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COLLEGE OF AGRICULTURE
SCHOOL OF RENEWABLE NATURAL RESOURCES
325 BIOLOGICAL SCIENCES EAST BUILDING

September 2, 1983

MEMORANDUM TO: Division Chairmen
SRNR

FROM: Frank Gregg *FG*

SUBJECT: History of the School of Renewable Natural Resources

Would you work out whatever arrangements seem appropriate to see that your faculty have a chance to read this. I am sure Erv would appreciate hearing from you. You may also want to advise your students that the History is available and give them a chance to read it. If you wish, we will make a few additional copies.

FG:rjb
Attachment

HISTORY OF THE SCHOOL OF RENEWABLE NATURAL RESOURCES

The School of Renewable Natural Resources in the College of Agriculture was established in the University of Arizona in 1974. It was the culmination of ideas and efforts by many individuals over a number of years. It began with the initiation of several programs in the Colleges of Agriculture and Liberal Arts. The oldest programs were Range Management that evolved from the Botany and Range Ecology programs in the Colleges of Liberal Arts and Agriculture, Wildlife Ecology that evolved from the Department of Zoology in the College of Liberal Arts, and Soil and Water Science that evolved from the Department of Agricultural Chemistry and Soils in the College of Agriculture. Later programs were Landscape Architecture that evolved from the Horticulture Department in the College of Agriculture and Fisheries Science from the Department of Zoology in the College of Liberal Arts. The newest programs were the Forest-Watershed, Watershed Hydrology and Natural Resource Recreation programs that evolved from the Department of Watershed Management in the College of Agriculture.

EARLY HISTORY

The earliest program in the school began in the 1913-14 school year with a Grazing Range Studies course in the Biology Department taught by Professor J. J. Thornber. In 1927 Dr. William G. McGinnies started teaching the course. By 1930 the Range Ecology program had become a Department in the College of Agriculture with Dr. McGinnies as its Head. Later it was combined with Botany in the College of Letters, Arts and Sciences (now Liberal Arts) to form the Department of Botany and Range Ecology and still later the Department of Botany and Range Management.

In 1951, a Cooperative Wildlife Research Unit and B.S. and M.S. degree programs in Wildlife Management were established at the University of Arizona in the Zoology Department in the College of Liberal Arts with Dr. Lyle K. SOWLS as Leader and Program Director. A Ph.D. program in Wildlife Management was added in 1957. In 1958 a Fisheries program was added to the Wildlife Unit with Dr. William McConnell as its Leader. The Fisheries/Wildlife arrangement lasted until 1964 when it became a separate Arizona Cooperative Fisheries Unit in the College of Liberal Arts. In 1959, both M.S. and Ph.D. degrees were offered in Fisheries Management through the Wildlife program. Later in 1961 separate B.S., M.S. and Ph.D. programs were offered in Fisheries Management. In 1967, both the Wildlife and Fishery Management programs were transferred to the new Biological Sciences Department and were renamed Wildlife Biology and Fishery Biology, respectively. In 1971 Dr. Jerry C. Tash replaced Dr. McConnell as project leader for the Cooperative Fisheries Unit. These arrangements continued until 1974.

The major stimulus for formation of the School began during the 1954-55 school year when the Range Management program from the Botany and Range Management Department in the College of Liberal Arts was transferred to the Department of Agronomy in the College of Agriculture. The combined department was named the Department of Agronomy and Range Management. Dr. Dean F. McAlister was Head of the Department and Dr. Robert R. Humphrey was senior member of the range faculty. The range management curriculum consisted of basic and advanced range management courses covering range plants and ecology, range resources and evaluation, and range research. Also, a range field studies course was taught in the summer to give students training in range ecology, administration and management. Also, preforestry courses in forest

resources and forest influences were taught. By this time all three degrees--B.S., M.S. and Ph.D. - were offered to majors in Range Management.

FORMATION OF THE DEPARTMENT OF WATERSHED MANAGEMENT

In 1957, using the nucleus of forestry courses taught in the range management program, a preforestry program was initiated in the College of Agriculture under the direction of Resident Instruction in cooperation with the Departments of Horticulture, Agronomy and Range Management. Also in 1957, the range and forestry staff prepared a proposal for the formation of a separate Department of Range and Forestry. This was submitted to the Dean of Agriculture, Dr. Harold Myers, who submitted it to the President of the University, Dr. Richard A. Harvill. The proposal was rejected.

The range faculty then solicited the support of Mr. Arthur Newton Pack, president of the Charles Lathrop Pack Forestry Foundation, in setting up a Wildlands Management program at the University of Arizona which would include the range and preforestry programs in the College of Agriculture and the wildlife management program in the College of Liberal Arts. Mr. Pack was receptive to the idea and approached Agriculture Dean Harold E. Myers directly with the proposal.

As a result of his contact with Dean Myers, Mr. Pack granted the University \$120,000 to assist in the formation of a Department of Watershed Management, \$100,000 to go toward the establishment of the Department and \$20,000 for Pack Fellowships to support plant physiology and root studies in cooperation with the Arizona-Sonora Desert Museum. The Department of Watershed Management was then established in 1958 from the existing Range Management and the preforestry programs in the

College of Agriculture. The Wildlife Management program in Biological Sciences, however, was not transferred to the new department at this time.

Two faculty positions authorized by the Board of Regents in 1958, a department head and an associate professor, were added to the four full-time faculty in the new department. In addition, several graduate assistants were carried on grant funds. Also, the Plant Materials Center, with Mr. Louis Hamilton as Manager and three full-time assistants, was affiliated with the Department and operated on a grant from the Soil Conservation Service. Later, in 1962, it was transferred back to the Soil Conservation Service.

By the 1959-60 academic year, the Department of Watershed Management was fully organized with Dr. Andrew L. McComb as Head. Bachelor of Science and Master of Science degrees were available in two majors--Watershed Management and Range Management--and the Ph.D. degree was offered in Range Management. Range Management courses remained unchanged, but several forestry courses were altered and new courses added. In 1959, an Extension Specialist position was established in the area of range management. Also, a series of three summer service courses in range plants, range management and poisonous plants (one each year) was initiated. The series was discontinued after two years because of excessive work load. A Ph.D. degree with a major in Watershed Management was approved in 1961.

EVOLUTION OF THE SCHOOL IDEA

In November 1960, the formation of a School of Wildland Management with divisions or departments in Watershed, Range, Forestry, Wildlife, and Recreation was proposed but no action was taken.

In 1965, Dr. McComb resigned and Dr. John H. Ehrenreich was appointed Head of the Department of Watershed Management.

Until the mid 60's, the Department of Watershed Management offered two undergraduate majors, one in Watershed Management (options in Watershed Hydrology, Forest Management, and Forest Science) and the other in Range Management (general range management option). An M.S. and Ph.D. program was also available in the two majors with the doctoral program coordinated through the Plant Science Graduate Committee.

During the 1966-67 academic year, several more undergraduate options were added. A Wildland Recreation option was established in the Watershed Management major while the Range Management curriculum was expanded to include options in Range-Watershed and Range Science.

A proposal to combine existing programs in the Department of Watershed Management with the Fisheries and Wildlife programs in the Biology Department into a School of Natural Resources was submitted to Dean Harold Myers in 1967. The combined program would have been administered through chairmen for undergraduate instruction, graduate programs, and research coordination. Their responsibility would have been to facilitate the development of a broad-spectrum study and research program which would include all of the renewable natural resource components. The curricula proposed were watershed, recreation, forestry, range, fisheries, wildlife and natural resource planning. Again, no action was taken.

The development of an independent undergraduate major in recreation received considerable attention in 1969-70. At the same time, the forestry faculty prepared a self-evaluation report which resulted in the Forest-Watershed program receiving an affiliated status with the Society of American Foresters.

Significant curriculum changes took place in the Department of Watershed Management during 1970-71 when two new undergraduate majors-- Natural Resource Recreation and Fisheries Management--were established. The Natural Resources Recreation major originated from the existing Wildlands and Outdoor Recreation option. A graduate program in Natural Resource Recreation was also available under the major in Watershed Management.

