; Community Planning; Food Science and Animal Industries; and Plant and Soil Science); and three program areas in the Division of Home Economics (Clothing, Textiles and Related Arts; Food and Nutrition; and Human Development and Family Resource Management). It has ongoing basic and applied research activities in each academic department and in the Division of Home Economics. Currently, 45 individual research projects are conducted by scientists in the following areas: soybean breeding, genetics, pest management, and nutrient requirement, plant tissue culture and biotechnology, food and nutrition, remote sensing of earth resources, triticale and small grains breeding, crop production, biomass and biofertilizer, Christmas trees, fruit production and urban studies, farming systems and sustainable agriculture. This proposal fits well within the research

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research training and leadership in research on planning and development issues in Third World countries. Students also have options in international agriculture development, international development planning or international business management.

Alabama A&M considers collaborative linkages with institutions in less developed countries as a vital means of establishing real mutual understanding, trust, and friendship with Third World countries and of ensuring sustainability of their development. The linkages provide the greatest opportunities for our faculty members and those from the linkage institutions to work on problems of mutual interest enabling them to visit each other, to share ideas and to exchange information. Currently, Alabama A&M University has formal linkage agreements with the Obafemi Awolowo University, Ife, Nigeria; the University of Liberia; the University of Ouagadougou, Burkina Faso; the Ministry of Agriculture, Ghana, the National Institute of Agronomic Research, Niger; the Ministry of Higher Education, Computer Services and Scientific Research, Cameroon and the International Institute of Tropical Agriculture (IITA), Nigeria. Informal linkages exist with the University of Sierra Leone; and the University of Zimbabwe. These formal agreements provide an umbrella for our scientists and their counterparts from the collaborating institutions to work together on problems of mutual interest. They greatly enhance the internationalization efforts of the university and serves as avenues for the faculty and students to develop the real and meaningful experiences for an effective international involvement and career goals.

IV. Collaborative Mechanisms/Networks:

The proposed research will enhance ongoing research in the Department of Environmental Science at the University of Botswana in which Dr. Musisi Nkambwe is the principal investigator. Specifically, it is complementary to another collaborative research arrangement with the Departments of Physical and Human Geography at the University of Stockholm, through a project entitled "Resource Utilization and Regional Planning Information Systems Project" (RURPIS). The research component of RURPIS within which this proposal fits is the Land Use and (land)

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thrust of the remote sensing program at AAMU and in the A.I.D. priority area of environment and natural resource management.

The School has well-equipped laboratories for anaylyses of soil and plant samples. The instrumentation includes: microscopes, atomic absorption, amino acid analyzer, electron microscopes, spectro-photometers, gas chromatographs, and many more modern instruments. There is also a well-equipped remote sensing/GIS laboratory, which is designated as the Alabama Center for Applications of Remote Sensing (ACARS). The computer hardware includes: 16 personal computers (486 and 386 machines), Sun and Intergraph workstations, a microvax, color and Black&white printers, a digitizer, and cartridge and magnetic tape drives. The software on-hand includes: The Earth Resource Data Analysis System (ERDAS), IDRISI GIS, ATLAS graphics, and Intergraph's MGE graphics and image processing software.

To meet the training needs of international and domestic students desiring a career in international development, many of the departments have internationalized their curricula by offering new courses on developing country needs. Several of the faculty have provided assistance and others have pledged their support to assist in training and research activities related to soil chemistry, soil fertility, crop management, agriculture and rural development, surface and groundwater quality management, remote sensing/GIS, land use planning, management, and conservation, food microbiology, food chemistry, food engineering processing, food product development, sensory evaluation, food biochemistry/nutrition, animal nutrition, poultry science, reproductive physiology and environmental microbiology. A Ph.D. Program in Plant and Soil Science is offered to train both National and International students, and provide an expanded curriculum of in-depth study in the areas of crop physiology, crop breeding, crop production, horticulture, remote sensing, soil chemistry, soil fertility, soil microbiology, tissue culture, biotechnology, plant pathology, plant genetics and cytogenetics. A Master's Degree in Planning and International Economic Development is offered within the recently established International Planning and Economic Development Research Institute. This institute provides opportunities for

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Suitability Information Systems (LUSIS). Modeling and mapping land suitability (using GIS techniques and expert systems) as a basis for conservation in Botswana has been proposed in collaboration with the University of Stockholm, as part of LUSIS. This proposed research will aid in modeling, mapping, and relating land suitability to existing land use identified from satellite imagery.

In addition to the University of Botswana and Alabama A&M University, Kansas State University, Department of Geography will be a participant in the research being proposed. Professors Duane Nellis, Charles Bussing and Tommy Coleman have analyzed remotely sensed data using ERDAS and have already identified effects of vegetation change resulting from various phenomena in Botswana from two previous trips. Although their research documents changes related to poor land use practices, it lacks information on the processes that led to these practices. However, the ongoing work at U.B. has documented the process of land and land cover deterioration. Research planned at U.B. will document land use competition and develop models which will assist in planning for sustainable productivity of land resources. The first stage in this research will be to organize resource data and land use information at the local level into a geographic information systems format. To extend the results, analysis of remotely-sensed imagery is essential; however, U.B. does not have the capability for in-depth imagery analysis. This proposal will provide assistance in the analysis of digital satellite imagery and vector data which will allow local case studies to be extrapolated to the district and national level.

It is expected that assistance will be provided through Dr. Musisi Nkambwe, a collaborator in this effort, to secure clerical assistance, vehicles for in-country travel to the study site and other logistical needs that may require special attention from someone residing in the country. This is not foreseen as a major problem to the success of the proposed project.

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V. Scientific Aspects of Proposed Work:

Statement of research proposed:

This study will focus on the development of models that will provide a rapid appraisal of land use information in representative ecological zones. Phase I of the research will concentrate on the most significant resource problems--overgrazing, deforestation, and soil erosion--that have been locally identified in each of three ecological zones and will draw extensively on the local consultations conducted for the National Conservation Strategy (Bussing, 1987). Different types of current satellite imagery and digital data will be evaluated to extract additional planning information that is not currently available by studying existing air photos and maps. All data gathered will be organized in a geographic information system (GIS). Phase II of the research will concentrate on land use conflicts in various zones, and their relevance to expected land use conservation practices will be analyzed. This phase will select three local communities from three ecological zones identified in Phase I to make a comparative analysis of the land use conflicts and how they relate to principles of land conservation.

An intimate relationship already exists among Alabama A&M University, Kansas State University, and the University of Botswana personnel who will be involved in the project. As per the requirements of this USAID-HBCU research program, Dr. Coleman will be primarily responsible for the coordination of the project, for image processing of the satellite data, and for converting hard copy map data into digital format for use in the GIS (Phase I). Dr. Nellis of Kansas State will assist in the analyses of the satellite imagery and formulation of the GIS referred to in Phase I. Dr. Bussing of Kansas State will assist in the comparative analyses of land use conflicts discussed in Phase II of the proposed research. Dr. Nkambwe will provide assistance in ground truth verification of the classified satellite imagery, collection of hard copy map data and testing of the GIS. He will provide valuable information needed for refining the GIS before it is recommended for nationwide application.

