

**RECLAMATION RESEARCH IN NORTH DAKOTA**

**PART B**

**RESEARCH PUBLICATION BRIEFS**

**WILDLIFE AND WETLANDS (WL)**

**Title:** THE USE OF THE AIRPLANE IN WILDLIFE HABITAT IMPROVEMENT

**Author:** R.N. Bach

**Organization:** North Dakota State Game and Fish Department, Bismarck ND

**Format:** Report

**Reference:** North Dakota State Game and Fish Department, Division of Federal Aid, Project 7R, 1945

**Key Index Words:** Wildlife Habitat, Revegetation, AML

**Brief Description**

This report evaluates the preliminary results of aerial plantings tested near the Wilton Mine (McLean and Burleigh Counties, ND) in the spring of 1945.

**Analysis of Conclusions**

This is one of the earliest attempts at aerial planting made at an abandoned mined land in North Dakota.

**Title:** THE USE OF THE AIRPLANE IN WILDLIFE HABITAT IMPROVEMENT

**Author:** R.W. Stuart

**Organization:** North Dakota State Game and Fish Department, Bismarck ND

**Format:** Report

**Reference:** North Dakota State Game and Fish Department, Division of Federal Aid, Project 7R, 1947

**Key Index Words:** Wildlife Habitat, Revegetation, AML

**Brief Description**

This report provides a brief description of the techniques used in aerial planting around the Wilton Mine in the year 1946

**Analysis of Conclusions**

This is one of the earliest attempts at aerial planting made at an abandoned mined land in North Dakota.

**Title:** A PRELIMINARY SURVEY AND PROPOSED DEVELOPMENT PLAN FOR WILTON MINE GAME MANAGEMENT AREA

**Author:** C.R. Odin

**Organization:** North Dakota State Game and Fish Department, Bismarck, ND

**Format:** Report.

**Reference:** North Dakota State Game and Fish Department, Pittman-Robertson Division, Project W-39-R-2, 1955

**Key Index Words:** Wildlife Habitat, AML

**Brief Description**

This report discusses the results of a survey that was conducted during the summer and fall of 1954 to initiate a plan for future reclamation and development of Wilton Mine Game Management area (Burleigh and McLean counties, ND).

**Analysis of Conclusions**

The information provided in this report should be useful for the reclamation of abandoned mine lands.

**Title:** DEVELOPMENT AND EVALUATION OF CUSTER MINE GAME MANAGEMENT AREA, 1955-1956

**Author:** W. Boldt

**Organization:** North Dakota State Game and Fish Department, Bismarck, ND

**Format:** Report

**Reference:** North Dakota State Game and Fish Department, Pittman-Robertson Division, Project W-39-R-3, Job 3., 1957

**Key Index Words:** Revegetation, AML, Wildlife Habitat

**Brief Description**

This report discusses the results of some reclamation work conducted at the Custer Mine, near Garrison, ND, by the State Game and Fish Department during 1955 and 1956. The reclamation operations at this abandoned mine included spoil leveling, tree and shrub planting, and habitat evaluation.

**Analysis of Conclusions**

This study is relevant to abandoned mine land program in North Dakota.

**Title:** DEVELOPMENT AND EVALUATION OF CUSTER MINE GAME MANAGEMENT AREA, 1956-1957

**Author:** G.W. Enyeart

**Organization:** North Dakota Game and Fish Department, Bismarck, ND

**Format:** Report

**Reference:** North Dakota Game and Fish Department, Pittman-Robertson Division, Project W-37-R-4, Job 3, 1957

**Key Index Words:** Revegetation, Wildlife Habitat, AML

### **Brief Description**

Tree and shrub planting methods, vegetation counts, and evaluation of planting success are included in this progress report of the reclamation effort at the Custer Mine, six miles east of Garrison, ND. The reclamation work was conducted by the State Game and Fish Department during 1956 and 1957.

### **Analysis of Conclusions**

The information contained in this report should be useful for the reclamation of abandoned mine lands.