A major in Fisheries Management was established in the Department of Watershed Management with the support of the Arizona Cooperative Fishery Unit and the Department of Biological Sciences. As a result, until the formation of the School of Renewable Natural Resources in late 1974, two undergraduate fisheries programs were offered on campus. The Fisheries Management major in the Department of Watershed Management was oriented primarily to the management of fresh-water fish habitat while the Fishery Biology program in the Department of Biological Sciences prepared students for research and graduate studies in the biological aspects of fish species. In 1971-72 the Forest Science option in Watershed Management was deleted but options in Watershed Hydrology and Forest-Watershed Management were retained. All options in range management were deleted. An optional Plan B, non-thesis professional Master of Science program was also established in the Range and Watershed Management programs.

In 1972, Dr. David Thorud replaced Dr. Ehrenreich as Head of the Department of Watershed Management. Dr. Malcolm J. Zwolinski served as Acting Head in the interim. Also, in May 1972 an accreditation team from the Society of American Foresters visited the campus and in October

the Department received full accreditation of its Forest-Watershed undergraduate curriculum.

With the retirement of Dean Harold Myers in 1972, an intensive search was conducted for a new agriculture dean. To provide him with some suggestions for possible changes in the College of Agriculture, President Schaefer brought several outside consultants to campus for two- and three-day visits with College faculty and members of the Search Committee. Each consultant, independently, suggested that the natural resource management program administered by the Department of Watershed Management receive greater visibility and support. In 1973, Dr. Gerald R. Stairs, Forestry Department Head at Wisconsin, was selected as College of Agriculture Dean.

Departmental changes in 1973 resulted in the establishment of a Remote Sensing Laboratory (later renamed Laboratory for Remote Sensing and Computer Mapping), with responsibilities in research activities, watershed modeling, and computer assisted instruction. Dr. William O. Rasmussen was appointed Director. A computerized bibliographic information retrieval system on watershed management (WAMIS) was initiated with Ms. Linda White as Librarian to reference on-campus publications pertaining to forestry and watershed management in the western U.S. and developing nations. Also in 1973, the Agricultural Chemistry and Soils and Agricultural Engineering Departments were combined into the Soils, Water and Engineering Department and the Horticulture Department was renamed Horticulture and Landscape Architecture.

The Landscape Architecture program was first established in the Department of Horticulture in 1966 with Guy Greene as program leader. Initially it was a four-year B.S. degree but later, in 1969, an M.S.

degree in Landscape Architecture was added and in 1974 a separate program was established.

FORMATION OF THE SCHOOL

The School of Renewable Natural Resources was formally created by action of the Board of Regents on December 21, 1974, following the submission of a proposal to President Schaefer in August requesting the formation of an Institute of Renewable Natural Resources. The purposes of the School were to provide increased integration of existing inter-related programs; better identify the University's role in natural resources management; help improve the quality and efficiency of teaching; facilitate research support; increase research efficiency; improve the University's capability to provide state, national and international service; and to provide leadership across the campus in renewable natural resource research, education and public service.

Eight undergraduate majors were established in the new School, five of which were in the old Watershed Management Department and the remainder transferred from other departments. Landscape Architecture from the Department of Horticulture and Landscape Architecture; Wildlife Biology and Fishery Biology (to be combined with Fisheries Management) from the Department of Biological Sciences; and Soil and Water Science from the Department of Soils, Water and Engineering was combined with existing majors in Forest-Watershed Management, Watershed Hydrology, Range Management, Natural Resource Recreation and Fisheries Management of the former Department of Watershed Management. Soon after their transfer to the School the Wildlife Biology major was renamed Wildlife Ecology and the combined Fisheries Management/Fishery Biology curriculums redesignated as a single major in Fisheries Science. Master

of Science and Doctor of Philosophy graduate programs in Fishery Biology and in Wildlife Biology were also transferred to the School with similar name changes. Existing M.S. and Ph.D. programs in Watershed Management (Forest-Watershed Management, Watershed Hydrology, and Natural Resource Recreation) and Range Management were retained. M.S. and Ph.D. degrees were also available in Soil and Water Science. The Soil and Water Science program was a special degree offered in the School by the Soils, Water and Engineering Department in the College of Agriculture. Dr. Thorud was named Associate Dean of the College of Agriculture and Director of the School. Chairmen of the various programs were Dr. Phil Ogden, Range Management; Dr. Gordon Lehman, Forest-Watershed; Dr. John Thames, Watershed Hydrology; Dr. David King, Natural Resource Recreation; Professor William Havens, Landscape Architecture; Dr. Roger Hungerford, Wildlife Ecology; Dr. Boyd Kynard, Fisheries Science; and Dr. Kenneth Barnes, Soil and Water Science.

The Arizona Cooperative Wildlife Research Unit, the Arizona Cooperative Fishery Unit, the Center for Remote Sensing, the Center for Quantitative Studies, and the Natural Resources Information Service also became affiliated with the School. Unit Leaders were Dr. Lyle Sowls, Wildlife; Dr. Jerry Tash, Fisheries; Dr. William Rasmussen, Remote Sensing; Dr. Robert Kuehl, Quantitative Studies; and Ms. Linda White, Information Services.

Enrollment in the various programs in the School at the time of formation was 434 undergraduates and 109 graduates for a total of 543 students. Of these 134 were in Forest-Watershed Management, 39 in Watershed Hydrology, 46 in Natural Resource Recreation, 40 in Range Management, 88 in Wildlife Ecology, 28 in Fisheries Science, 32 in Soil and Water Science and 136 in Landscape Architecture.

In 1975-76, the undergraduate curriculum in Landscape Architecture was upgraded to a five-year program and the School was authorized to award a professional Bachelor of Landscape Architecture degree. Subsequently, a Master of Landscape Architecture graduate degree major was established.

In 1977, Dr. Thorud resigned as Director of the School and Dr. Ervin H. Zube was selected as his replacement. In the interim, Dr. Malcolm J. Zwolinski served as Acting Director. Also, Dr. Stairs resigned as Dean of the College of Agriculture and Dr. Darrel S. Metcalfe was named Acting Dean.

The Bachelor of Landscape Architecture program received interim accreditation by the National Landscape Architectural Accrediting Board in 1976 and was formally accredited in 1979. In 1978, the Society of American Foresters reevaluated and reaccredited the School's Forest-Watershed program for the next 5 years.

In 1979 a B.S. degree in Renewable Natural Resources was offered in all programs except those receiving a Bachelor of Landscape Architecture. Prior to this, B.S. degrees in these school programs were only offered in Agriculture. There were no changes in the graduate programs. Extension activities in the State were strengthened with the addition of a Wildlife-Range Extension Specialist stationed in Phoenix.

In 1979, Dr. Philip Knorr assumed chairmanship of the Forest-Watershed Management program and Dr. Michael McCarthy of the Landscape Architecture program. Previously, Dr. Martin Fogel replaced Dr. John Thames as chairman of the Watershed Hydrology program. Continuing chairmen were Dr. Phil Ogden for Range Management and Dr. Roger Hungerford for Wildlife Ecology/Fisheries Science.

To increase public communication and improve natural resource research and educational activities, a Rangelands Coordinating Committee was established in 1978 and Director's Advisory council in 1979. One result of these programs was the establishment in 1980 of a three-man Range Management Task Force to implement some of these objectives. Dr. Jimmy LaBaume was employed to head up the Task Force. Another was the development of a School newsletter with wide distribution to inform the public of research findings and School activities.

In 1979-80, an off-campus 12-unit independent study requirement was established in the fifth-year Landscape Architecture program to involve students in landscape architectural problems. Similarly, a 4-unit field studies program was set up in the Forest-Watershed Management program during the last four weeks of the spring semester to provide students field training and experience. Also, a cooperative Research and Education Unit was established in the School by the Heritage Conservation and Recreation Service to research recreational opportunities; protect cultural, historic and natural resources; and develop curricula for training professional recreation resource managers. Dr. A. Heaton Underhill was Unit Leader. The program was terminated in 1980-81 due to changes in Washington so the unit leader and his responsibilities were transferred to the National Park Service Cooperative Unit within the School.