It is currently viewed that the nature of the proposed project across continents may require

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bursts of activity during the northern hemisphere summers, i.e. June through August, and from December through January, when the two collaborating groups in the U.S. may get together in Botswana to conduct field work. Most of the work, however, can be conducted independently while at their respective institutions.

Bibliographic references supporting proposed research:

The usefulness of satellite-based remote sensing techniques in assessing natural resources and ecotype mapping is well documented in the literature. Since the initial launch of the Landsat satellite, considerable evidence has shown that remotely-sensed data acquired from aerospace platforms can provide accurate and timely information of natural resources (Hegyi and Quentet, 1980; Barker, 1981; Bartolucci et al., 1983; Barker, 1988). Foresters were the first to use remotely-sensed data for applications to forest inventory and damage assessment operations (Heller, 1975). The synoptic view achieved through the use of aerospace remote sensing systems allows regional inventories to be performed, and many researchers have reported the successful use of Landsat multispectral scanner (MSS) data in mapping forest resources (Kirby et al., 1975; Dodge and Bryant, 1976; Fleming and Hoffer, 1977; Kourtz, 1977; Harding and Scott, 1978; Beaubien, 1979; Johnson et al., 1979; Kalensky et al., 1979; Montgomery et al., 1982). Still others have been successful in using Landsat Thematic Mapper (TM) data for mapping general forest types, defining stand age groups, and condition assessment of forest stands (Nelson and Hoffer, 1980; Benson and DeGloria, 1985; MacKenzie, 1986; Hopkins et al., 1988; Coleman et al., 1990a; Coleman et al., 1990b). An application in which considerable integration gains have been achieved is that of change detection. Remote sensing offers greatly enhanced capability to GIS in updating map information on a regular basis. Ehlers et al. (1990) demonstrated that SPOT data could be used in a GIS environment for regional growth analysis and local planning at a scale of 1:24,000. Once incorporated into a GIS, the spatial growth pattern can be readily analyzed (Jadkowski and Ehlers, 1989). Change detection in forestry by means of integration of cartographic and remotely-sensed data has been demonstrated by Goldberg et al. (1985) and

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Goodenough et al. (1987) using a knowledge-based approach. Recent advancements in satellite remote sensing and GIS technologies have made it possible to use satellite and ancillary data to differentiate wetland habitats and wildlife openings which are important to forest managers (Jensen et al., 1984; Hodgson et al., 1987). Another application of integration which combines satellite imagery and digital elevation models (DEM) can be used to produce realistic perspective views of the terrain for planning and environmental impact analysis (Gugan, 1988). The last few years have seen increased use of GIS for simple two-dimensional modeling using standard overlay procedures (Berry, 1987). Extension to three-dimensional spatial and dynamic modeling is crucial for application in several disciplines such as marine science, climatology, geology, and soils modeling (Burrough et al., 1988).

The traditional methods of acquiring, storing, and analyzing spatially referenced data are too costly and inflexible in meeting information requirements. Computerized geographic information systems are emerging as the spatial data handling tool of choice for solving complex geographical problems. A well designed GIS allows analysts to process and interrelate many more kinds of data than were previously feasible. Therefore, GIS users have the potential to improve traditional missions, such as data collection, research, assessment, and information delivery (Guptill, 1989). Geographic information systems have been used successfully for various natural resource management and planning projects (Walsh, 1985; Hart et al., 1985; Burrough, 1986; Ripple, 1987).

The integration of such capable data acquisition and analysis technologies is becoming increasingly important for resource management. This progress has been facilitated by a number of recent developments including: (i) software and hardware advances in GISs (Dangermond, 1987; Frank, 1988; Croswell and Clark, 1988); (ii) the availability of high resolution satellite data in digital formats such as SPOT's High Resolution Visible (HRV) and Landsat Thematic Mapper (TM); and (iii) new developments in automated information extraction, especially the application of image matching techniques for Digital Elevation Model (DEM) generation (Swann et al., 1988).

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Methodology and Time Plan:

The methodology to be followed in carrying out this research is designed to fit in with the Government of Botswana's planning at the local level. Under the current development strategy an effort has been made to follow an approach that recognizes the ability to identify needs and problems of development. The government seeks advice through local councils at the district level and strongly supports a democratic "bottom up" philosophy. Within this framework the central administration would lay out overall development strategies which district level administrations would use to help local communities administer their development programs on resource utilization. This approach has many favorable points. Specifically:

(1) It utilizes local knowledge in a country where major differences in human and natural resources occur at the local level.

(2) It facilitates a continuous interest in those programs that give a sense of self-reliance in rural development.

The land use and land cover classification system for use with remote sensor data as described by Anderson et al. (1976) will be used to generate a level II land use classification of the three ecological zones. Three sources of remotely-sensed data will be used which include high altitude color infrared photography (CIR), Landsat's TM data, and a combination of Landsat's TM and SPOT panchromatic data. The satellite data will be subjected to standard processing routines for radiometric and geographic corrections and haze removal. The high altitude CIR photography will be analyzed using basic aerial photo-interpretation techniques (Lillesand and Kiefer, 1987). A supervised maximum likelihood algorithm using a combination of selected spectral bands will be used to classify the satellite data. The training data sets will be derived by identifying the land use classes identified in the above classification of the CIR photography, as polygons in each of the satellite scenes. The training data sets will be examined statistically to see if the land use classes represented by the polygons are separable and/or contain multiple spectral classes.

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Analyses:

Kappa statistics will be used to test the overall agreement of the three land use classifications (Congalton et al., 1983). Chi-square (X^2) analyses will be used to test the null hypothesis (Ho) which states that the land use classification generated from visual analysis of high altitude CIR photography is the same as that generated by computer analyses of satellite imagery (Snedecor and Cochran, 1978). The performance of the algorithm will be evaluated by randomly selecting ten locations of each land use class from the classified image and comparing them to ground reference data. The sites will be randomly located throughout the river basin to ensure that the entire area is represented. Ground truth data sheets will be compiled and an error matrix will be constructed for each classification. The percent correct, commission error, and omission error will be calculated using equations presented by Benson and DeGloria (1985).

Requirements for implementing the research and expected results:

Considerable thought has gone into the drafting of this proposed research. All parties involved have previous knowledge of the need and financial costs of this activity. It is because of this awareness that the in-country logistical arrangements will be handled by Dr. Nkambwe and the majority of the data analyses are being conducted in the U.S. at Alabama A&M University and Kansas State University. This arrangement will reduce greatly the cost of the project while providing the much needed GIS for the ecological zones identified and the impetus for a nationwide management plan using GIS technology.

