

# North Dakota's Flora and Vegetation: A Longstanding Focal Point for Research, Teaching, and Management

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North Dakota's grasslands, wetlands, and scattered forests, which are a significant part of the state's resource base, have long attracted the attention of scientists. Initially, much of the attention was devoted to the flora, and the work (plant systematics) of documenting plant species occurrences, habitat requirements, species characteristics and species associations continues to the present. Examination of vegetation (plant ecology) and study of the use of natural vegetation in the sense of plant communities such as grasslands and forests began much later. These endeavors are complementary approaches to understanding the state's native plant life.

Botanists have come to North Dakota with varied backgrounds and interests, each adding a unique input to research, teaching and management.

Apparently the first plant collectors to reach North Dakota were John Bradbury and Thomas Nuttall. Their party ascended the Missouri River to the Knife River Indian Villages near present-day Stanton where they remained from June 22 to July 18, 1811. The plants collected on this trip were described in Pursh's **Flora Americae Septentrionalis**. An interesting account of the trip with a list of the more important plants collected is given by Mr. Bradbury in his **Travels in the Interior America**.

About mid-July 1839 a Company of U.S. Topographical Engineers under the command of I.N. Nicollet entered North Dakota through the valley of the James River, which they followed to near the mouth of Bone Hill Creek. They then went on a northeasterly course to the Sheyenne River near Valley City. From there they went to near present-day Devils Lake, then east along the North Fork of the Goose River, then south, leaving North Dakota near Lake Tewaunkon. Mr. Chas Geyer was the botanist on this expedition. Many of the plants collected on this trip were ultimately named by John Torrey, who is often referred to as the Father of American Botany.

In the summer of 1883, J.H. Leiberger, a well known grass systematist, collected along the Northern Pacific Railroad, mainly in western North Dakota. His collections are in the University of Minnesota Herbarium.

The earliest plant collections represented in the herbaria in North Dakota institutions are those of Professor C.B. Waldron. He came to North Dakota in August 1890 from Michigan Agricultural College to become Professor of Horticulture and Forestry, a position he held until 1945. Many of Waldron's collections are still in the NDSU Herbarium.

Professor H.L. Bolley came to NDAC as Professor of Botany and Zoology from Purdue University in 1890. He became Dean and Botanist with the North Dakota Agricultural Experiment Station. During the summers of 1891 and 1892 Professor Bolley spent most of his time in the field collecting native plants. His plants and those of Professor C.B. Waldron provide the basis for the NDSU Herbarium. Professor H.L. Bolley is noted for many contributions to North Dakota agriculture. He retired at NDSU in 1949.

In 1897 the Division of Agrotopology of the U.S. Department of Agriculture published Bulletin No. 6, **Grasses and Forage Plants of North Dakota**. This work was based largely upon collections made by Professor M.A. Brannon of the University of North Dakota. His collections provide the basis for the University of North Dakota Herbarium.

Lawrence Root "L.R." Waldron studied botany at NDAC under Professor H.L. Bolley, obtained his M.S. working with fishes at the University of Michigan, became associated with the NDAC Botany Department in 1899 and transferred to the Plant Breeding Program in 1905 where he continued until 1955. While with botany he collected native plants throughout North Dakota. Herbarium records indicate that he made noteworthy new collections in western North Dakota. Professor H.L. Bolley and L.R. Waldron published, in 1900, **A Preliminary List of Seed-bearing Plants in North Dakota**.

Beginning in the summer of 1906, a State Biology Survey was instituted as part of the Agricultural College Soil and Geological Survey which had been organized in 1901. Dr. W.B. Bell, who came from the University of Iowa in 1906, was in charge of the Biological Survey. Dr. Bell was a zoologist but his first duties were to collect plants. Herbarium records show that he collected plants from primarily Morton, McKenzie, Richland and Ransom Counties. Dr. Bell was allowed to collect zoological specimens from 1911 until he left NDAC in 1916. His botanical duties were taken over in 1911 by Herbert F. Bergman for the Biological Survey. Dr. Bergman's Ph.D. work was published in 1912 and was entitled, **Flora of North Dakota**.