In 1980, the programs in the school were reduced to four divisions. The objectives were to increase the responsibilities of the chairmen and increase the operating efficiency of the School. The four divisions were Forest-Watershed Resources (including Forest Management and Watershed Hydrology), with Dr. Philip N. Knorr Chairman; Landscape Resources, with Dr. Michael M. McCarthy Chairman; Range Resources, with

Dr. E. Lamar Smith Chairman; and Wildlife, Fisheries and Recreation Resources (including Natural Resource Recreation, Fisheries Science and Wildlife Ecology options), with Dr. C. Roger Hungerford as Chairman. The Soil and Water Science program was transferred to the Department of Soils, Water and Engineering. Later, in 1982, Dr. William W. Shaw, replaced Dr. Hungerford as Wildlife, Fisheries and Recreation Resources Division Chairman, and, in 1983, Dr. Stanley K. Brickler replaced Dr. McCarthy as Landscape Resources Division Chairman. With this reorganization the undergraduate and graduate programs in Wildlife Ecology and Fisheries Science were consolidated and M.S. and Ph.D. degrees were offered in Renewable Natural Resource Studies.

In February 1981 the Range Management program in the School was accredited by the international Society for Range Management. As a result, three of the school divisions--Forest-Watershed, Landscape Architecture and Range Management are nationally accredited and the fourth--Wildlife-Fisheries Science--meets national certification standards.

In 1981, a National Park Service Research Unit was established within the School. Its research activities were directed to studies of vegetation in the Grand Canyon National Park, riparian habitat analyses, and ecological studies of columnar cacti at Organ Pipe Cactus National Monument. Dr. Roy Johnson is Unit Leader. Also, in 1982, the Center for Remote Sensing program and its personnel were transferred to the Agriculture College's Computer Applications Group. The School's Information Services functions were transferred to the College in 1977.

In 1982, a Natural Resources Measurement, Analysis and Communications Teaching Lab was established in the School to train undergraduate and graduate students in computer technology.

TEACHING INNOVATIONS AND SPECIALIZED COURSES

Microcomputer Teaching Laboratory. Several innovative teaching approaches involving the use of computers have been developed. INGRID, a computer mapping program for undergraduates in land resource planning, has effectively been used with data from research on critical/significant environments. In the Spring of 1983 a graduate level course emphasizing the use of programmable calculators for hydrologic analysis was successfully offered. The recent establishment of a Teaching Laboratory utilizing microcomputers has greatly increased undergraduate and graduate programming and computer use skills. Many faculty in all Divisions of the School are utilizing the Laboratory for class and field assignments.

Forestry Field Studies Program. A four-unit forestry field studies program offered during the last four weeks of the spring semester provides students with heretofore inadequate field training an opportunity for additional field work. To accommodate this course, several faculty members have accelerated the teaching of their professional forestry courses to the first eleven weeks of the spring semester. This innovative program allows students to accept full-time summer positions and still participate in the required field course program.

Range Field Studies Course. This is an upper division 2-week, 2-unit range management field course in central and northern Arizona taught during the last two weeks of summer vacation. It is designed to broaden the students background through on-the-ground observations of range species, vegetation types and ranching systems; to study the problems, practices and opportunities involved in multiple use

management of wildland ecosystems; to become acquainted with the organization, operation and personnel of various land management agencies; and to gain experience in outdoor living. The course is taught by a range faculty member in cooperation with experienced agency field personnel. Its principal value is to integrate classroom teaching with field application.

Off-Campus Landscape Study Program. An off-campus independent study requirement for fifth-year landscape architecture students has been developed. The twelve-unit course involves the preparation of student proposals for independent study at various locations. The major emphasis is to involve students in the solution of landscape architectural problems in Mexico. School faculty will coordinate these off-campus activities and assist with arrangements.

Natural Resources Internship Programs. These programs provided current students, usually between their junior and senior years, with supplemental course credits, paid full-time off-campus field experience, and on-the-job training in their professional fields. The experience gave students insight into their training needs so that they could better plan their coursework and motivated them to study harder to prepare themselves professionally. A comprehensive report on internship activities and an evaluation of the training program was required from the student. Grades were based on both job performance and quality of the training and evaluation report. Professors served as advisors, making periodic on-the-job evaluations. In most cases successful students were given permanent jobs in the various agencies after graduation. Cooperating agencies included the Bureau of Land Management, Forest Service, Bureau of Indian Affairs and Arizona Game

and Fish Department. Students participating included majors in Fisheries, Wildlife Management, Range Management, Forestry and Watershed Management. The program was highly successful while funds were available both in providing a unique educational experience for students and fostering valuable relationships with sponsoring agencies.

Natural Resources Conservation Camp and Workshop. This camp, later designated a workshop, is for concerned Arizona youths between the ages of 15 and 18. It was initiated in 1962 under the direction of Barry N. Freeman, representing the Arizona Agricultural Extension Service, in cooperation with Wayne Kessler, representing the Arizona Association of Soil Conservation District Supervisors. Later sponsors include the Arizona Section of the Society for Range Management, School of Renewable Natural Resources, Arizona Game and Fish Department, Forest Service, Bureau of Land Management, Soil Conservation Service, Arizona Bureau of Geology and Mineral Technology, National Park Service, ASARCO Mines and numerous individuals and resource-related industries and service clubs concerned for the future of the youth and natural resources of our state and nation. The objectives are to give Arizona youths on-the-ground hands-on education and experience in natural resource evaluation, planning and management, and face-to-face contact with natural resource managers and administrators. It is hoped that these experiences will provide them with a better understanding and love for the land and all its uses so that they can provide informed leadership in its conservation and management for present and future generations. The program started as a boys camp, later added a girls camp and is now coeducational. The success of the camp and workshop has been outstanding. It is now recognized as one of the nation's best Natural

Resource Workshops and received a Certificate of Appreciation from the Governor and his Commission on the Arizona Environment.

Curriculum Innovations. The combining of the undergraduate curricula in Wildlife Ecology and Fisheries Science in 1981 has resulted in a more efficient and effective training of students in both majors. Another major innovation was the establishment of the interdisciplinary graduate-level program in Renewable Natural Resources Studies. This program offers M.S. and Ph.D. degrees to continuing students and mid-career professionals interested in natural resources administration, planning, management and research. It provides training and research opportunities in natural resources in combination with studies in such areas as policy, economics, and behavioral science. Graduates will provide expertise that cuts across natural resource disciplines and bridges gaps between technical and economic, social and political considerations. The establishment of this new graduate major in Renewable Natural Resource Studies and formal recognition of an arid land forestry option in the M.S. program for Watershed Management in 1982 have resulted in a substantial increase in graduate applications from all over the world.

Short Courses for Professional Employees. Over a ten-year span from 1965 through 1974 the Department of Watershed Management offered a week-long short course in early January for Bureau of Land Management field personnel. The course was designed to bring participants up to date on the latest research and concepts regarding management of western lands for water yield improvements and erosion control. Over 300 BLM employees attended this course during this time and many have since assumed positions of leadership in the agency. Also, the School

currently coordinates the offering of University credit for a number of professional courses in fire management at the National Advanced Resources Technology Center at Marana. These courses are attended by personnel from many of the federal and state land management agencies. School faculty are also involved in numerous other workshops, short courses, and field days ranging from conservation education for school teachers to watershed hydrology for international scientists and range inventory techniques for Arizona ranchers.

Center for Training in Arid Land Forestry. In 1983, AID designated the School as a center for training of students from arid and semi-arid zones in Arid Land Forestry. To meet the objectives of this program the Forest-Watershed Division has prepared a Drylands Forestry curriculum backed by the USDA's Office of International Cooperation and Development and the U.S. Agency for International Development. Its objective is to develop a package of old and new courses in the School and related departments which will be of value to American and foreign students interested in working in developing arid countries or with American Indian tribes. One summer course on "Forestry in Arid Environments" is taught each year exclusively for foreign students. Dr. Philip Knorr is project leader.