The results of this proposed research will provide an improved capability for natural resource management in the various ministries of the Botswana government. With adequate training in remote sensing and GIS at both the national and district levels of government, managers will have a tool that will help them to achieve a conservationally sound sustained development process at the local level.

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Time-phased Plan of Work beginning October 1993 and ending September 1995

Activities	Quarters*							
	1	2	3	4	5	6	7	8
1. Acquisition of hardcopy maps & remote sensing data	X							
2. Begin digitizing hardcopy map data	X							
3. Begin analysis of remote sensing data	X							
4. Visit to Botswana (Coleman, Nellis and/or Bussing)	X							
5. Quarterly report		X						
6. Complete analysis of target land use competition sites		X						
7 Quarterly report			X					
8. Complete analysis of satellite data			X					
9. Varification of land use classification (Dr. Nkambwe)			X					
10. Begin Integration of satellite and other spatial data			X					
11. Quarterly report				X				
12. Complete digitizing and integration of satellite and spatial data				X				
13. Quarterly report					X			
14. Varification of classification (Dr. Nkambwe)					X			
15. Refinement of GIS / data analysis					X			
16. Quarterly report						X		
17. Final report and manuscript preparation						X	X	
18. Visit to Botswana (Coleman, Nellis and/or Bussing) presentation of GIS								X

* 1 = Oct., Nov., Dec., 1993; 2 = Jan., Feb., Mar., 1994; 3 = Apr., May, June, 1994; 4 = July, Aug., Sept., 1994; 5 = Oct., Nov., Dec., 1994; 6 = Jan., Feb., Mar., 1995; 7 = Apr., May, June, 1995; 8 = July, Aug., Sept., 1995;

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VI. Compliance with Federal Guidelines and Regulatory Procedures:

This proposal complies with all federal guidelines and regulatory procedures. It does not involved any biotechnology activities, human subjects or laboratory animals.

VII. Qualifications of Principal Investigators:

A detailed current curriculum vitae of each of the project personnel is included in Appendix A. Dr. Coleman will serve as the project director and principal investigator. He will contribute 30% of his time during the regular academic year and 50% during the summer months to this project.

Dr. Coleman has experience in working in Botswana and a similar environment in Niger. During the summers of 1989 through 1991 he worked with professors from Kansas State University (Drs. Duane Nellis and Charles Bussing) collaborators in this proposed research, in Botswana conducting GIS training workshops and piolet studies involving land use classifications of satellite data and its use in managing the country's natural resources. Trip reports, recommendations and published papers from that work are on file at USAID/Gaborone. Dr. Coleman served as a consultant for three weeks in Niger to evaluate the feasibility of using remote sensing and GIS to assist in managing their research stations. He has also worked in Nigeria and Cameroon performing land use/ inventory studies for private land owners and the A.I.D., respectively. He has been involved with several remote sensing/ GIS studies in the U.S. and is currently serving as the Director of the Alabama Center for Applications of Remote Sensing (ACARS) at Alabama A&M University.

Dr. Duane Nellis and Dr. Charles Bussing of Kansas State University also have work experience in Botswana involving land use and remote sensing studies from visits during 1989 through 1991. Additionally, Dr. Bussing completed a sabbatical in Botswana during 1987.

Dr..Musisi Nkambwe is currently employed as a Senior Lecturer in the Department of Environmental Science, University of Botswana, Gaborone, Botswana. He has extensive experience in the use of satellite data involving land use studies and GIS development in Africa and

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has published extensively in this area. He was also involved in the level II GIS training workshop conducted by the authors at the University of Botswana in 1991 and has successfully conducted other remote sensing/ GIS training workshops for Botswana government employees.

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VIII. Budget Information

A. Personnel	
1. Dr. T. L. Coleman, Principal Investigator	
20% time, 12 month calendar year	11,200
2. Research Associate	
25% time, 12-month calendar year	6,000
3. Fringe Benefits	
24.36% of A1 and A2	4,190
Subtotal A	21,390
B. Other Direct Costs	
1. Travel overseas (to collect data and present results)	
Dr. Coleman (2 trips business class @ 6,345.45)	12,691
Dr. Duane Nellis (1 trip business class @ 6,546)	6,546
Dr. Charles Bussing (1 trip business class @ 6,546)	6,546
2. Per diem in Botswana (40 man days @ 138/day)	5,520
3. Expendable Supplies	
Paper, pens, notebooks, etc.	500
4. Other Supplies	
Maps, satellite data, etc.	8,000
Subtotal B	39,803
C. General and Administrative Cost	
(Overhead 40.4% of A and B)	24,722
D. In Country Expenses	
1. Vehicle rental and driver	7,000
2. Lodging for driver and Dr. Nkambwe	3,000
3. Gasoline, oil etc for vehicle	800
Subtotal D	10,800
E. Overhead for off-campus expenses (26% of D)	2,800
TOTAL ESTIMATED COST	99,523

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APPENDIX A:

CURRICULUM VITAES

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VITA

Tommy L. Coleman
[redacted]

PERSONAL DATA:
[redacted] U. S. Citizen. Married with three children. No physical limitations.

EDUCATION:
Ph.D., 1980, Iowa State University, Major -Soil Morphology and Genesis
M.S., 1977, University of Georgia, Major - Soil Morphology and Classification
B.S., 1974, Fort Valley State College, Major - Agronomy
Further study 1985-1987, Univ. of Southern Miss. and 1987 at Ohio St. Univ.- Remote Sensing

TEACHING:
SPS-454 Tropical Soils; SPS-476 Remote Sensing of Earth Surface Features; SPS-503 Techniques for Land Judging; SPS-556 Soil-Clay Mineralogy; SPS-635 Advanced Soil Classification; SPS-674 Principles of Geographic Information Systems for Resource Management; SPS-590/690 Special Problems - Remote Sensing/GIS Workshops

EMPLOYMENT RECORD:

9/92 - Present	Physical Scientist, USDOI, USGS, National Mapping Division
12/90 - Present	Director, Alabama Center for Applications of Remote Sensing Lab
10/89 - Present	Associate Professor, Alabama A&M University (Sabbatical leave 9/92)
10/83 - 9/89	Assistant Professor, Alabama A&M University
1/81 - 10/83	Postdoctoral Research Fellow, Alabama A&M University
9/77 - 11/80	Research Associate, Iowa State University
3/77 - 9/77	Soil Scientist, USDA-Soil Conservation Service
9/75 - 3/77	Graduate Research Assistant, University of Georgia
6/74 - 9/75	Soil Scientist, USDA-Soil Conservation Service

PROFESSIONAL SOCIETIES, HONORS and ACTIVITIES:

Memberships:
American Society of Agronomy (ASA)
Soil Science Society of America (SSSA)
American Society of Photogrammetry and Remote Sensing (ASPRS)
Southern Regional Soil Survey Work Planning Conference
Alabama Soil and Water Conservation Committee
Alabama Professional Soil Classifiers Association
Minorities in Agriculture, Natural Resources and Related Sciences (MANRRS)
Water Resource Council of Alabama
Alabama GIS Advisory Committee
ERDAS Users Group
Alabama Educators Association
National Educators Association
Intergraph Users Group

Honors:
School of Agri. & Home Eco. Outstanding Research Award 1992
Who's Who in America 1992, 47th Edition
Who's Who in Science and Engineering 1992/1993
Outstanding Young Men of America 1984 & 1988

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Beta Kappa Chi Honor Society
Agronomy Student Award 1973-74
Fort Valley State College Men's Thermostat Award 1974
Who's Who Among American Colleges and Universities 1973-74

PEER REVIEW PANELS:

NSF, Instrumentation Laboratory Improvement (ILI) Program - 1991 & 1993
USDA-CSRS Water Quality Special Grants Program - 1991
Water Resource Research Institute (WRRI) Proposal FY 91, FY 92
A I.D. General Agricultural Training Program 1990 - Present
National Center for Geographic Information and Analysis (CNCGIA) Review 1990
Journal Manuscript Reviewer
- Soil Science Society of America Journal 1989 - Present
- Remote Sensing of Environment 1989 - Present
- Science of Technology Publication Limited 1988

Community Activities:

Omega Psi Phi Fraternity, Inc.
Evening Star Lodge No. 6(F&AM),
Tennessee Valley Consistory (32 Mason)
North Alabama Golf Club
North American Golf Association, Inc.
Mount Spraggins Community Watch
Parent Teachers Association
National Association for the Advancement of Colored People (NAACP)

RESEARCH PROJECTS and GRANTS:

- Enhancement of Remote Sensing/GIS Instruction for Undergraduates. 109,380. The National Science Foundation - ILI Program, USE-9251589, 1992-1994.

- Improved Management of Watersheds Using Remote Sensing and GIS Techniques. 452,933. USDA, CSRS - Capacity Building Grants Program, AMD-9201868, 1992-1994.

- Strengthening the Research and Training in Environmental Science. 497,402. The National Science Foudation RIMI Program, HRD - 9253025, 1992-1995.

- Enhancement of GIS/Remote Sensing, Computer and Information Sciences, and Engineering Technology/Drafting and Design at Alabama A&M University. 520,000.00. Intergraph Corporation, 3306-7042, 1992.

- Networking State-Supported Universities Through the Alabama Supercomputer Network Cray Supercomputer for cooperative Teaching and Research in Geographic Information Systems. 20,750. Alabama Supercomputer Authority, UA17-92, 1992-1993.

- Application of GIS and Remote Sensing Technology in Assessing Pollution Problems in Watersheds. 78,000.00/yr. USDA-CSRS, 1990-1995.

- Wetland Habitat Classification of the Conecuh National Forest. 25,571.00. USDA-Forest Service, 1991-1992.

- Remote Sensing for Forest Regeneration Applications. 36,000.00. USDA-Forest Service, 1989-1991.

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- Implementation of GIS Technology in Monitoring Non-Point Pollution Sources in Lake Ogletree Watershed. 6,800.00. City of Auburn Water Board, 1990.

- Applications of Remote Sensing Technology to the Management of Agricultural and Natural Resources of Alabama. 295,000.00. USDA-CSRS, 1985-1990.

- Training Program in Survey Monitoring and Salinity Development Using Remote Sensing Technology. 30,620.00. FAO-USDA/OICD/ITD, 1989.

- The Utilization of Satellite Digital Data for Monitoring and Evaluating Forest Plantations. 60,000.00. USDA-Forest Service, 1987-1990.

- Strengthening Research and Training in the Applications of Remote Sensing. 298,806.00. National Science Foundation, 1986-1990.

- Remote Sensing of Solar Reflectance and Absorbance to Estimate Phytomass, Leaf Area Index, and Percent Cover in Young Pine Plantations. 19,200.00. USDA-Forest Service, 1987- 1989.

- Development of Remote Sensing Techniques Capable of Delineating Soils as an Aid to Soil Survey. 118,000.00. NASA - NSTL, Mississippi, 1984-1986.

- North Alabama Small Farm Soil Conservation and Farming System Demonstration Project. 50,664.00. USDA-Soil Conservation Service, 1985-1988.

- Evaluation of the Effects of Soil Moisture and Pertinent Soil Diagnostic Properties on Thermal Infrared and Reflectance Characteristics. 97,386.00. NASA - NSTL Mississippi, 1983-1985.

- Application of Appropriate Conservation Technology to Enhance the Economic Development of Small Farm Operations in Three North Alabama Counties. 20,000.00. Tennessee Valley Authority, 1983-1984.

PUBLICATION RECORD:

Referred Journal Articles - 19
Published Abstracts - 19
Technical Publications - 21
Other Publications - 6

PUBLICATIONS (JOURNALS AND PROCEEDINGS):

Coleman, T. L., P. A. Agbu, and O. L. Montgomery. 1993. Spectral differentiation of surface soils and soil properties: Is it possible from satellite platforms? Soil Sci. (In Press).

Coleman, T. L. 1992. Three-dimensional modeling of an image-base GIS to aid land use planning. Geocarto International. 7(4):47-53.

Coleman, T. L., J. H. Miller, and B. R. Zutter. 1992. Estimating leaf area and above-ground biomass of forest regeneration areas using a corrected normalized difference vegetation index. p. 214-230. *In* Proceedings of the ASPRS/ASCM/RT 92 Convention - Monitoring and Mapping Global Change.Vol. 4. Remote Sensing and Data Acquisition. 3-8 August 1992. Washington, D. C. Am. Soc. Photogram. & Rem. Sens., Bethesda, MD.

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Coleman, T. L., R. S. Fletcher, and W. H. Clerke. 1992. Spectral differentiation of wetland habitats within the Conecuh National Forest. p. 64-74. *In* J. D. Greer (ed). Proceedings of the Fourth Forest Service Remote Sensing Applications Conference. 6-11 April 1992. Orlando, FL. USDA Forest Service Nationwide Forestry Applications Program. Salt Lake City, UT.

Coleman, T. L., W. H. Clerke, W. Tadesse, and R. S. Fletcher. 1992. Evaluation of remote sensing methods used to differentiate forested wetlands. *In* M. Carlotto (ed). SPIE Proceedings - Digital Image Processing and Visual Communications Technologies in te Earth and Atmospheric Sciences II. Vol. 1819. 15-20 November 1992. Boston, MA. The International Society for Optical Engineering, Bellingham, WA.(In Press)

Miller, J. H., and T. L. Coleman. 1992. Can a modular multiband radiometer be used to estimate young pine biomass and LAI? *In* Southern Weed Science Proceedings. (In Press)

Coleman, T. L., and O. L. Montgomery. 1992. Assessment of spectral characteristics for differentiating among soils categories in the southeastern United States. Alabama A&M Univ. Res. J.