**Title:** A PRELIMINARY SURVEY AND PROPOSED DEVELOPMENT PLAN  
FOR CUSTER MINE GAME MANAGEMENT AREA

**Author:** C.R. Odin

**Organization:** North Dakota Game and Fish Department, Bismarck, ND

**Format:** Report

**Reference:** North Dakota Game and Fish Department, Pittman-Robertson Division,  
Project W-39-R-2, 1957

**Key Index Words:** Wildlife Habitat, AML, Revegetation

### **Brief Description**

This report contains the preliminary findings of the Game and Fish Department at the Custer Mine, six miles east of Garrison, ND. A spoilbank slope survey and a vegetation inventory were conducted in the summer and fall of 1954. Soil samples for laboratory analysis were also collected. Recommendations are made as to the direction the reclamation of this area should take.

### **Analysis of Conclusions**

The information contained in this report should be useful for the reclamation of abandoned mine lands.

**Title:** ANNUAL PROGRESS REPORT OF CUSTER MINE GAME MANAGEMENT AREA (LIGNITE SPOIL PILES)

**Author:** G.W. Enyeart

**Organization:** North Dakota Game and Fish Department, Bismarck, ND

**Format:** Report

**Reference:** North Dakota Game and Fish Department, Pittman-Robertson Division, Project W-39-R-5, Job 8, 1958

**Key Index Words:** Revegetation, Wildlife Habitat, AML

### **Brief Description**

Tree and shrub planting methods, vegetation counts and evaluation of planting success are included in this progress report of the reclamation effort at the Custer Mine, near Garrison, ND. The reclamation work was conducted by the State Game and Fish Department during 1957 and 1958.

### **Analysis of Conclusions**

The information contained in this report should be useful for the reclamation of abandoned mine land.

**Title:** DEVELOPMENT AND EVALUATION OF CUSTER MINE GAME MANAGEMENT AREA

**Author:** G. James

**Organization:** North Dakota Game and Fish Department, Bismarck, ND

**Format:** Report

**Reference:** North Dakota Game and Fish Department, Pittman-Robertson Division, Project W-39-R-6, Job 3, 1960

**Key Index Words:** Wildlife Habitat, AML, Revegetation

### **Brief Description**

Tree and shrub planting methods, vegetation counts, and evaluation of planting success are included in this progress report of the reclamation effort at Custer Mine, six miles east of Garrison, ND. The reclamation work was conducted by the State Game and Fish Department during 1958 and 1959.

### **Analysis of Conclusions**

The information provided in this report should be useful for the reclamation of abandoned mine lands.

**Title:** RECLAIMING STRIP MINED LANDS IN NORTH DAKOTA BY ESTABLISHING GAME MANAGEMENT AREAS.

**Author:** T.A. Gwynn

**Organization:** Knife River Coal Mining Company, Bismarck, ND

**Format:** Report

**Reference:** Knife River Coal Mining Company Progress Report, 41 p., January 1965

**Key Index Words:** Revegetation, Spoil Properties, Wildlife Habitat

**Brief Description**

This is a progress report discussing the techniques and success of reclamation efforts involving soil tests and spoil analyses, experimental planting, and habitat evaluation. The reclamation work reported took place from 1963 through 1964 at Knife River Coal Company's North Beulah and South Beulah mines in North Dakota, and was conducted in cooperation with the various state and federal agencies.

**Analysis of Conclusions**

This information on pre-law reclamation techniques may be useful for revegetation of abandoned mined lands.

**Title:** A PROGRESS REPORT - RECLAIMING STRIP MINED LAND BY ESTABLISHING GAME MANAGEMENT AREAS

**Author:** T.A. Gwynn

**Organization:** Knife River Coal Mining Company, Bismarck, ND

**Format:** Report

**Reference:** Knife River Coal Mining Company Progress Report, 27 p., July 1966

**Key Index Words:** Revegetation, Wildlife Habitat

**Brief Description**

This progress report discusses the techniques and success of reclamation efforts involving experimental leveling, tree, crop and grass planting, and habitat evaluation. The reclamation work was conducted from 1963 to 1966 at the North Beulah, South Beulah, Wilton, Underwood, and Gascoyne mining areas of North Dakota and the Savage Mine in Montana. Wildlife moving into planted areas was causing some damage to the trees, but willows seemed to be spreading enough to give extensive browsing for deer.

**Analysis of Conclusions**

This information on pre-law reclamation techniques may be useful for revegetation of abandoned mined lands.