International Watershed Development Course. In 1979, the School, in cooperation with the USDA's Office of International Cooperation and Development and the U.S. Agency for International Development, initiated a summer course entitled "Resource Development of Watershed Lands." The course is presented annually to international students from developing countries around the world. Since 1979, an average of 20 to 25 students

participate in the course each year. Dr. John Thames is the leader of the project.

Man and the Biosphere Training Courses. Since 1979, the School has conducted a series of regional training courses in developing countries on "Watershed Resources Management and Environmental Monitoring." The course is presented in cooperation with UNESCO's Man and the Biosphere Programs and the U.S. Agency for International Development. To date it has been presented in the Philippines twice and once in Thailand, Panama and Honduras and is planned in India, Indonesia and West Africa. The 2- to 3-week course, which consists of lectures, laboratory work and field exercises, is presented by instructors from the U.S. and host countries to complement respective knowledge and skills. On the average, 25 to 30 participants have taken the course. Dr. Peter F. Ffolliott is the project leader.

Saudi Arabia University Development Program. In late 1979, Saudi Arabia and the United States entered into an innovative bilateral agreement for the development of a higher educational institution at King Abdulaziz University in Saudi Arabia. The U.S. agreed to provide the assistance of U.S. educators to the Institute of Meteorology and Arid Land Studies (later changed to the Faculty of Meteorology and Environmental Studies) to train students for employment in various sectors of Saudi Arabian government organizations and society and to undertake mutually beneficial research. The underlying force of this agreement was a proposal written by Drs. Martin Fogel of the School and Theodore Downing in the Department of Anthropology at the University of Arizona. Funds from Saudi Arabia were used to assign faculty to King Abdulaziz University to conduct arid lands research in the fields of

meteorology, hydrology and environmental sciences and to assist in the overall management of the program. The benefit to the University of Arizona was the opportunity to actively participate in arid lands research projects.

AID Watershed Management Programs. During the period from 1969-1976, the Department of Watershed Management, and later the School of Renewable Natural Resource, received an institutional grant from Agency for International Development to strengthen the University of Arizona's existing competency in watershed management activities that are concerned with the optimum utilization of water for agriculture. By developing this increased capability, the University of Arizona was able to respond to the needs of lesser developed countries in the management of lands for the conservation and production of renewable natural resources. The grant allowed the Watershed Management Department and School to increase its faculty and graduate students which had a major impact on related teaching and research programs at the University of Arizona.

AID Range Management Shortcourse. This course is sponsored by the U.S. Agency for International Development to provide training in range management principles and practices to employees and international students from developing countries working or studying in natural resource and livestock management programs. It is a continuing 9-week summer course taught jointly by range management personnel from the Universities of Arizona and New Mexico. It includes classroom and field instruction designed to introduce and update training in the principles and practices of range management. Some 20 to 30 students mostly from African and Asian countries, attend the course each year. Results of

the program have been to broaden perspectives, increase understanding and improve performance of workers and students from these emerging countries. Dr. Milo Cox is project leader.

SIGNIFICANT PROJECTS

Arizona Cooperative Wildlife Research Projects. This unit established in 1951 under the leadership of Dr. Lyle K. SOWLS, has made very significant contributions. Over 64 theses and dissertations have been completed by graduate students and over 94 publications have been produced by unit personnel. Early studies emphasized desert ecology, white-tailed deer, mourning doves, white-winged doves and Gambel's quail. Later studies included scaled quail, Mearns' quail, Abert squirrels, Merriam's turkey, collared peccary, coyotes, gray foxes, kit foxes, coati mundi, pocket gophers, and bobcats. Recent studies include raptors, band-tailed pigeons, rodents, rabbits, sandhill cranes, mule deer, coues' deer, elk, bighorn sheep, sea otter, coots and other waterfowl and waterbirds.

Significant findings include the importance of Vitamin A and weather on quail reproduction and populations; effect of wildfire on deer habitat and distribution; forage relations between deer and cattle; ecology of sea otters in the Aleutian Islands; biology, nutrition and population dynamics of the collared peccary; movements, density, diet and habitat preferences of coyotes, gray foxes, kit foxes and bobcats; movements, habitat requirements and management of sandhill cranes and other waterfowl; and the effects of the CAP project on mule deer and bighorn sheep movements and ecology.

Impacts of the CAP on Wildlife. The Arizona Cooperative Wildlife Unit is using radio-collared animals to study the movements of desert

bighorn sheep and desert mule deer in western Arizona to evaluate the impacts of the Central Arizona Project (CAP) on their movements and distribution. It is anticipated that the study will provide information which can be used to reduce negative impacts of the CAP project on their movements and to reduce drownings in the canal. The study is under the leadership of Dr. Paul R. Krausman and is funded by the USDI Bureau of Reclamation.

Artificial Oases for Wildlife. The Arizona Cooperative Wildlife Research Unit is currently studying artificial oases to develop ways to mitigate habitat losses due to the construction of the Central Arizona Project canal. It is anticipated that the availability of green vegetation around these oases will compensate for wildlife habitat lost due to construction of the canal and that the studies will provide information as to where oases may be located so as to minimize wildlife drownings in the canal. The project is under the direction of Dr. Norman S. Smith and is funded by the USDI Bureau of Reclamation.

Masked Bobwhite Quail Project. A project to restore masked bobwhite quail to its former range in southern Arizona and the northern part of the state of Sonora in Mexico was initiated in 1960 under the leadership of Dr. Roger C. Hungerford. Agencies that have been involved in the project include the Arizona Wildlife Research Unit, the Arizona-Sonora Desert Museum, U.S. Fish and Wildlife Service and the Arizona Game and Fish Department. Studies involve finding effective ways of releasing captive birds into the native ranges, protecting them from predators, and finding habitats most conducive to their survival. The objective is to restore a unique game bird to its primeval habitat.

Arizona Cooperative Fishery Research Projects. This Unit has been providing management information on fisheries in Arizona since 1964. The 69 research studies conducted during this period have been cooperatively funded by the U.S. Fish and Wildlife Service, the Arizona Game and Fish Department, and The University of Arizona in conjunction with some grants from many other agencies. Of particular value to Arizona fisheries were studies on Tilapia as a biological weed control agent and on causes and effects of high pHs in high mountain lakes. A current series of studies on factors that control population numbers in aquatic animals has great potential for improving most of the current management techniques now in use for Arizona fish. Information from these studies has already indicated that fisheries in closed ponds or lakes must be periodically rejuvenated by man because the fish lose their innate ability to regulate their own numbers. Dr. Jerry C. Tash is the present Unit Leader.

Natural Resource Recreation Projects. Research in natural resource recreation has been aimed at providing resource managers with information about public preferences and values with regard to recreation. For example, a study of recreational use and visitors to the Mogollon Rim in the Payson-Heber area showed that many visitors and potential visitors were simply unaware of some of the recreational facilities in the area and these facilities were being underused while others were being overused. Hence, the capacity and recreational benefits provided could be increased simply by providing more information to the public about the recreational opportunities in the area. Studies in Southeastern Arizona have demonstrated the importance and value of nongame wildlife to Arizonans and visitors to the State.

This information has brought about increased attention to nongame wildlife management and research.

Critical and Prime Land Studies. The purpose of this Hatch Project is to develop an interdisciplinary, computer-based, technical capability which can be used by planners, managers and the public to identify, evaluate and manage critical and prime lands in the State of Arizona. It will also serve as a training guide and model for use on similar lands in other areas. The study is being conducted in cooperation with the Fish and Wildlife Service. Dr. Jon Rodiek initiated the project. The goal of the project is to assure that the United States will develop and retain a farm, range, forest and wetlands base for the production of high quality food, fiber, wood, water, recreational amenities, and other agricultural products; to develop mechanisms which will prevent irreversible losses of these lands to other uses; and to assure appropriate levels of environmental quality. To date several national resource classification systems have been digitized relevant to infrastructure, soils, physiography, land form, vegetation and wetlands and field checked in a pilot study area. The next steps are to integrate these basic classification systems by microcomputer manipulation, to evaluate characteristics to determine their actual productive value, and to establish permanent monitoring stations to assess impacts on basic biological and human values.