Coleman, T. L., G. Brown, B. E. Pinker, G. C. Sharma, and K. D. Roberts. 1992. Stream relocation: A solution to DDT contamination. Alabama A&M Univ. Res. J.

Coleman, T. L. 1991. Three-dimensional modeling of an image-base geographical information system for land use planning. p. 159-168. *In* G. Trobia and W. L. Mumbleau (eds). Proceedings of the Urban and Regional Information System Association (URISA) 1991 Annual Conference. Vol. II-Geographic Information Systems. 11-15 August 1991. San Francisco, CA. URISA, Washington, D. C.

Coleman, T. L., P. A. Agbu, O. L. Montgomery, T. Gao, and S. Prasad. 1991. Spectral band selection for quantifying selected properties in highly-weathered soils. Soil Sci. 151(5):358-361.

Coleman, T. L., L. Gudapati, and J. Derrington. 1990. Monitoring forest plantations using Landsat Thematic Mapper data. Remote Sensing of Environment. 33(3):211-221.

Coleman, T. L., A. U. Eke, U. R. Bishnoi, and C. Sabota. 1990. Nutrient losses in eroded sediment from a limited-resource farm. J. of Field Crops Res. 24:105-117.

Eke, A. U., T. L. Coleman, U. R. Bishnoi, and C. Sabota. 1990. Soil loss under row cropping of sweet potato, soybean and two small fruit crops in northern Alabama. J. of Sustainable Agriculture. 1(1): 41-54.

Gao, T., and T. L. Coleman. 1990. Use of satellite spectral data for mapping aquatic macrophytes and nutrient levels in lakes. p. 109-116. *In* R. Mills (ed). Proceedings, 10th Annual International Geoscience and Remote Sensing Symposium. 20-24 May 1990. College Park, MD. IEEE Catalog No. 90CH2825-8. The Institute of Electrical and Electronics Engineers, Inc., New York, NY.

Coleman, T. L., L. Gudapati, and J. Derrington. 1990. Evaluation of TM imagery for monitoring forest plantations. p. 147-162. *In* J. D. Greer (ed). Protecting National Resources with Remote Sensing. Proceedings of the Third Forest Service Remote Sensing Applications Conference. 9-13 April 1990. Tucson, AZ. Am. Soc. Photogrammetry and Remote Sensing, Bethesda, MD.

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Agbu, P. A., and T. L. Coleman. 1990. Techniques of digital analysis for soil map unit discrimination. p. B1-B9. *In* Proceedings of 1990 ACSM-ASPRS Fall Convention, Technical Papers. 5-10 November 1990. Anaheim, California. Am. Soc. Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping. Bethesda, MD.

Coleman, T. L., L. Gudapati, and L. E. Massay. 1990. Assessment of thematic mapper imagery in differentiating among natural and plantation pine stands. p. 130-146. *In* C. Elvidge (ed). Proceedings, Twelth Biennial Workshops on Color Aerial Photography and Videograph and Image Processing 89. 23-26 May 1989. Reno, NV. Am. Soc. for Photogrammetry and Remote Sensing. Bethesda, MD.

Coleman, T. L., and L. Gudapati. 1989. Land use/land cover analysis using thematic mapper imagery. *In* Proceedings of the U.S. IGUG Annual Conference. 9-12 October 1989. Orlando, FL. Monograph No. 89-014. p. 12.

Coleman, T. L., U. R. Bishnoi, C. Sabota, and A. U. Eke. 1987. Evaluating soil and nutrient loss under different cropping systems on a limited-resource farm. p. 123-132. *In* V. T. Sapra and U. R. Bishnoi (eds). Proceeding of Workshop on Farming Systems Research for Limited Resource Farms. Huntsville, Alabama. 10-12 August 1987. Alabama A&M University, Huntsville, AL.

Coleman, T. L., and O. L. Montgomery. 1987. Soil moisture, organic matter and iron content effect on the spectral characteristics of selected Vertisols and Alfisols in Alabama. Photogrammetric Engineering and Remote Sensing. 53(12):1659-1663.

Bishnoi, U. R., T. L. Coleman, and C. Sabota. 1985. Soil Conservation Service Strategies for the Survival of Small Farmers in North Alabama. p. 241-251. *In* T. T. Williams (ed.) Strategy for Survival of Small Farmers - International Implications. Proc. Professional Agri. Workers Conf. 8-10 December 1985. Tuskegee Institute, Tuskegee, AL.

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Coleman, T. L., and T. E. Fenton. 1982. A reevaluation of mathematical models for predicting various properties of loess-derived soils in Iowa. Iowa State Journal of Res. 56(4):341-352.

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Coleman, T. L. 1977. Soil factors influencing subsurface sewage disposal in Piedmont Soils. M. S. diss., The Univ. of Georeia, Athens, GA.

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Coleman, T. L., and W. Tadesse. 1992. Spatial variability of heavy metals in disturbed urban soils. p. 300. *In* Agron. Abstr. American Society of Agronomy, Madison, WI.

Tadesse, W., and T. L. Coleman. 1992. Spatial variability of macronutrients in disturbed urban soils. p. 112. *In* Ninth Biennial Research Symposium Abstr. The Association of Research Directors of HBCUs. Atlanta, GA.

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Fletcher, R. S., T. L. Coleman, and W. H. Clerke. 1992. Assessment of wildlife habitats using remote sensing techniques. p.84. *In* Ninth Biennial Research Symposium Abstr. The Association of Research Directors of HBCUs. Atlanta, GA.

Coleman, T. L., P. A. Agbu, and O. L. Montgomery. 1991. Spectral separation of highly-weathered surface soils using Landsat Thematic Mapper data. p. 309. *In* Agron. Abst. American Society of Agronomy, Madison, WI.

Coleman, T. L., P. A. Agbu, O. L. Montgomery, T. Gao, and S. Prasad. 1991. Spectral band selection for quantifying selected properties in highly-weathered soils. p. 8. *In* Abst. of Technical Papers. Southern Branch American Society of Agronomy, Madison, WI.

Ross, H. L., T. L. Coleman, and L. Gudapati. 1991. Integration of remote sensing and geographic information systems for managing Lake Ogletree Watershed. p. 5. *In* Abst. of Technical Papers. Southern Branch American Society of Agronomy, Madison, WI.

Agbu, P. A., and T. L. Coleman. 1990. Comparison of SPOT spectral maps for soil map unit delineation. p. 289. *In* Agron. Abst. American Society of Agronomy, Madison, WI.

Sharma, R. A., T. L. Coleman, P. A. Agbu, and T. Gao. 1990. Application of digital image analysis in mapping saline and alkali soils of Karnal, India. p. 303. *In* Agron. Abst. American Society of Agronomy, Madison, WI.