**Title:** CLASSIFICATION OF NATURAL PONDS AND LAKES IN THE  
GLACIATED PRAIRIE REGION

**Authors:** R.E. Stewart and H.A. Kantrud

**Organization:** Northern Prairie Wildlife Research Center, Division of Wildlife Research, U.S.  
Fish and Wildlife Service, Jamestown, ND

**Format:** Report

**Reference:** Bureau of Sport Fisheries and Wildlife Resource Publication 92, 1971

**Key Index Words:** Wetlands, Prairie Potholes, Vegetation, Water Quality, Wildlife

### **Brief Description**

This is the guide by which wetlands in the Prairie Pothole Region are classified. Seven "classes" are denoted. These include ephemeral ponds (Class I), temporary ponds (Class II), seasonal ponds and lakes (Class III), semipermanent ponds and lakes (Class IV), permanent ponds and lakes (Class V), alkali ponds and lakes (Class VI) and fen (alkali bog) ponds (Class VII). These classes may be further subdivided into subclasses based on average salinity of surface water. These subclasses are fresh (Subclass A), slightly brackish (Subclass B), moderately brackish (Subclass C), brackish (Subclass D) and subsaline (Subclass E). Vegetative cover may be used to further characterize a wetland.

### **Analysis of Conclusions**

The question of what constitutes a reclaimed wetland is still open for discussion. The use of this classification standard will help wetland specialists to relate what is reclaimed to what occurs naturally.

**Title:** VEGETATION OF PRAIRIE POTHoles, NORTH DAKOTA, IN RELATION TO QUALITY OF WATER AND OTHER ENVIRONMENTAL FACTORS

**Authors:** R.E. Stewart and H.A. Kantrud

**Organization:** U.S. Bureau of Sport Fisheries and Wildlife in collaboration with the U.S. Geological Survey

**Format:** Paper

**Reference:** Geological Survey Professional Paper 585-D, 1972

**Key Index Words:** Wetlands, Prairie Potholes, Vegetation, Water Quality

### **Brief Description**

Salinity and water permanence are the primary factors which control the type and extent of wetland vegetation associated with prairie potholes in North Dakota. Vegetation typically occurs in concentric bands around and within these wetlands. Vegetational types include low-prairie, wet-meadow, shallow-marsh emergent, deep-marsh emergent, fen emergent, submerged and floating, natural drawdown, cropland drawdown, and cropland tillage vegetation.

### **Analysis of Conclusions**

This is the classic treatise on wetland vegetation associated with prairie potholes. The proposition that salinity and water permanence are the principal contributing factors to wetland vegetative establishment is of penultimate significance in the contemplated design of reclaimed wetlands.

- Title:** AQUATIC INVERTEBRATES AND WATER CHEMISTRY OF STRIP MINE IMPOUNDMENTS IN WESTERN NORTH DAKOTA
- Author:** D.L. Batema
- Organization:** University of North Dakota, Grand Forks, ND
- Format:** M.S. Thesis
- Reference:** M.S. Thesis, Biology Department, University of North Dakota, Grand Forks, ND, 1979
- Key Index Words:** Wetlands, Impoundments, Water Quality, Trace Elements, Fauna

### **Brief Description**

The chemical and biological properties of mine impoundments (ponds) in Mercer County, ND were studied. Samples of water, bottom sediments and the spoil surrounding the ponds were analyzed for twenty-seven (27) chemical variables. Invertebrate species were identified and their biomass and diversity measured. The water in the mine impoundments was relatively high in sodium and sulfate ions, but their levels were within the normal range for alkaline ponds in North Dakota. No trace element problems were noted. The common phyla in these ponds were Mollusca and Arthropoda. The class insecta comprised about 10% of all species identified.

### **Analysis of Conclusions**

This study revealed that the chemical composition in the mine impoundments studied was not drastically different than what is found in many alkaline ponds in North Dakota. No heavy metal toxicity problems were reported. The conclusion drawn was that ponds on surface mined lands will tend to resemble naturally occurring ponds, both chemically and biologically, within a few years.

**Title:** ECOLOGY OF WETLAND VEGETATION ON SELECTED STRIP MINE PONDS AND STOCKDAMS IN THE NORTHERN GREAT PLAINS

**Author:** R.A. Olson

**Organization:** Department of Botany, North Dakota State University, Fargo, ND

**Format:** Ph.D. Dissertation

**Reference:** Ph.D Dissertation, North Dakota State University, Fargo, ND, 1979

**Key Index Words:** Wetlands, Vegetation, Impoundments, Stockdams

### **Brief Description**

Wetland plant communities of strip mine ponds and stockdams were studied through intense field sampling during 1976-1978. Floristically, stockdams were richer with 106 vascular plant species identified in 28 families compared to 76 species in 20 families from strip mine ponds. The magnitude of summer drawdown and basin slope are major factors determining wetland community attributes.