Rural Land Conversion Study. The purpose of this Hatch study is to establish a data base of the most influential variables which can be used to develop a system to assess the value of rural lands in the State of Arizona and their suitability for conversion to other uses. Categories of analysis include topography, soil suitability,

transportation, on-site and surrounding land use, flood potential, land value, utilities and services, zoning and planning, and visual quality. Persons being interviewed include agricultural scientists, wildlife biologists, recreationists, planners and general citizens. Results will be used to prepare a model for rural land conversion and to establish a long-term monitoring program to assess land values and their suitability for conversion. Early results indicate absolutely no consensus of opinion or clear conception of the potential for such a program. Dr. Don C. Wilkin is project leader.

Landscaping with Water Conserving Plants. The use of nature and introduced desert plants for site beautification, soil stabilization and water conservation has been promoted by various divisions of the School as well as other departments in the College of Agriculture and has now become a widely accepted practice. Major publications co-authored by members of the School which have promoted the practice include: "Landscaping with Native Arizona Plants" by the Natural Vegetation Committee of the Arizona chapter of the Soil Conservation Society of America, E. M. Schmutz, editor; "Native Trees and Shrubs for Landscape Use in the Desert Southwest" by C. M. Sacamano and W. D. Jones; and "Plants for Dry Climates" by M. R. Duffield and W. D. Jones. This practice has resulted in tremendous savings in precious water, reductions in landscape planting and maintenance costs, and preservation of unique desert plants.

Recreation Water Quality Research. The principal objective of water quality research is to provide state and federal agencies with information and guidelines needed to safely use and manage recreation waters. The research began in 1972 and has been funded for various

studies by the Eisenhower Consortium, Arizona Agricultural Experiment Station, U.S. Forest Service and the National Park Service. Water bodies studied were Big Lake, Hawley Lake and the Little Colorado River in the White Mountains; Sabino and Madera Canyons in the Coronado National Forest; Salt River and its chain of lakes; and the Colorado River in the Grand Canyon National Park. Results showed that recreational use has a direct health-related impact on water quality; most all natural waters fail drinking water standards and should be treated before use; flushing of watersheds by storm runoff has the greatest health-related impact on recreational waters; wildlife and livestock also have serious impacts; and disturbance of bottom sediments, which contain higher concentrations of bacteria than overlying waters, can render waters unsafe for body contact. These and future findings will provide a basis for identifying health-related recreation water quality standards and management procedures for protecting the public health.

Desert Biome Studies. Beginning in 1969, ecological studies of the Sonoran Desert were conducted over a 7-year period as part of the International Biological Program and were sponsored by the National Science Foundation. The studies were conducted by more than 100 biologists from the U.S. and other countries who investigated basic ecological interrelationships in desert communities with the ultimate goal of developing models of desert ecosystems. The results of these studies have provided a greater understanding of desert ecology and consequently the management of desert ecosystems. A series of eleven synthesis volumes on the major accomplishments of the program have been published. Dr. John L. Thames was Project Leader for the School.

Nutrient and Soil Balance in Ponderosa Pine Ecosystems. The primary purpose of this project was to determine the movement of nutrients in the forest in relation to ecosystem processes and composition. The project was funded by the U.S. Forest Service. The project leader was Dr. James O. Klemmedson. Results showed that nutrient capital in ponderosa pine ecosystems is distributed in a complex array of biotic and abiotic components, and that the nutrients are not static, moving from one component to another in a cyclical fashion. These results add to the pool of knowledge which resource managers need to predict significant events of the forest and to prescribe land management practices which will increase productivity and use of a wide range of forest products and facilities.

Biomass and Nutrients in Desert Shrub Ecosystems. The purpose of this study was to determine the effect of environmental factors on the seasonal and annual spatial distribution patterns of nitrogen and carbon in the soil-plant systems of mesquite and palo verde desert shrub ecosystems. The study was conducted on the Santa Rita Experimental Range in cooperation with the National Science Foundation and the U.S. Forest Service. Dr. James O. Klemmedson was project leader. Results showed that over 77% of the nitrogen was in the soil, 20% in the shrub biomass and 3% in the understory vegetation and litter while carbon was almost equally distributed between soil and biomass. This information provides insight into the relative importance of various ecosystem components and the flow of these components in the ecosystem. These data provide benchmarks on the productivity and guidelines for the management of these ecosystems.

Comparative Studies of Dry Forests of Western North America. The purpose of this binational Mexico-U.S. program of research and education which began in 1976 is to undertake a series of joint studies of comparable dry forest sites in the states of Durango and Arizona in conformance with the objectives of UNESCO's Man and the Biosphere Program. Two sites have been selected for initial attention: La Michilia Biosphere Reserve in Durango and Beaver Creek Biosphere Reserve in Arizona. The objectives are to enhance cattle development and range improvement on forested areas; to increase the knowledge of flora and fauna for improving their use and management; to implement multi-resource inventory systems; and to describe interactions among vegetation, soils, geology, and land use so that agencies may plan a wiser use and conservation of these natural resources. Project leader for the School is Dr. Peter F. Ffolliott.

Surface Mine Reclamation Projects. The Watershed Hydrology Unit has been active in the area of surface mine reclamation in the West since 1973 when it held the first symposium to be given on the subject. Since then major projects have been funded by the Surface Environment and Mining (SEAM) program of the U.S. Forest Service, the Bureau of Mines, Environmental Protection Agency, Cooperative State Research Service (CSRS), Northwest Battelle Laboratory and the coal and copper mining industries. These projects included environmental impact statements, hydrologic monitoring, the development of computer models on earth handling, revegetation experiments, a demonstration of the rehabilitation of abandoned mine sites, and the construction of the largest water harvesting demonstration in this country. Much of the work involved research on the hydrology and water quality of mined

sites, pre-mining planning to maintain the hydrologic integrity of mined areas, and design criteria for water retention structures. The goals of these projects were to facilitate mining and to improve the economic and environmental aspects of reclamation. Dr. John L. Thames is project leader.

Range Utilization Project. This was a State funded project utilizing Hatch funds. It's major objectives were to develop better methods of measuring utilization and to promote proper use of rangelands. A major accomplishment of this project was the development of the Grazed-Class Method. It uses photo guides to estimate range use by placing grazed forbs and grasses in six grazed classes and calculating results. The method is fast, accurate, easily-learned and is being used by both ranchers and specialists for training and management. It is also being used by 4-H and FFA students in state contests. A similar Browsed-Class Method has been developed for estimating shrub utilization. These methods can be used to estimate current and proper use of key species, proper range use, distribution of grazing, and economics of range improvements. Dr. Ervin M. Schmutz was project leader.

Testing of Rangeland Monitoring Techniques. This project began in 1981 and is funded by a grant from the U.S.D.A. under the Special Grants Program for Anti-desertification Research. The general purpose of the project is to develop better procedures for obtaining and interpreting data on rangelands which can be used to estimate carrying capacity and monitor changes in range vegetation and soils related to management.

Tests for more efficient ways to estimate forage production and vegetation composition by weight showed that the dry-weight-rank method

was satisfactory for herbaceous species. Further work is needed for shrubs. The effects of seasonal and annual variability in vegetation on the interpretation of data on species composition obtained by several commonly used techniques (including weight estimate, frequency, canopy cover and step-point sampling) are being tested. Also, techniques for defining and measuring ground cover and its use for estimating erosion hazard are being studied. The work will attempt to develop an index to size and pattern of bare soil areas as well as the percentage of bare soil exposed to erosion. Dr. Lamar Smith is project leader.