Coleman, T. L., A.U. Eke, U. R. Bishnoi, and C. Sabota. 1989. Nutrient losses in eroded sediment from a limited-resource farm. p. 278. *In* Agron. Abst. American Society of Agronomy, Madison, WI.

Coleman, T. L., L. Gudapati, and J. Derrington. 1989. The utilization of satellite digital data for monitoring and evaluating forest plantations. p. 50. *In* Eighth Biennial Research Symposium Abstr. The Association of Research Directors of HBCUs. Washington, D.C.

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Massay, L., T. L. Coleman, and C. C. Brooks. 1987. Forest resource inventory of Jackson County, Alabama using Landsat TM data. p. 37. *In* Seventh Biennial Research Symposium Abstr. The Association of Research Directors of HBCUs. Washington, D.C.

Eke, A. U., T. L. Coleman, C. Sabota, and U. R. Bishnoi. 1987. Evaluation of soil and nutrient loss due to runoff from a small farm under different cropping and management systems. p. 239. *In* Agron. Abstr. American Society of Agronomy, Madison, WI.

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Gao, T., and T. L. Coleman. 1989. Inventory of lakes in northern Alabama using Landsat's Thematic Mapper data. Eighth Biennial Research Symposium. 8-11 Oct. 1989. The Association of Research Directors of HBCUs. Washington, D.C.

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Coleman, T. L. 1988. Remote Sensing Research at Alabama A&M University. Research Symposium. Demonstration of University Research and Service Capability for Support of Department of Defense Initiative. Huntsville, AL., 1-2 December 1988. Alabama A&M Univ., Huntsville, AL.

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Eke, A. U., T. L. Coleman, C. Sabota, and U. R. Bishnoi. 1987. Evaluation of soil and nutrient loss due to runoff from a small farm under different cropping and management systems. 79th Annual Meeting American Society of Agronomy, Atlanta, GA. 29 November - 4 December 1987. American Society of Agronomy, Madison, WI.

Bishnoi, U. R., C. Sabota, and T. L. Coleman. 1987. Use of FSR in developing an eroded small farm in north Alabama. Soil and Water Conservation on Steep Lands Workshop, San Juan, Puerto Rico. 22-26 March 1987. San Juan, Puerto Rico.

Sharma, G. C., T. L. Coleman, and C. C. Brooks. 1987. Overview of Alabama A&M University Remote Sensing Activities and Facilities. USDA-Soil Conservation Service, Fort Worth, TX. 20-22 July 1987.

Coleman, T. L., O. L. Montgomery, and C. C. Brooks. 1986. Assessment of spectral characteristics for differentiating soils at the group level. 78th Annual Meetings American Society of Agronomy, New Orleans, LA 30 November - 5 December 1986. American Society of Agronomy, Madison, WI.

Bishnoi, U. R., C. Sabota, and T. L. Coleman. 1986. Use of farming system research and extension (FSR/E) approach in developing a conservation demonstration on limited-resource farms. Annual Meeting of Soil Cons. Soc. Am. 3-6 August 1986. Soil Conservation Service, Winston-Salem, N.C.

Coleman, T. L., and O. L. Montgomery. 1985. Soil-moisture, organic matter and iron content effect on the spectral reflectance of four Alabama soils. Second Annual Arid Land Remote Sensing Workshop, Salt Lake City, Utah. 20-22 March 1985.

Montgomery, O. L., T. L. Coleman, and M. Ghafori. 1982. Forest inventory of woody biomass estimates using Landsat data. Fourth Biennial Research Symposium, Orlando, FL 27-30 October 1982. The Association of Research Directors of HBCUS, Washington, D.C.

TECHNICAL CONSULTING:

- 1992 Preliminary environmental analysis assessment for Mr. Troy Trulove. 23 December - 3 January 1992. Golden Road, Red Bay, AL.

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- 1991 Botswana GIS level II training workshop. AAMU-KSU-UB collaborative Linkage under the JMOU/PSG/AG Program. U.S.A.I.D. and the Government of Botswana. 16 July - 2 August 1991. Gaborone, Botswana.

- 1991 Evaluation of lake bottom sediments from Huntsville Country Club. 13 - 19 June 1991. Huntsville, AL.

- 1990 Land use conflicts and the conservation strategy in Botswana. AAMU-KSU-UB collaborative Linkage under the JMOU/PSG/AG Program. U.S.A.I.D. and the Government of Botswana. 30 June - 15 July 1990. Gaborone, Botswana.

- 1990 Technical assistance mission to INRAN/DRE. Niger Applied Agricultural Research Project (NAARP), U.S.A.I.D. and Institute National de Recherches Agronomique du Niger (INRAN). 10-26 March 1990. Niamey, Niger.

- 1990 Soil characterization study for Ms. Linda Townsend. 14-16 June 1990. 134 Granto Rd., Harvest, AL.

- 1989 Monitoring the impact of drought on sustainable Agricultural Development in Botswana. U.S A.I.D. and Government of Botswana. 16 June - 11 July, 1989. Gaborone, Botswana.

- 1989 Soil characterization study for Mr. David Barry. 19 January 1989. Union Grove, AL.

- 1988 Agricultural Study of Abiola Farms Limited: Evaluation of the soils and crop conditions as well as financial planning and marketing for the farm. Nigeria, Africa. 10 June - 2 July 1988. Lagos, Nigeria.

- 1987 Diagnostic Survey of Root and Tuber Crops Storage, Processing and Utilization in Cameroon. Cameroon, Africa. U.S.A.I.D. Contract No. 631-0058. 30 October - 5 December 1987. Younda, Cameroon.

- 1987 Soil characterization study for Mr. Cory Brown. 4 Aug. 1987. Brownsboro, AL.

- 1985 Huntsville Remedial Action Plan (Permit Application 404.26A) Olin Corporation. Olin Contract No. SE-EN-548-VAR-C.

- 1982 Reames Road Landfill. Soil Site Evaluation. The Long Creek Community Action Committee and Department of Urban Studies and Community Affairs. Johnson C. Smith University. Charlotte, NC.

THESIS COMMITTEES CHAIRED:

- Spatial Variation in Soil Chemical Properties at Different Profile Depths Within Selected Toposequences in Northern Alabama. Madhuri Tummalapalli. Ph. D. Dissertation (In Progress)

- Evaluation and Classification of Land Use Activity of the Chattooga River Basin Using Remote Sensing and GIS Technology. Venu G. Oddiraju. Ph. D. Dissertation (In Progress)

- Spectral Classification of Wetland Habitats Within the Conecuh National Forest. Reginald Fletcher. M. S. Thesis (In Progress)

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- Integration of Remote Sensing and Geographic Information System Technology for Managing Lake Ogletree Watershed. 1991. Herbert L. Ross. M. S. Thesis.
- Inventory of Lakes in Northern Alabama Using Landsat Data. 1989. Timing Gao. M. S. Thesis.
- Thematic Mapper and Digital Vector Data Integration for Improving Management of Natural Resources. 1988. Lennox E. Massay. M.S. Thesis.
- Evaluation of Soil and Nutrient Loss Due to Runoff Under Different Cropping and Management Systems. 1988. Austine U. Eke. M. S. Thesis.