### **Analysis of Conclusions**

This study confirms the importance of pond morphometry as a primary factor to enhance the potential for wetland vegetation reestablishment. This seminal study on the reasons for wetland plant community development on mine sites has had a strong bearing on the engineering design of proposed reclaimed wetlands.

**Title:** AQUATIC HABITAT OF WETLANDS, PONDS, AND LAKES OF SEMIARID REGIONS: AN ANNOTATED BIBLIOGRAPHY OF SELECTED LITERATURE

**Author:** C.L. Hawkes

**Organization:** Rocky Mountain Forest and Range Experiment Station, U.S. Forest Service, Rapid City, SD

**Format:** Report

**Reference:** NTIS PB81 131 682, 1980

**Key Index Words:** Wetlands, Vegetation, Wildlife Habitat, Fish

### **Brief Description**

This bibliography was prepared to meet the needs of both research and management groups interested in developing water quality guidelines and design and management requirements for water impoundments in strip mine areas in the Northern Great Plains. Emphasis in selecting literature was placed on the following topics: water quality, rooted aquatic and wet meadow vegetation, phytoplankton, zooplankton, waterfowl, fish, other wildlife, and design and management of impoundments and associated plants and animals.

### **Analysis of Conclusions**

Annotated bibliographies are extremely useful tools for both the experienced and beginning wetland reclamation specialist. Several citations within this particular report deal with work conducted in North Dakota.

**Title:** BREEDING BIRDS OF NATURAL WOODLAND, SHELTERBELTS AND ORPHAN MINE SPOILS IN SOUTHWESTERN NORTH DAKOTA

**Author:** G.A. Hiemenz

**Organization:** North Dakota State University

**Format:** M.S. Thesis

**Reference:** M.S. Thesis, Department of Zoology, North Dakota State University, Fargo, ND, 38 p., 1981

**Key Index Words:** Fauna, AML, Wildlife Habitat

### **Brief Description**

Thirty-nine breeding birds were recorded within selected natural woodlands, tree plantings and mine spoils in southwestern North Dakota. Hardwood draws exhibited the highest number of breeding birds, followed by shelterbelts, mine spoils, and prairie. The prairie area served as a control area. Bird species diversity and density were correlated with foliage height, diversity and total vegetation cover.

### **Analysis of Conclusions**

This study indicates why foliage diversity and cover are important parameters for wildlife diversity. These results support the current regulatory emphasis on the reestablishment of both tree diversity and herbaceous cover for wildlife use.

**Title:** A HANDBOOK FOR MEETING FISH AND WILDLIFE INFORMATION NEEDS TO SURFACE MINE COAL

**Authors:** C.R. Hinkle, R.E. Ambrose, and C.R. Wenzel

**Organization:** Science Applications, Inc, Oak Ridge, TN, for the Office of Surface Mining and Office of Biological Services, Washington, D.C.

**Format:** Reference Handbook

**Reference:** FWS/OBS 79/48.3.5, February 1981

**Key Index Words:** Wildlife Habitat, Fish

### **Brief Description**

This handbook contains information that will assist people in protecting, enhancing, and reducing impacts to fish and wildlife resources during the surface mining of coal. It specifically gives information pertaining to consideration of fish and wildlife resources in the pre-mining, mining, reclamation, and compliance phases of surface mining. Several appendices provide information on agency contacts, technical references, and sources of plant materials for revegetation.

### **Analysis of Conclusions**

The contextual elements of a fish and wildlife plan are presented complete with examples. This handbook would be useful to coal companies which are planning a wildlife inventory for a life-of-mine operation.

**Title:** WETLAND HYDROLOGY: STATE-OF-THE-ART AND ANNOTATED BIBLIOGRAPHY

**Author:** J.A. Leitch

**Organization:** Agricultural Experiment Station, North Dakota State University, Fargo, ND

**Format:** Report

**Reference:** North Dakota Research Report No. 82, July 1981

**Key Index Words:** Hydrology, Wetlands, Bibliography

### **Brief Description**

This paper reviews the literature on the hydrologic aspects of prairie potholes and suggests areas of needed research. Five areas discussed are: 1) flood control, 2) erosion control, 3) sediment entrapment, 4) groundwater recharge, and 5) water supply. Additionally, an annotated bibliography is provided.