Long-Term Resource Monitoring. This is a multi-disciplinary Hatch project initiated in 1980 in the Division of Landscape Resources to develop flexible long-term problem-solving monitoring schemes on selected critical lands in Arizona. A primary premise is that information collected during the next 10 to 50 years will be relevant for solving problems at that future date. The primary emphasis will be to collect information over time related to four specific land management/use activities: conversion/retirement of rural and agricultural lands; baseline conditions of riparian ecosystems; impacts of new technologies on land uses; and displacement/user conflicts in unique natural and built environments. Analysis of available literature has been completed, general procedures and rationale for monitoring studies have been developed, and specific monitoring sites have been identified. The next phase of the project concerns procedures for collecting, storage and sharing of data.

Natural Resource Values and Land Use Issues. This Landscape Resources project is designed to establish a comprehensive inventory of natural resource values and land use issues and to assess the

significance and relative importance of these values and issues for use in natural resource management and development of urban growth policies. The project is supported by McIntire-Stennis funds and is conducted in cooperation with the U.A. Department of Agricultural Economics. Dr. Ervin H. Zube is Project Leader. Accomplishments include a review of historical and contemporary documents relating to individual and group perceptions of Arizona landscapes, development of a survey questionnaire, refinement of the questionnaire with open-ended interviews, mailing of the questionnaire to a broad random sample of 1,500 households, and coding and statistical analyses of results. Interviews and the survey explored perceptions and attitudes about valued amenities, commodity resource uses, environmental descriptions, attitudes towards commodity and non-commodity users, perceptions of landscape quality, resource planning, perceptions of land use and land use changes, and value of outdoor activities and experiences.

Range Workshops and Task Force Activities. To reduce conflicts between federal and state agencies and livestock permittees, extension range specialists started a series of range workshops to evaluate techniques used by agencies to determine grazing capacity on Arizona ranges. The evaluation techniques were compiled in a handbook and discussed at ranch schools, field trips and workshops by range faculty, county extension personnel, agency personnel and livestock operators. Annual workshop activity created such a demand from agencies and ranchers for range management assistance that in 1980 a Range Task Force was formed at the University to increase the information base and assist in solving permittee-agency conflicts on management of public rangelands.

The workshop and Task Force activities identified a need to monitor vegetation response to range management activities. To meet this need an unbiased and sensitive method of measuring vegetation changes with frequency transects was developed and used to establish monitoring transects at specific locations on ranges throughout Arizona. These transects provide an excellent basis for communication and document specific changes which occur in response to management. Dr. Phil Ogden is project leader.

Prescribed Burning in Arizona. This project was initiated by Dr. Robert R. Humphrey in the early 1950's and has been continued by Dr. Robert F. Wagle and Dr. Malcolm J. Zwolinski. It has been conducted in cooperation with the Forest Service, Rocky Mountain Forest and Range Experiment Station, Bureau of Indian Affairs, Natural Park Service and others. The objectives of the program have been to control invasion and reduce abundance of undesirable trees and shrubs; provide a seedbed for establishment of desirable species; increase production and quality of forage species; remove fuel and reduce fire danger in forest lands; recycle nutrients; improve diversity and quality of wildlife and livestock habitat; improve distribution of animals and utilization of forage by livestock and wildlife; increase water quality and yield; provide long-range reduction of soil erosion and sedimentation; and improve natural beauty. The results of this program have been to establish prescribed burning as a common and successful range and forest practice for range and wildlife habitat improvement, for forest stand improvement and for fire control. Also, it has encouraged agencies, such as the National Forest and Park Services, to allow wildfires to

burn unchecked under certain conditions with desirable results and cost savings.

IMPACTS OF THE SCHOOL

The school has developed a strong interdisciplinary reputation for teaching and research. Since formation of the Department of Watershed Management in 1958-59, on-campus and off-campus faculty, teaching assistants and research assistants in the Department and School have increased from 15 to 121 (Table 1). Concurrently student enrollments have increased along with expansion of programs (Tables 2-5). In the same period 793 undergraduate and 364 graduate degrees have been awarded for a total of 1,157 degrees (Tables 6-9). Even more dramatic has been the increase in annual funding of research projects, from \$53,000 to over \$4 million (Table 10). These data testify to the validity of the multidisciplinary school concept and its ability to obtain qualified faculty and students to tackle complex interdisciplinary problems and to attract needed research funding.

This interdisciplinary thrust extends beyond the bounds of its own programs. In recent years, significant strides have been made to establish cooperative educational and research opportunities with other segments of the campus, including Law; Geography, Regional Development, and Urban Planning; Hydrology and Water Resources; Psychology; and Architecture. Also, the School's increasing competence in the management of arid and semiarid ecosystems is considered a major strength. This dynamic approach has also had great impacts in the public sector.

Benefits of the Watershed Management Program. During the past 25 years since the inception of the watershed management program at the

University of Arizona several private and public resource management agencies have benefited from the efforts of scientists and educators in the program. Three significant projects conducted within the past few years have provided special benefits.

A summarization of our knowledge of the effects of vegetation and vegetation manipulation on water yields in Arizona provided several responsible agencies with guidelines for determining the effects of vegetation management activities on water resources. It also provided the managers with information about where water yields could be increased and estimates of the magnitude of increases that could be expected. The work also identified areas where information was lacking and additional research that was needed.

A second project dealt with rehabilitation of mined lands and mine spoils in Arizona. This effort provided information about how the arid and semi-arid lands of Arizona can be returned to a semi-natural state and how the land can also be developed for the production of useful vegetative products. Food and fiber production was established by the use of special water harvesting systems developed by the project.

A third contribution of watershed management research was the establishment of guidelines by the National Park Service for float trips on the Colorado River through the Grand Canyon. Water quality investigations led to the identification of problems related to the types of recreational use on the river and to the number and size of user groups. These studies were partially the basis for Park Service policies restricting the recreational use of the river through the canyon in order to protect the river and recreation value of the float activity.

Numerous other projects have dealt with the growth and management of ponderosa pine forests in Arizona, the production of Christmas trees,

the consumption of water by various riparian and forest tree species, the water quality of lakes and streams, and with water yield from various vegetation zones. These projects have provided information of benefit to responsible federal and state management and regulatory agencies including the U.S. Forest Service, the Bureau of Land Management, the Bureau of Indian Affairs, several Indian tribes, the National Park Service, Arizona Water Commission, Arizona Health Department, and the Salt River Project.

Influence of the Range Management Program. Range management faculty at the University of Arizona have been involved in graduate and undergraduate teaching, extension and research related to the wise use of rangeland for many years. Students trained in range management at UA are now working in a variety of capacities (including ranching, public rangeland administration, research, and teaching) in Arizona and other states as well as in a number of foreign countries. While it is difficult to quantify the influence of this training on the productivity of rangelands directly, there is no doubt that it has contributed to increased understanding of rangeland ecosystems and is at least partially responsible for the generally improved condition and better management of rangelands in all these areas.

The effects of range research efforts over the years have provided information and guidelines for range managers on both public and private lands. Projects include introduction of new forage plants, range revegetation, mechanical and chemical brush control, controlled burning for range improvement, guidelines for proper grazing practices, range fertilization, effects of grazing on watershed values, and studies of basic range ecology. Other specific examples of recent research which

have been widely accepted and used by land management agencies include the following: the grazed-class method of measuring forage utilization and the plant frequency technique for monitoring range trend developed at UA have been accepted by ranchers and range technicians in Arizona and other states; grazing systems designed to meet the needs of Arizona ranges have been devised and implemented; a guide to improvement of Arizona rangelands has been published and is in its second revision; data on nutrient balance in forested rangelands has been incorporated into Forest Service management procedures; and research on brush control and pasture improvement carried out by UA personnel in northeast Brazil have been widely implemented in that country.

It should be pointed out that many of these research and education efforts were carried out by UA faculty working in close cooperation with personnel of the Forest Service, BLM, SCS, State Land Department, Agricultural Research Service, private ranchers, agricultural chemical and equipment companies, and governments of other countries.