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BRIEF VITA
M. DUANE NELLIS

Current Position: Director, Institute for Social and Behavioral Research; and Professor and Head, Geography
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Academic Interests: Rural Resource Systems, Environmental Geography, Remote Sensing, and Geographic Information Systems

Academic Degrees: Ph.D. (Geography) Oregon State University, 1980
M.S. (Geography) Oregon State University, 1977
B.S. (Geography) Montana State University, 1976

Selected Professional Memberships:

National Council for Geographic Education; Association of American Geographers; and, American Society of Photogrammetry and Remote Sensing.

Selected Honors and Awards:

Young Research Scholar, Institute of British Geographers; Presidential Lecturer, Kansas State University; Outstanding Undergraduate Teaching Award, Kansas State University; Advisor of the Year, Kansas State University; Phi Kappa Phi; Gamma Theta Upsilon; Sigma Xi.

Grants:

Thirty-one grants from a range of granting sources, including, for example, National Science Foundation, U.S. Department of Agriculture, U.S. Department of Interior, U.S. Agency for International Development.

Publications:

Articles--42 refereed publications and reports published in a wide range of journals include Journal of Geography, Geographical Perspectives, Water Resources Bulletin, Geocarto International, Photogrammetric Engineering and Remote Sensing, Remote Sensing of the Environment, and Geographical Bulletin.

Books - Six books or book chapters. Recent books include CURRENT TRENDS IN REMOTE SENSING EDUCATION, 1989 (Co-edited with Lougeay and Lulla), and PERSPECTIVES ON APPLIED PHYSICAL GEOGRAPHY, 1990 (Co-authored with Oliver, Bussing, and Stover).

Presentations:

46 Presentations at Professional Meetings; 39 invited presentations at high schools, other universities, clubs, etc.

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Professional Service:

Examples of recent service commitments include Chair, Association of American Geographers Remote Sensing Specialty Group; Chair, NCGE Remote Sensing Committee; President, Kansas Academy of Science; Regional Coordinator, Gamma Theta Upsilon; Member, Kansas Geographic Information System Policy Board; Editorial Board, GEOCARTO INTERNATIONAL; and various university service.

Selected Recent Publications:

"Interfacing Geographic Information Systems and Remote Sensing for Rural Land Use Analysis," PHOTOGRAMMETRIC ENGINEERING AND REMOTE SENSING, (1990), pp. 329-331. (Co-authored with J. Jensen and K. Lulla).

"Biomass Estimation of Grassland Ecosystems Using Landsat Thematic Mapper Data." PROCEEDINGS OF THE ELEVENTH NORTH AMERICAN PRAIRIE CONFERENCE, (1989), pp. 53-55. (Co-authored with John Briggs).

"Desertification and Sustainable Development Issues in Botswana," PAPERS AND PROCEEDINGS OF APPLIED GEOGRAPHY CONFERENCES, Vol. 12, (October 1989), pp. 99-106. (Co-authored with C. Bussing).

"Shuttle Imaging Radar-B for Regional Land Use Analysis in Ecuador," GEOCARTO INTERNATIONAL, Vol. 4, No. 2, (1989), pp. 65-67.

"The Impact of Spatial Scale on Konza Landscape Classification Using Textural Analysis," JOURNAL OF LANDSCAPE ECOLOGY, Vol. 2, No. 2, (1989), pp. 93-100. (Co-authored with J. Briggs).

"The Application of Remote Sensing Technology to Rural Resource and Land Use Planning in the U.S.," INTERNATIONAL YEARBOOK OF RURAL PLANNING, (December 1988), pp. 191-211.

"SPOT Satellite Data for Pattern Recognition on the North American Tall Grass Prairie Long Term Ecological Research Site," GEOCARTO INTERNATIONAL, Vol.3, No.3 (September 1988) pp. 37-40. (Co-authored with J. Briggs).

"Land Tenure and Range Management Practices in the Northern Flint Hills," THE GEOGRAPHICAL BULLETIN, Vol. 30, No. 1 (May 1988) pp. 41-50. (co-authored with S. Wilds).

"A Remote Sensing Approach for Predicting Water Demand in Irrigated Areas of Western Kansas," PECORA XI: SATELLITE LAND REMOTE SENSING, (August 1987), pp. 440-446.

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CURRICULUM VITAE

A. BIO-DATA

1. Name: MUSISI-NKAMBWE, (Surname) SAMWIRI (Other names)

2.

3. Country of Nationality: Uganda.

4. Marital Status: Married.

5. Name of Spouse: Marcia Lewis-Nkambwe.

6. Names of Children and their Ages: Mirembe, 10 yrs; Ssanyu, 8 yrs; Mwesigwa, 6 yrs.

7. Permanent Address: c/o Department of EnvironmentalScience,
University of Botswana,
Private Bag 0022 Gaborone,
Botswana.

8. Present Address: c/o Academy for Educational Development
P/B 00117
Gaborone, Botswana.

B. EDUCATION BACKGROUND

9. Post-Secondary Institutions:

University of East Africa (Makerere College)
June, 1967 to March, 1970.

Pennsylvania State University,
September, 1970 to May, 1972.

University of Kansas (at Lawrence),
July, 1972 to May, 1975.

10. Academic Qualifications:

B.A. (East Africa, 1970)

M.Sc. (Penn State, 1972)

Ph.D. (Kansas, 1975)

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C. WORK EXPERIENCE

11. Work Experience Outside Universities:

(i) Senior Economics/Geography Teacher Luwero Secondary School, P.O. Luwero, (Uganda) June-Sept., 1966.

(ii) Research Assistant, Town Planning, Country and Town Planning Department, Kampala, (Uganda), March-July, 1968.

12. Work Experience within Universities:

(i) Demonstrator/Teaching Assistant, March-August, 1970, Department of Geography, University of East Africa, Makerere College, P.O Box 7062, Kampala, Uganda.

(ii) Research Assistant, Kansas University, Space Technological Centre (Centre for Research INC or CRINC), Lawrence, Kansas 66045.

(iii) Lecturer, Department of Geography, Makerere University, July, 1975 to April, 1977.

(iv) Lecturer II, to Senior Lecturer, University of Ife, Nigeria, May, 1977 to November,1988.

(v) Senior Lecturer, University of Botswana, July, 1989 to present.