### **Analysis of Conclusions**

Since probable hydrologic consequences (PHC) are of paramount importance as justification for the reestablishment of wetlands, this report is particularly useful as a background text.

**Title:** SOILS, MICROBIOLOGY, AND CHEMISTRY OF PRAIRIE WETLANDS: RESEARCH METHODS AND ANNOTATED BIBLIOGRAPHY

**Author:** L.A. Ogaard

**Organization:** Agricultural Experiment Station, North Dakota State University, Fargo, ND

**Format:** Report

**Reference:** North Dakota Research Report No. 84, July 1981

**Key Index Words:** Microbiology, Wetlands, Bibliography

### **Brief Description**

The broad topics of wetland soils, wetland microbiology, and wetland chemistry are briefly discussed. Potential research and the methods one might employ to implement this research are provided along with a selected annotated bibliography.

### **Analysis of Conclusions**

This report underscores the paucity of information regarding the soils, microbiology, and chemistry of prairie pothole wetlands. This is a background text for the wetland reclamation specialist.

**Title:** WETLAND VEGETATION OF THE PRAIRIE POTHOLE REGION:  
RESEARCH METHODS AND ANNOTATED BIBLIOGRAPHY

**Author:** L.A. Ogaard

**Organization:** Agricultural Experiment Station, North Dakota State University, Fargo, ND

**Format:** Report

**Reference:** North Dakota Research Report No. 85, July 1981

**Key Index Words:** Vegetation, Wetlands, Prairie Potholes, Bibliography

### **Brief Description**

Primary production, nutrient cycling and plant distribution are topics briefly addressed in this report. Both the methods to measure these phenomena and suggested basic research needs are presented. An annotated bibliography surveys literature germane to the Prairie Pothole Region.

### **Analysis of Conclusions**

For the neophyte in wetland vegetation this document provides an overview of past and potential research. The literature survey is a starting point on which to base a wetland reclamation plan.

**Title:** THE FAUNA OF THE PRAIRIE WETLANDS: RESEARCH METHODS AND ANNOTATED BIBLIOGRAPHY

**Author:** L.A. Ogaard

**Organization:** Agricultural Experiment Station, North Dakota State University, Fargo, ND

**Format:** Report

**Reference:** North Dakota Research Report No. 86, July 1981

**Key Index Words:** Wetlands, Fauna, Bibliography

**Brief Description**

The subjects of waterfowl, non-game birds, mammals and poikilothermic vertebrates and invertebrates are briefly addressed. An annotated bibliography of selected published literature in support of these and other wetland related topics is provided.

**Analysis of Conclusions**

This is an overview of the types of animals associated with prairie wetlands. This could be a general guide to what fauna one could potentially expect on reclaimed wetlands.

**Title:** SOCIOECONOMIC VALUES OF WETLANDS: CONCEPTS, RESEARCH METHODS, AND ANNOTATED BIBLIOGRAPHY

**Author:** J.A. Leitch

**Organization:** Agricultural Experiment Station, North Dakota State University, Fargo, ND

**Format:** Report

**Reference:** North Dakota Research Report No. 81, August 1981

**Key Index Words:** Wetlands, Bibliography

### **Brief Description**

This report presents concepts and methods associated with estimating wetland values, and a selected, annotated bibliography in the area of socioeconomics. Three research projects are suggested as part of an overall, comprehensive systems approach to the question of wetland valuation.

### **Analysis of Conclusions**

Although the contents of this report have little bearing on the physical and biological reclamation of wetlands, the "value" of a wetland has a profound influence on whether that wetland will be reclaimed. The concepts presented could further bolster the commitment to reclaim wetlands from the standpoint of both private industry and the state regulatory agency.