Impacts of the Wildlife, Fisheries and Recreation Division. The Division, especially the Wildlife and Fisheries Cooperative units, has performed an important role in disseminating information to the general public and to resource management interests concerning management of terrestrial and aquatic wildlife resources. Also, its formal education program has produced graduates who have filled positions in county, state, and federal agencies as well as private organizations involved in land management and conservation issues. These include two directors of the U.S. Fish and Wildlife Service, a director of wildlife conservation

agency in a Canadian province, and a director of game management for the country of Kenya.

Impacts of research projects on resource management activities include the development of comprehensive local plans by faculty and students which have had significant influences on the development of Catalina State Park and other recreation areas. Also, numerous state projects have assessed the impacts of human activities on fish and wildlife resources and have developed methods for reducing these impacts. These projects include: studies on the impacts of the CAP on wildlife, use of oases as a means for mitigating CAP effects on wildlife, use of sewage effluent for developing waterfowl habitat, development of management plans for two-season fishing in Arizona lakes, development of management plans for trophy fishing in Arizona lakes, evaluation of the economic significance of wildlife-oriented recreation in Arizona, evaluation of the impacts of underground nuclear testing on mammals in the Aluetian Islands, and assessment of public participation in nonhunting wildlife-oriented recreation. International projects include assistance to the United Nations in planning for parks and wildlife conservation in the Philippines, assistance to Paraguay in developing plans for the conservation of endangered species, and assistance to Australia in integrating wildlife conservation into forest management practices.

THE FUTURE OF THE SCHOOL

Important in-house objectives for the future include expansion of the School's extension program to include areas such as forestry, recreation, fisheries and watershed hydrology; acquisition and development of field research and teaching facilities to upgrade instructional

field courses and to provide support for extensive field research programs; and continuation of new research initiatives in urban forestry, non-commodity resource values, big game management and ecology, and effects of fire on natural ecosystems.

The continuing overall objectives of the School will be to (1) provide leadership across the campus and throughout the state in renewable natural resource research, education and management, (2) coordinate and improve the quality of teaching among the component disciplines, (3) integrate and improve the efficiency of interdisciplinary research, (4) attract expanded research support from granting agencies, (5) increase expertise and expand service opportunities on complex problems, and (6) provide international leadership for developing nations in arid regions through expansion of faculty participation in international educational programs and research projects and continued participation in domestic and international conferences and short courses for resource managers working in these countries.

TABLE 1

FACULTY AND RESEARCH STAFF IN THE DEPARTMENT OF WATERSHED MANAGEMENT
AND SCHOOL OF RENEWABLE NATURAL RESOURCES

Fiscal Years	Head & Director	On Campus Faculty & Adjunct Faculty	TA's & RA's	Res Staff & Off Campus Adjunct	Total Faculty & Research Staff
1958/59	McComb	6	4	5	15
1959/60	"	6	5	7	18
1960/61	"	7	8	5	20
1961/62	"	8	9	5	22
1962/63	"	8	10	3	21
1963/64	"	8	10	1	19
1964/65	"	8	10	4	22
1965/66	"	10	13	4	27
1966/67	Ehrenreich	11	17	4	32
1967/68	"	14	23	8	45
1968/69	"	15	19	4	38
1969/70	"	16	16	5	37
1970/71	"	16	20	8	44
1971/72	Zwolinski/Thorud	18	27	10	55
1972/73	Thorud	18	31	11	60
1973/74	"	20	41	9	70
1974/75	"	23	34	13	70
1975/76	"	31	32	6	69
1976/77	"	35	32	17	84
1977/78	Zwolinski/Zube	37	46	13	96
1978/79	Zube	40	33	18	91
1979/80	"	43	31	20	94
1980/81	"	43	33	18	94
1981/82	"	47	46	25	118
1982/83	"	43	55	23	121

TABLE 2

STUDENT ENROLLMENTS FOR THE SCHOOL OF RENEWABLE NATURAL RESOURCES
AND THE DEPARTMENT OF WATERSHED MANAGEMENT
(1958-1982)

Fiscal Years	Bachelor's					Totals
	WsM	RaM	NRR	WFSc*	LAr	
Department of Watershed Management						
1958-59		27**				27
1959-60		41**				41
1960-61		36**				36
1961-62		59**				59
1962-63	45	25				70
1963-64	48	26				74
1964-65	66	33				99
1965-66	75	38				113
1966-67	71	34				105
1967-68	71	39				110
1968-69	77	29				106
1969-70	83	26				109
1970-71	66	13	32			111
1971-72	76	59	42			177
1972-73	85	43	41	4		173
1973-74	102	17	53	7		179
School of Renewable Natural Resources						
1974-75	102	26	52	27	116	323
1975-76	122	46	61	99	117	445
1976-77	124	59	60	153	193	589
1977-78	104	59	63	183	146	555
1978-79	88	55	56	186	149	534
1979-80	73	62	64	156	146	501
1980-81	75	47	53	151	137	463
1981-82	73	38	45	162	132	450
1982-83	48	37	21	131	91	328

* Students in Wildlife Biology in the College of Liberal Arts are not included.

** Total enrollment in WsM and RaM.

WsM - Watershed Management
RaM - Range Management
NRR - Natural Resource Recreation
WFSc - Wildlife and Fisheries Science
LAr - Landscape Architecture

TABLE 3

**STUDENT ENROLLMENTS FOR THE SCHOOL OF RENEWABLE NATURAL RESOURCES
AND THE DEPARTMENT OF WATERSHED MANAGEMENT
(1958-1982)**

Fiscal Years	Master's					Totals
	WsM	RaM	RNR	WFSc*	LAr	
Department of Watershed Management						
1958-59		7**				7
1959-60		8**				8
1960-61		9**				9
1961-62		19**				19
1962-63		20**				20
1963-64		17**				17
1964-65		25**				25
1965-66	15	10				25
1966-67	25	15				40
1967-68	35	13				48
1968-69	26	11				37
1969-70	20	16				36
1970-71	24	15				39
1971-72	28	5				33
1972-73	29	5				34
1973-74	31	8				39
School of Renewable Natural Resources						
1974-75	39	5		0	14	58
1975-76	38	6		7	11	62
1976-77	27	6		14	7	54
1977-78	32	11		18	6	67
1978-79	32	10		15	3	60
1979-80	32	8		20	3	63
1980-81	28	16		24	14	82
1981-82	25	16		23	18	82
1982-83	30	19	4	22	13	88

* Students in Wildlife Biology in the College of Liberal Arts are not included.

** Total enrollment in WsM and RaM.

WsM - Watershed Management
RaM - Range Management
RNR - Renewable Natural Resources
WFSc - Wildlife and Fisheries Science
LAr - Landscape Architecture

TABLE 4

**STUDENT ENROLLMENTS FOR THE SCHOOL OF RENEWABLE NATURAL RESOURCES
AND THE DEPARTMENT OF WATERSHED MANAGEMENT
(1958-1982)**

Fiscal Years	Doctoral				Totals
	WsM	RaM	RNR	WFS ^{c*}	
Department of Watershed Management					
1958-59		5**			5
1959-60		6**			6
1960-61		6**			6
1961-62		8**			8
1962-63		12**			12
1963-64		12**			12
1964-65		18**			18
1965-66	12	11			23
1966-67	16	12			28
1967-68	22	9			31
1968-69	23	8			31
1969-70	26	18			44
1970-71	24	16			40
1971-72	22	12			34
1972-73	22	12			34
1973-74	8	5			13
School of Renewable Natural Resources					
1974-75	9	7		0	16
1975-76	12	10		2	24
1976-77	16	7		2	25
1977-78	13	6		2	21
1978-79	8	9		4	21
1979-80	11	6		8	25
1980-81	9	7		8	24
1981-82	13	9		12	34
1982-83	16	9	2	13	40

* Students in Wildlife Biology in the College of Liberal Arts are not included.