Three especially noteworthy independent botanists should be mentioned here in connection with the early botanical survey of the state. Dr. J. Lunell was a physician

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and farmer who lived near Leeds. He collected plants in the Leeds vicinity and along the Great Northern Railroad to Minot. He published a flora of North Dakota. Dr. J.F. Brenckle was a physician in Kulm. He collected flowering plants from the Kulm area and contributed much to the botanical knowledge of the area. Mr. Clarence H. Waldron lived in Fargo and collected many native plants in North Dakota. He produced many new state records.

Following the passage of the pure seed law in North Dakota and the subsequent establishment of a state seed laboratory in Fargo, O.A. Stevens was hired in 1909 as Seed Analyst and Assistant Professor of Botany. Stevens obtained his B.S. degree at Kansas State University where he had worked with Dr. A.S. Hitchcock, a well-known agrostologist. He was definitely one of this country's true naturalists, for during his long career he published over 200 papers in more than 40 scientific journals. His articles ranged widely over aspects of bird, plant and insect life.

O.A. Stevens demonstrated to his students a keen interest in all living organisms. He was recognized internationally as an authority on bees and wasps, as well as for his work in plant systematics. He developed a herbarium at North Dakota State University that is very representative of North America through the collection of North Dakota plant specimens and the exchange of these specimens with other botanists throughout North America. He alone is responsible for about one-half of the 200,000 specimens in the North Dakota State University Herbarium.

O.A. Stevens completed his M.S. work at NDAC in 1926 and was given a Doctor of Science degree at NDSU in 1948 and an honorary Doctor of Science degree at UND in 1965. Stevens Hall, which houses Botany, Biology, Geography, Geology, and Zoology, is named after Dr. Stevens.

In 1950 with the support of the North Dakota Institute for Regional Studies (NDIRS), Dr. Stevens published his **Handbook of North Dakota Plants**. This publication represented the culmination of 40 years of careful collection, research, and interpretation of the vascular plants of the state, updating and expanding earlier plant systemic works. Dr. Stevens retired in 1956, but continued to serve NDSU as professor emeritus and as a curator for NDIRS until he moved to California because of his health in 1976. At the age of 94 Dr. O.A. Stevens died in Sacramento, California in January, 1979. He had spent nearly 70 years studying plants, birds, and insects in North Dakota and was and still is known as North Dakota's foremost naturalist.

The first trained plant ecologist at NDAC, Dr. Abraham Dietrich Stoesz, joined the Botany Department at NDAC in 1931. Although primarily an ecologist, he had broad training in the overall field of botany, having received the B.A. degree from Bluffton College in 1923, and the M.A. (1928) and Ph.D. degrees (1931) from the University of Minnesota. At that time he joined the NDAC faculty he was one of only two individuals offering instruction in the Botany Department. Plant ecology was not a regularly offered course in the department but was listed as an opportunity for specialized individual study at an advanced level.

Dr. Stoesz was an excellent teacher, much liked and respected by the students, many of whom joined him in field trips to the nearby lake and forest region of Minnesota and to the prairies of the Sandhills area along the Sheyenne River southwest of Fargo. He constantly encouraged his students to seek careers in plant-related fields, where botanical knowledge was essential. He himself carried on limited

research work in the Sandhills region, but his heavy teaching load prevented him from major research efforts.

In 1937 he left NDAC to join the Soil Conservation Service, U.S. Department of Agriculture, as a plant materials specialist, where he subsequently had a long and distinguished career. A scholarship was later established at NDSU by his family to commemorate his association with the University.

The real beginning of teaching and research in the general area of ecology as applied to grassland, range, and to a more limited extent woody vegetation, began at NDAC in 1930 with the appointment of Dr. Herbert Christian Hanson as Professor of Botany and Head of the Department of Botany. He also held a part-time appointment with the Experiment Station. Dr. Hanson earned the B.A. degree from the University of Minnesota (1914) and M.A. and Ph.D. degrees from the University of Nebraska (1916 and 1925). He had worked with Dr. F.E. Clements and Dr. J.E. Weaver, two of the major figures in plant ecology in the United States at that time. He came to NDSU from Colorado State University at Fort Collins, where he had been engaged in teaching and research in range ecology and management.