D. PUBLICATIONS

1. Thesis/Dissertation

(i) "Intra-Regional Differential Development: An Analysis of Relative Spatial Economic Growth in Pennsylvania", Master's Thesis, Pennsylvania State University, 1972.

(ii) "Transportation Networks as Agent and Index of Modernisation in Costa Rica", Ph.D. Dissertation, University of Kansas, Lawrence, Ks., 1975.

2. Authored Books/Monographs

(iii) Nkambwe, Musisi (1985) Introduction to Aerial Photo Interpretation - Monograph for undergraduate course.

3. Edited Books/Monographs

(iv) Nkambwe, Musisi (ed.) (1986) Application of Remote Sensing Techniques in Nigeria, Nigerian Society of Remote Sensing, Publication No. 2, 1985.

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4. Contributions to Books and Monographs

(v) Nkambwe, Musisi (1979) "Transportation Network for Assemblage and Distribution of Port Traffic", Chapter 4 in Monograph, Public Projects Studies Group, University of Ife, Ile-Ife, Landward Connections and the Development of Nigerian Ports. 211 pp. (Study carried out for Massachusetts Institute of Technology, U.S.A.).

(vi) Ayeni, O.O. and Musisi Nkambwe (1981) "Patterns and Degree of Degeneration of Fuelwood in Western Nigeria", Chapter 8 in G.J.A. Ojo, W.B. Morgan and R.P. Moss, Rural Energy in Southwestern Nigeria, United Nations University Report No. NRR-4/UnUP-344.

(vii) Nkambwe, Musisi (1983) "Remote Sensing in Urban Population Estimates in Nigeria" in Adepoju, A. (ed), Technical and Political Aspects of Population Enumeration in Nigeria, Chapter 5.

(viii) Nkambwe, Musisi (1984) "A Study of Patterns of Change of Fuelwood Availability in Western Nigeria with the Help of Remote Sensing", in G.J.A. Ojo and O. Adejuwon, Rural Energy Systems in Southwestern Nigeria. United Nations University.

(ix) Nkambwe, Musisi (1986) "A Model for Estimating Urban Population and its Distribution with Aerial Photographs Using Floor Density Rates" in Musis Nkambwe (ed.), Application of Remote Sensing Techniques in Nigeria, Nigerian society of Remote Sensing. Publication No. 2.

(x) Nkambwe, Musisi (1985) "Urban Transportation Features and Problems" in Olanrewaju, O. and T. Falola, Transportation in Nigeria (Syracuse University Press). Chapter 9.

5. Articles Published in Learned Journals

(xi) Nkambwe, Musisi (1979) "Evaluation of Landsat Imagery for Geographical Research in Nigeria", Nigerian Geographical Journal, Vol. 22, p. 77-87.

(xii) Nkambwe, Musisi (1979) "Remote Sensing in Urban Information Systems for Spatial Planning in Nigeria", East African Geographical Review, No. 17, June 1979, p. 9-30.

(xiii) Nkambwe, Musisi (1982) "Urban changes in Nigeria", Urban Studies, Vol. 19, p. 321-327.

(xiv) Nkambwe, Musisi (1984) "Recent Route Developments in the Traditional Urban Areas of Southwestern Nigeria: The Case of Ile-Ife", Tropical Geography, Vol. 5, No. 2, p. 154-164.

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(xv) Nkambwe, Musisi (1985) "Route Development Versus Planning in Urban Areas of Southwestern Nigeria", Third World Planning Review, Nov. 1985.

(xvi) Nkambwe, Musisi (1984) "Intra-National Tourism in Nigeria", Canadian Journal of African Studies.

(xvii) Nkambwe, Musisi (1984) "Development of Routes and Changes in Accessibility to Individual Buildings in Ilorin", African Urban Studies.

(xviii) Nkambwe, Musisi (1987), "Framework for an Urban Information System for Nigeria", Photogrammetria, Vol. 41, No. 3, p. 163-172.

6. Manuscripts Accepted for Publication

(xix) Nkambwe, Musisi (1984) "A Study of Physical Urban Growth of Ile-Ife with the Help of Aerial Photographs", Nigerian Geographical Journal.

(xx) Nkambwe, Musisi (1985) "Transformation of Traditional Urban Areas in Nigeria: The Route component", Ekistics.

(xxi) Nkambwe, Musisi (1990) "The Resource Utilization and Regional Planning Information Systems in Botswana", The International Journal of Geographic Information Sysems

(xxii) Nkambwe, Musisi, (1990) "Using Cheap and Simple GIS Software to Map Landuse Suitability in Botswana" The Journal of Rural and Urban Planning in Southern Africa.

7. Published Conference Proceedings

(xxiii) Ojo, G.J.A. and Musisi Nkambwe (1978) "Tourism Awareness and Participation in Nigeria: A Case Study of University Students" in G.J. Afolabi Ojo (ed.); Environmental Resource Development in Developing Countries. Proceedings of IGU Commission on Environmental Problems, Ile-Ife, Nigeria.

(xxiv) [illegible] Geographical Congress, Tokyo, Japan, Sept. 1-5, Vol. 1, p. 350-351.

(xxv) Nkambwe, Musisi (1982) "Route Construction and Changes in Accessibility in Urban Areas of Southwestern Nigeria", Iniao Geografica International Conferecia Regional Latino Americana, Rio de Janeiro, July, 1982.

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8. Papers Presented at Conferences

(xxvi) Uganda National Forum on Settlement, Kampala, February, 1976. "Remote Sensing and Settlement Planning".

(xxvii) Commonwealth Geographical Union Conference, Dar es Salaam, Tanzania, September, 1976. "Remote Sensing: An Important solution for the Data Problem for Regional Planning in Eastern Africa".

(xxviii) International Geographical Union Conference, Lagos, 1979. "Tourism Awareness and Participation in Nigeria".

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9. Paper communicateed for Publication

Nkambwe, Musisi (1990) "Conservation for Sustainable Development in Botswana," Geografiska Annaler.

10. Current Research Activities:

Application of Geographic Information Systems, particularly for resource utilization and regional planning.

11. Other Relevant Information:

Editor, East African Geographical Review, 1975/76.

Editor, Nigerian Society of Remote Sensing, 1986-1987.

Chairman, Academic Committee, Department of Geography, University of Ife, 1987/88.

Representative of Dean of Faculty of Social Sciences on Faculty Board of Faculty of Science, University of Ife, 1987/88.

Representative of Dean of Faculty of Social Sciences on Governing Board, Centre for Energy Research and Development, University of Ife, 1987/88.

Representative of Dean of Faculty of Social Sciences on Board of Studies, Faculty of Science, University of Ife, 1987/88.

Designed and run a "National Workshop on Data Acquisition for Urban and Regional Planning" for the Obafemi Awolowo University Consultancy Services (UNIFECS) for two years 1987 and 1988.

Current coordinator, collaborative research on GIS programs, Department of Environmental Science, University of Botswana.

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