**Title:** WETLAND FORAGE: IMPORTANCE IN A DROUGHT YEAR

**Author:** L.A. Ogaard

**Organization:** Department of Agricultural Economics, North Dakota State University, Fargo, ND

**Format:** Report

**Reference:** NDSU-Agricultural Economics Miscellaneous Report No. 36, 1981

**Key Index Words:** Wetlands, Drought

### **Brief Description**

A telephone survey of farmers and ranchers was conducted in early 1981 to assess the importance of wetland forage to these agriculturists during a drought, the summer of 1980. Conclusions drawn included: 1) most farmers using wetland hay would experience financial loss in very dry years if it were not available, 2) the magnitude of loss would be highly variable, 3) a significant amount of wetland hay was harvested in the 1980 drought, 4) most of the respondents did not intend to drain their wetlands, and 5) the per acre value of this wetland hay (total replacement value divided by total acres harvested) came to \$64.44.

### **Analysis of Conclusions**

Wetlands provide a multiplicity of uses. One such use is hayland. This study confirms the importance of this forage source to agriculturists during a dry year. This is a potential value accrued to a surface owner when wetlands are reclaimed.

**Title:** PRACTICES FOR PROTECTING AND ENHANCING FISH AND WILDLIFE ON COAL SURFACE MINE LAND IN THE POWDER RIVER - FORT UNION REGION

**Authors:** B.R. Proctor, R.W. Thompson, J.E. Bunin, K.W. Fucik, G.R. Tamm, and E.G. Wolf

**Organization:** Science Applications, Inc., for Western Energy Land Use Team (WELUT), U.S. Fish and Wildlife Service in cooperation with Bureau of Mines

**Format:** Handbook

**Reference:** FWS/OBS-83/10, 1983

**Key Index Words:** Wildlife, Mining Impacts

### **Brief Description**

This handbook for mid-level managers, field inspectors and mine reclamation specialists was written to identify the points at which fish and wildlife resources can be protected and enhanced on a regional basis during the various phases of mine development and reclamation.

### **Analysis of Conclusions**

This document is a practical guide by which fish and wildlife resources may be protected and enhanced during coal mining activities. This would be a useful tool to assist mining companies in the preparation of wildlife management plans.

**Title:** THE IMPORTANCE OF RIPARIAN VEGETATION COMMUNITIES IN COLORADO, MONTANA, WYOMING, AND NORTH DAKOTA

**Author:** S.A. Young

**Organization:** Reclamation Research Unit, Montana State University, Bozeman, MT

**Format:** Paper

**Reference:** Proceedings of the Coal Development Workshops, Grand Junction, CO and Casper, WY, Vol.II, pp. 1087-1164, July 1983

**Key Index Words:** Riparian Vegetation, Surface Water, Groundwater

### **Brief Description**

Riparian vegetation associated with North Dakota wetlands, wet meadows, subirrigated and overflow sites, saline lowlands, and the Missouri River are characterized. The author indicates that riparian zones are particularly sensitive to disturbance and are unique from a reclamation standpoint because of their association with surface and/or groundwater systems.

### **Analysis of Conclusions**

This paper emphasizes the importance of surface and/or groundwater to the reclamation of riparian vegetation. The "groundwater connection" may take a long time to establish, and this time delay may or may not impinge on the reclamation process of riparian vegetation. The importance of adequate water supply to the vitality of wetlands is a strong consideration in reconstructing watersheds of sufficient size to "fuel" the reclaimed wetland.

**Title:** CLASSIFYING AQUATIC RESOURCES: A QUANTITATIVE APPROACH

**Author:** M.A. Rumble

**Organization:** Rocky Mountain Forest and Range Experiment, South Dakota School of Mines and Technology, Rapid City, SD

**Format:** Paper

**Reference:** Proceedings of the Third Biennial Plains Aquatic Research Conference, Bozeman, MT, pp. 89-99, August 1983

**Key Index Words:** Wetlands, Water Quality

### **Brief Description**

Twenty-seven water quality parameters from forty-one (41) coal and bentonite surface mine and livestock ponds were used to show how quantitative, multivariate procedures could be used to classify aquatic resources. Several sites were located within North Dakota. Data was subjected to polar ordination to define the groups of ponds based on water quality criteria, followed by analysis of variance and discriminant analysis to estimate the classification functions and coefficients.

### **Analysis of Conclusions**

This approach to wetland classification is based on water quality parameters. The dynamic nature of the chemical milieu in wetlands suggests a given wetland could possibly be classified several ways based on the season, rainfall, etc. The utility of this quantitative classification system may be somewhat limited for reclamation work in North Dakota.