Dr. Hanson was a hard-driving, dynamic, energetic individual, with a passion for perfection in academic and field research studies. He was held in high esteem by his colleagues and professional associates in the field of plant ecology as evidenced by his election to the presidency of Ecological Society of America in 1938. In his teaching and research at NDSU he emphasized the application of ecological methods to practical problems in natural resource use and management. He instituted a formal three-quarter course in plant ecology immediately after his arrival and soon added a course in range management and improvement.

Students were attracted by his teaching and by his active encouragement of their training for employment in the area of applied ecology in such fields as range management, forestry, soil conservation, and resource management. At the same time he was particularly concerned with promoting advanced study in botanical fields for students he judged motivated toward and capable of attained advanced degrees. In a few short years Dr. Hanson recruited, trained and arranged placement for a number of students, who went on to distinguish themselves in their chosen careers.

Shortly after arriving at NDSU Dr. Hanson began field studies in the range area of western North Dakota, where a number of his students worked on these studies, several of them attaining masters degrees under his guidance. Most of these studies were supported primarily by the Experiment Station. Major areas of study included methods of range vegetation analysis, relation of vegetation types and plant production to specific soil types and site conditions, establishment of permanent plots for long term studies of weather and grazing effects on native vegetation, analysis of soil moisture conditions on specific range sites, and range re-seeding problems and practices.

Perhaps unfortunately, Dr. Hanson became involved in the "great purge" of 1937. The purge resulted in Dean H.L. Walster being relieved of his position as Director of the Experiment Station. In August of 1937 Dr. Hanson was appointed Director of the Experiment Station to succeed Dean Walster. Two years later in August of 1939 Dean Walster was reinstated as Experiment Station Director and Dr. Hanson was named Vice-Director. This obviously was not a very

satisfactory situation for either man, and shortly afterward (1940) Dr. Hanson left to become Director of the Matanuska Valley Resettlement Project in Alaska.

After a period of distinguished service on the Matanuska Project, where he continued ecological vegetation studies in addition to his other duties, Dr. Hanson returned to the lower states. He became Professor of Botany at Catholic University of America in Washington, D.C. Following retirement he moved to Berthoud, Colorado, where he died while busily engaged in an ecological study of front-range vegetation.

Dr. Warren C. Whitman was one of Dr. Hanson's students, beginning work on his M.S. degree under Dr. Hanson's direction in the summer of 1935. He received the M.S. degree in 1936 and went on to the University of Wisconsin for advanced work in plant physiology, receiving his Ph.D. degree in 1939. He was appointed to the regular NDSU staff as Assistant Botanist in the Experiment Station in 1938. For the next 40-some years, with time for military service in World War II and a year with the U.S. Forest Service at Miles City, Montana, Dr. Whitman was to carry on and expand the research and teaching efforts in applied ecology begun by Dr. Hanson.

Over the years Dr. Whitman's primary work was with the Experiment Station, although he also had extensive duties in teaching and administration in the academic area. The principal emphasis of Dr. Whitman's work was in the development of the field of plant ecology as applied to the management of northern plains rangelands. The work of Dr. Whitman and his students was centered at and in the vicinity of the Dickinson Experiment Station and the Little Missouri National Grasslands in western North Dakota.

One of the early trials established at the Dickinson station in cooperation with the NDSU Department of Animal Husbandry was on levels of carotene, protein, and phosphorus in range grasses as related to animal nutrition. Through the cooperation of the Dickinson Experiment Station Superintendents, Raymond J. Douglas and later Thomas J. Conlon, a number of other range and pasture grazing trials were established beginning in the early 1950s. Grazing studies have since become an integral and expanded part of the program of range research in this area.