** Total enrollment in WsM and RaM.

WsM - Watershed Management

RaM - Range Management

RNR - Renewable Natural Resources

WFS^c - Wildlife and Fisheries Science

TABLE 5

**STUDENT ENROLLMENTS FOR THE SCHOOL OF RENEWABLE NATURAL RESOURCES
AND THE DEPARTMENT OF WATERSHED MANAGEMENT
(1958-1982)**

Fiscal Years	Student Enrollment			Totals
	Bachelor's	Master's	Doctoral	
Department of Watershed Management				
1958-59	27	7	5	39
1959-60	41	8	6	55
1960-61	36	9	6	51
1961-62	59	19	8	86
1962-63	70	20	12	102
1963-64	74	17	12	103
1964-65	99	25	18	142
1965-66	113	25	23	161
1966-67	105	40	28	173
1967-68	110	48	31	189
1968-69	106	37	31	174
1969-70	109	36	44	189
1970-71	111	39	40	190
1971-72	177	33	34	244
1972-73	173	34	34	241
1973-74	179	39	13	231
School of Renewable Natural Resources				
1974-75	323	58	16	397
1975-76	445	62	24	531
1976-77	589	54	25	668
1977-78	555	67	21	643
1978-79	534	60	21	615
1979-80	501	63	25	589
1980-81	463	82	24	569
1981-82	450	82	34	566
1982-83	328	88	40	456

TABLE 6

**DEGREES AWARDED BY THE SCHOOL OF RENEWABLE NATURAL RESOURCES
AND THE DEPARTMENT OF WATERSHED MANAGEMENT
(1958-1982)**

Fiscal Years	Bachelor's					Totals
	WsM	RaM	NRR	WFSc*	LAr	
Department of Watershed Management						
1958-59	0	8				8
1959-60	0	4				4
1960-61	1	5				6
1961-62	0	6				6
1962-63	0	3				3
1963-64	3	4				7
1964-65	9	7				16
1965-66	10	10				20
1966-67	9	10				19
1967-68	11	7				18
1968-69	15	14				29
1969-70	20	5				25
1970-71	12	5	0			17
1971-72	16	2	0			18
1972-73	10	11	9			30
1973-74	10	3	15	3		31
School of Renewable Natural Resources						
1974-75	13	2	17	2	20	54
1975-76	13	1	13	6	20	53
1976-77	25	6	11	9	5	56
1977-78	18	6	9	17	18	68
1978-79	20	11	12	20	30	93
1979-80	18	7	10	21	9	65
1980-81	9	17	14	19	18	77
1981-82	12	10	12	22	14	70
Totals	254	164	122	119	134	793

* Graduates in Wildlife Biology in the College of Liberal Art are not included.

WsM - Watershed Management
 RaM - Range Management
 NRR - Natural Resource Recreation
 WFSc - Wildlife and Fisheries Science
 LAr - Landscape Architecture

TABLE 7

**DEGREES AWARDED BY THE SCHOOL OF RENEWABLE NATURAL RESOURCES
AND THE DEPARTMENT OF WATERSHED MANAGEMENT
(1958-1982)**

Fiscal Years	Master's					Totals
	WsM	RaM	RNR	WFS [*]	LAr	
Department of Watershed Management						
1958-59	0	4				4
1959-60	0	1				1
1960-61	0	2				2
1961-62	3	5				8
1962-63	0	2				2
1963-64	3	3				6
1964-65	4	7				11
1965-66	4	1				5
1966-67	4	4				8
1967-68	3	7				10
1968-69	11	4				15
1969-70	1	5				6
1970-71	3	3				6
1971-72	3	1				4
1972-73	10	1				11
1973-74	5	0				5
School of Renewable Natural Resources						
1974-75	15	4		0	3	22
1975-76	11	1		4	2	18
1976-77	14	2		3	6	25
1977-78	8	3		5	1	17
1978-79	11	3		10	2	26
1979-80	10	1		5	1	17
1980-81	15	6		4	0	25
1981-82	9	7	0	8	0	24
Totals	147	77	0	39	15	278

* Graduates in Wildlife Biology in the College of Liberal Arts are not included.

WsM - Watershed Management
RaM - Range Management
RNR - Renewable Natural Resources
WFS^c - Wildlife and Fisheries Science
LAr - Landscape Architecture

TABLE 8

**DEGREES AWARDED BY THE SCHOOL OF RENEWABLE NATURAL RESOURCES
AND THE DEPARTMENT OF WATERSHED MANAGEMENT
(1958-1982)**

Fiscal Years	Doctoral				Totals
	WsM	RaM	RNR	WFSc*	
Department of Watershed Management					
1958-59	0	1			1
1959-60	0	1			1
1960-61	0	1			1
1961-62	0	0			0
1962-63	0	2			2
1963-64	0	1			1
1964-65	0	0			0
1965-66	3	0			3
1966-67	0	4			4
1967-68	3	1			4
1968-69	1	1			2
1969-70	2	2			4
1970-71	1	2			3
1971-72	4	3			7
1972-73	5	1			6
1973-74	4	3			7
School of Renewable Natural Resources					
1974-75	7	1		0	8
1975-76	2	3		0	5
1976-77	3	1		0	4
1977-78	4	0		0	4
1978-79	2	2		0	4
1979-80	5	1		2	8
1980-81	1	1		1	3
1981-82	2	1	1	0	4
Totals	49	33	1	3	86

* Graduates in Wildlife Biology in the College of Liberal Arts are not included.

WsM - Watershed Management
 RaM - Range Management
 RNR - Renewable Natural Resources
 WFSc - Wildlife and Fisheries Science

TABLE 9

**DEGREES AWARDED BY THE SCHOOL OF RENEWABLE NATURAL RESOURCES
AND THE DEPARTMENT OF WATERSHED MANAGEMENT
(1958-1982)**

Fiscal Years	Degrees Awarded			Totals
	Bachelor's	Master's	Doctoral	
Department of Watershed Management				
1958-59	8	4	1	13
1959-60	4	1	1	6
1960-61	6	2	1	9
1961-62	6	8	0	14
1962-63	3	2	2	7
1963-64	7	6	1	14
1964-65	16	11	0	27
1965-66	20	5	3	28
1966-67	19	8	4	31
1967-68	18	10	4	32
1968-69	29	15	2	46
1969-70	25	6	4	35
1970-71	17	6	3	26
1971-72	18	4	7	29
1972-73	30	11	6	47
1973-74	31	5	7	43
School of Renewable Natural Resources				
1974-75	54	22	8	84
1975-76	53	18	5	76
1976-77	56	25	4	85
1977-78	68	17	4	89
1978-79	93	26	4	123
1979-80	65	17	8	90
1980-81	77	25	3	105
1981-82	70	24	4	98
Totals	793	278	86	1157

TABLE 10

RESEARCH PROJECT FUNDING

in the Department of Watershed Management
and School of Renewable Natural Resources

FISCAL YEARS	DEPARTMENT AND SCHOOL	SPECIAL FUNDING	STATE & FEDERAL FORMULA	TOTALS
Department of Watershed Management				
1958-59	"	-	52,865	52,865
1959-60	"	12,950	56,205	69,155
1960-61	"	50,934	69,855	120,789
1961-62	"	61,797	90,800	152,597
1962-63	"	99,515	107,935	207,450
1963-64	"	107,328	118,410	225,738
1964-65	"	80,150	129,254	209,404
1965-66	"	18,560	142,010	160,570
1966-67	"	89,065	154,416	243,481
1967-68	"	9,200	179,458	188,658
1968-69	"	456,023	191,850	647,873
1969-70	"	78,827	211,325	290,152
1970-71	"	89,905	228,400	318,305
1971-72	"	143,824	254,693	398,517
1972-73	"	307,869	267,050	574,919
1973-74	"	258,314	280,627	538,941
School of Renewable Natural Resources				
1974-75	"	665,363	400,844	1,066,207
1975-76	"	562,576	479,099	1,041,675
1976-77	"	593,350	455,861	1,049,211
1977-78	"	864,629	501,169	1,365,798
1978-79	"	1,186,416	596,520	1,782,936
1979-80	"	866,597	633,375	1,499,972
1980-81	"	2,619,582	812,887	3,432,469
1981-82	"	2,723,294	871,792	3,595,086
1982-83	Estimate to July 1, 1983	3,311,436	931,531	4,242,967