**Title:** PRAIRIE POND MORPHOMETRY AND AQUATIC PLANT ZONATION - NORTHERN HIGH PLAINS

**Authors:** A.J. Bjugstad, M.A. Rumble, R.A. Olson, AND W.T. Barker

**Organization:** U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, Rapid City, SD

**Format:** Paper

**Reference:** Proceedings of Third Biennial Plains Aquatic Research Conference, Bozeman, MT, pp. 101-111, August 1983

**Key Index Words:** Wetlands, Vegetation, Pond Morphometry

### **Brief Description**

Wetland plant communities were distributed in narrow, concentric bands around pre-law strip mine pond margins, compared to larger, more complex, mosaic patterns on livestock ponds.

### **Analysis of Conclusions**

This paper confirms the importance of pond morphometry to enhance the potential for wetland vegetative reestablishment on reclaimed wetlands.

**Title:** ROOTED AQUATIC PLANT REVEGETATION OF STRIP MINE IMPOUNDMENTS IN THE NORTHERN GREAT PLAINS

**Authors:** G.W. Fulton, W.T. Barker, and A.J. Bjugstad

**Organization:** Department of Botany, North Dakota State University, Fargo, ND, Rocky Mountain Forest and Range Experiment Station, Rapid City, SD

**Format:** Paper

**Reference:** Proceedings of Third Biennial Plains Aquatic Research Conference, Bozeman, MT, pp. 113-117, August 1983

**Key Index Words:** Revegetation, Impoundments, Wetlands

### **Brief Description**

Twelve species of emergent aquatic plants were successfully transplanted on shorelines of two abandoned strip mine ponds in North Dakota. Three planting techniques (pots, plugs, sprigs) compared planting labor to plant injury. A year after planting, survival was highest in pots, followed by plugs and sprigs. Survival decreased with increasing water depth for all techniques and species. Two years after planting, all plots had increased in area by vegetative spreading. Area occupied was influenced by interactions of species, planting technique, initial survival, water depth, slope, soil erosion/deposition, and soil texture.

### **Analysis of Conclusions**

This is the only published study in North Dakota to date which addresses the question of transplanted aquatic vegetation. A follow-up study which compares naturally revegetated sites with those artificially assisted would confirm the efficacy of transplanting on reclaimed wetlands.

**Title:**                   **POTENTIAL FOR ENHANCING NON GAME BIRD HABITAT VALUES  
ON ABANDONED MINE LANDS OF WESTERN NORTH DAKOTA**

**Authors:**               J.B. Burley and R.B. Hopkins

**Organization:**       North Dakota State University, Fargo, ND

**Format:**               Paper

**Reference:**            Proceedings of Symposium on Surface Mining, Hydrology, Sedimentology, and  
Reclamation, Lexington, KY, 1984

**Key Index Words:**   Wildlife Habitat, AML

**Brief Description**

Twelve measures are defined which could create potentially more diverse habitat for non game avifauna.

**Analysis of Conclusions**

Selected measures proposed to enhance abandoned mine sites for wildlife usage could also apply to contemporaneous mining where wildlife habitat is the primary or secondary land use. For example, the strategic placement of rock piles and snags could diversify the wildlife habitat while concomitantly supporting a rangeland land use.

**Title:** ESTABLISHING A BALANCE IN RECLAMATION AND THE CREATION OF WILDLIFE HABITAT

**Authors:** J. D. Friedlander

**Organization:** Coteau Properties Company, The Freedom Mine, Beulah, ND

**Format:** Paper

**Reference:** Land and Water: 15-19, November/December 1993

**Key Index Words:** Wildlife Habitat, Land Use, Revegetation

### **Brief Description**

The Freedom Mine's efforts to create a balanced blend of , postmining land uses is discussed. The locally inherent conflict between production agriculture and wildlife land uses is resolved with careful planning, landowner consent, and maximization of the value of wildlife habitats. Designing and developing wildlife habitats such as wetlands, rockpiles, waterfowl nesting islands in sedimentation ponds, and shrub and tree communities are done with an eye to the future.

### **Analysis of Conclusions**

This paper serves to affirm that balancing of interests between production agriculture and wildlife postmining land uses is not an impossible task. Landowners whose first preference may be to return mined lands to purely agricultural land uses do see the importance of developing wildlife habitats where such habitats are dictated by ecological necessity and do not diminish the economic value of their land.