Areas of special studies in the Dickinson region included grazing trials with pasture fertilization, pasture combinations utilized with native range, range fertilization effects, and long-time comparisons of grazing effects on range composition. Many basic range ecology studies were undertaken by Dr. Whitman and his students, especially in the area of range production in relation to species composition of the vegetation and site characteristics. A special area of study on which a number of students worked was microclimatic effects and energy relations in range plant communities. Studies of distribution and composition of woody vegetation types in this primarily grassland area, with special reference to wildlife uses were carried out. Problems of revegetation of reclaimed mined land with native plant species were investigated.

In the area of range management teaching, Dr. Whitman added a number of specific courses in various aspects of scientific and applied range management, until a total of eight courses in this area were available and being taught. These courses, in combination with additional courses in plant taxonomy and plant ecology plus offerings in soils and animal science, were more than adequate to provide an academic major in the range management field at NDSU. Additional

personnel were recruited to aid in the expanded range management area. Much of the work in this area was offered at the graduate level and numerous students secured M.S. and Ph.D. degrees under Dr. Whitman and others teaching and conducting research in this field.

Dr. Whitman, as Chairman of the Botany Department, retired on June 30, 1976. He continued employment in a non-administrative capacity until age 70. During this period he worked primarily for the Experiment Station, being involved in grant-funded work, the North Dakota Regional Environmental Assessment Program, and the Tri-College University. He has remained active in a non-official capacity to the present time.

Dr. Loren David Potter contributed substantially to the description and ecological understanding of northern plains vegetation. Dr. Potter was graduated from NDSU with a major in Botany in 1940. He received the M.S. at Oberlin College in 1946, working under Paul Sears, and earned his Ph.D. at the University of Minnesota in 1948. He was appointed to the NDSU staff in 1947.

Dr. Potter immediately established a reputation as an excellent, fair, and demanding teacher. One of the strongest aspects of his ecological teaching was his ability to impart knowledge of plant ecology in the field. Many of his students still remember the great experience of learning from him on the extensive field trips through the western range country.

While in North Dakota Dr. Potter conducted several field studies, the best known of which probably are his studies of the ponderosa pine and the limber pine areas of the Badlands in western North Dakota and the woodland vegetation of the Turtle Mountain region.

In 1955-56 Dr. Potter took sabbatical leave and conducted a phytosociological study of the San Augustin Plains in New Mexico. The results of this study were reported in a classical paper published in *Ecological Monographs* in 1957. Two years later he left NDSU to become Chairman of the Department of Biology at the University of New Mexico, Albuquerque. In his work in New Mexico he was very active in ecological research, with much of his later activities being concerned with Lake Powell and the surrounding area on the Colorado River in Arizona. He retired in 1985, but has continued actively writing and conducting field studies since that time.

Dr. D. Ross Moir came to the NDAC Botany Department in 1952, having been earlier educated at the University of Manitoba. Between then and 1966, when we entered private business with family members, his masterful teaching was an important input to students who, in various ways, would deal with the regional plant life. He carried out plant collections with Dr. Stevens and worked with Dr. Loren Potter on the first detailed study of the Turtle Mountain forests. For several years he also did research in northern Canada and was one of the earliest researchers in the Midwest to receive National Science Foundation funding for ecological research.

Dr. Robert L. Burgess, a plant ecologist trained at the University of Wisconsin, served the NDSU Botany Department from 1963 to 1970. He and several graduate students contributed significantly to our ecological understanding, including studies of vegetation change in the sandhills area of southeastern North Dakota, forests along the Sheyenne River, Red River, and Missouri River, wetlands of the Turtle Mountains, and conditions within shelterbelts. He was an articulate, forceful spokesman for appropriate land and water



management practices. Subsequently, he worked for a decade at the Environmental Sciences Division of Oak Ridge National Laboratory (Tennessee) as a senior researcher and administrator. Since 1981 he has been Professor and Chairman of Environmental and Forest Biology at the State University of New York College of Environmental Science and Forestry in Syracuse.

Dr. Harold Goetz joined the NDSU faculty in 1964. Dr. Goetz was one of Dr. Whitman's students in range management and range ecology, receiving his B.S. degree in 1960 and his M.S. degree in 1963. While on the NDSU staff, he continued work in range science for the Ph.D. degree at Utah State University, receiving the degree in 1968. Dr. Goetz was a native North Dakotan, having grown up on a ranch near Halliday. At NDSU Dr. Goetz further expanded a Experiment Station program in range research and the range ecology and management teaching operations of the Botany Department. Under his guidance the graduate program continued to develop and numerous M.S. and Ph.D. degrees in the general area of range ecology and range science were awarded.

The range research program carried on by Dr. Goetz and his students was largely under Experiment Station sponsorship, but an increasingly large proportion of the work was funded by grants from outside agencies, especially the U.S. Forest Service. Dr. Goetz' early work was concerned with basic studies of range plant growth and development. He expanded work on range fertilization and range improvement through mechanical treatments and interseeding. The soil aspects of range improvement received increasing attention as the program developed.

As the research program continued to expand, considerable effort was put into the characterization of range habitat types in western North Dakota with special concern for the evaluation of both grassland and woody types as related to range condition and trend. Dr. Goetz and his students were much interested in the characterization of tree and shrub habitats in the primarily grassland area of western North Dakota and the importance of these types to big game and other wildlife of the region.

The addition of new grassland and range experimental ranches in the Coteau region near Streeter and on the Missouri Plateau near Manning required the development of new research plans. Dr. Goetz had major responsibilities in developing plans for the expanded grazing studies at these stations.

At the same time that he was heavily involved in the range research program, Dr. Goetz was continuing to teach and to become involved in academic administration. Dr. Goetz was an excellent teacher, well-liked by students and respected by his colleagues. It was apparent early in his career that Dr. Goetz had special aptitude and capacity for administrative work. He became Chairman of Department of Botany in 1975. He served as Acting Dean of the College of Science and Mathematics in 1980-81. He received the student-sponsored Blue Key Doctor of Service Award in 1983. In 1985 he went to Colorado State University at Fort Collins as Chairman of the Department of Range Science. In this capacity he directs the teaching and research activities of one of the leading departments of range science in the United States.

Dr. William T. Barker, a plant systematist and ecologist, came to NDSU in 1968 from the University of Kansas in Lawrence, where he worked under Dr. R.L. McGregor. Upon his arrival he began working on a systematic survey of

the flora of North Dakota with the help of his graduate students. Over 25 of the state's 53 counties have had recent floristic surveys as a result of this work. In addition, a **Manual of North Dakota Wetland Plants** has been produced. Dr. Barker was a member of the Great Plains Flora Association that has produced two books, **Atlas of the Great Plains Flora** and **The Great Plains Flora**. The latter book won the American Botanical Society's H.A. Gleason Award for the outstanding plant systematics or plant ecology publication for 1986. Dr. Barker and his students have added over 100,000 herbarium specimens to the NDSU Herbarium. Dr. Barker is currently working on a revision of Dr. O.A. Steven's book for the North Dakota flora. To aid with this project a computer data bank is being developed so that all the specimen data of the NDSU Herbarium can be easily retrieved.

In 1969, motivated by a strong interest in the application of botanical and ecological techniques to the solution of practical range problems, Dr. Barker began working with the Sheyenne Valley Grazing Association and the U.S. Forest Service in the Sheyenne National Grasslands in southeastern North Dakota. Research interests here have included plant community analysis, prescribed burning, mowing, fertilization, grazing systems, grassland utilization and production, and habitat requirements for prairie chickens.

Dr. Barker helped develop range research plans and establish the Central Grassland Research Station (CGRS). In 1979 he began studies with his graduate students at CGRS on plant community analysis, grassland production and utilization, grazing systems, and upland nesting bird success.

Dr. Donald R. Scoby joined the NDSU Botany Department in 1967 while completing his Ph.D. with Dr. Whitman. Prior to then he had worked in secondary science teaching in Kansas and Colorado. His thesis, "Utilization of radiant energy in mixed grass prairie," was one of several done in the late 1960s and early 1970s near Dickinson, which greatly expanded our understanding of grassland functional processes. Subsequently, his efforts went in three major directions. Over a 22-year period he taught an estimated 20,000 students in a range of biology courses. He led science education efforts in the state, supervising student teachers, consulting with teachers, organizing the North Dakota Junior Academy of Science, and more recently, orchestrating a statewide Science Olympiad. Throughout his career he emphasized ecological principles for proper resource management. The so-called biological farming he and his wife carried out, in addition to their teaching careers, predated the now widely discussed practice of low input sustainable agriculture. Dr. Scoby retired from NDSU in 1989 and now teaches part-time at Moorhead State University.

Dr. Gary K. Clambey, who had received part of his education at NDSU before serving in the U.S. Army, completed his Ph.D. at Iowa State University and returned to the NDSU Botany Department as an ecologist in 1974. His teaching includes undergraduate and graduate courses in plant ecology, together with courses in environmental science, general ecology, and biogeography. He and graduate students have studied forests, remnant grasslands, and shelterbelts in the southern Red River Valley region. Earlier work was done with planning for energy development and environmental impacts in west-central North Dakota. In that same region he has investigated vegetation in the Knife River area for the National Park Service. In 1986 he was co-editor of the **Proceedings of the Ninth North American Prairie Conference**. The wetland research begun earlier in Iowa has continued in a project concerning design of a flood control system on a tributary of the Red River. He is also

concerned with other aspects of water management, including interbasin water diversion and possible ecological consequences. An ongoing teaching and research endeavor is development of a geographic transect model for illustrating principles of ecology and resource management.

Mr. Paul E. Nyren received his M.S. degree in Range Science at Washington State University in 1975. He came to North Dakota in 1975 to work on mine land reclamation for NDSU at the USDA-ARS Research Station in Mandan. In October 1975 he joined the NDSU faculty as Assistant Botanist at the Dickinson Experiment Station. Then in 1981 Paul became the Superintendent at the newly created Central Grassland Research Station. His research interests are mine land reclamation, range interseeding, range fertilization, grassland utilization and production, livestock production, grazing systems, seedbed preparation, range plant variety trials, remote sensing to monitor range condition and the design of range equipment.

Dr. Don Kirby received his Ph.D. from Texas A & M University and joined the NDSU faculty in 1980 because of his research expertise and interest in rangeland grazing systems, especially short duration grazing. Since 1981, he has researched short duration grazing at the Dickinson Experiment Station and Central Grasslands Research Station. He has reported on the effects of grazing on various plant communities and species, multispecies livestock grazing, livestock performance and production and wildlife use of grazed lands. Additional research interests of Dr. Kirby have included biological control of leafy spurge, wetland ecology, and reclamation of rangelands on mined lands. His future research directions will include improving environmental quality, increasing productivity of rangelands, and biological control of noxious plants.

Dr. Llewellyn L. Manske received his Ph.D. from NDSU in 1980 and joined the Botany Department as Range Botanist at the Dickinson Experiment Station. In 1985 he became an Assistant Professor in the Animal and Range Sciences Department. He has studied the habitat requirements and population dynamics of the greater prairie chicken in the Shewenne Grasslands. At the Dickinson Experiment Station he has been interested in range plant phenology, grazing systems, grassland production, livestock production, grassland nutrient cycling, rhizosphere biology, range interseeding and control of noxious weeds.

Dr. Mario E. Biondini received his Ph.D. from Colorado State University in 1984 and joined the Animal and Range Sciences Department in July 1986. His broad area of research interest is the study, analysis and modeling of grassland and wetland ecosystems. Specifically he is interested in the interrelationships among primary producers, grazers and decomposers in carbon and nutrient cycling; landscape level aspects of plant community structure and dynamics; and use of multivariate statistics, mathematical analysis and dynamic models in the study of ecosystem structure and function.

Dr. Carolyn E. Grygiel received her Ph.D. from Colorado State University in 1983 and joined the Animal and Range Sciences faculty in 1990 as a Research Associate/Instructor. Her major research interests are plant and landscape ecology, autecology and plant systematics. The projects she is currently working on involve landscape ecology and hierarchical theory as they relate to the prairie ecosystem and landscape level aspects of plant community structure and dynamics as they relate to wetland ecosystems.

The botanical knowledge for North Dakota is far from being complete. The next century offers many challenges for future botanical work.