RECLAMATION RESEARCH IN NORTH DAKOTA

PART B

RESEARCH PUBLICATION BRIEFS

MINING AND RECLAMATION (MR)

Title: **STUDY OF THE SPOIL BANKS ASSOCIATED WITH LIGNITE STRIP MINING IN NORTH DAKOTA**

Authors: C.G. Carlson and W.M. Laird

Organization: North Dakota Geological Survey, Grand Forks, ND

Format: Report

Reference: North Dakota Geological Survey, Miscellaneous Series 24. 28p., 1964

Key Index Words: AML, Mine Inventory

Brief Description

This report provides an inventory of 34 mined areas in western North Dakota which were surveyed by the authors to evaluate reclamation efforts made at these mines. Problems related to spoil reclamation are also discussed.

Analysis of Conclusions

The information provided in this report is useful for understanding pre-law reclamation status of several mines in North Dakota.

Title: **KNIFE RIVER SPOILS BANK STUDY**

Author: T.A. Gwynn

Organization: Knife River Coal Mining Company, Bismarck, ND

Format: Report

Reference: Knife River Coal Mining Company Private Records, 1964

Key Index Words: Revegetation, Spoil Properties, Planting Techniques,

Brief Description

This is a progress report of mine spoil reclamation efforts conducted by Knife River Coal Mining company's North and South Beulah mines in Mercer County, North Dakota. The work described took place during 1963 and 1964, and involved laboratory analyses of spoil materials, experimentation with field planting techniques, and communication with other researchers. The report also includes recommendations for future work.

Analysis of Conclusions

The results reported are based on reclamation techniques that were being followed at the time when there was no reclamation law in North Dakota, and segregation and respreading of topsoil was not practiced. This information may be useful in reclaiming abandoned mined lands.

Title: **REHABILITATION OF THE LIGNITE AREAS OF NORTH DAKOTA FOLLOWING SURFACE MINING**

Author: T.A. Gwynn

Organization: Knife River Coal Mining Company, Bismarck, ND

Format: Paper

Reference: Symposium on the Great Plains of North Dakota (C.C. Zimmerman and S. Russell, ed.), pp. 129-137. The North Dakota Institute for Regional Studies, Fargo, ND, 1967

Key Index Words: Revegetation, Erosion

Brief Description

This paper presents a compilation of reclamation data and information about surface coal mines in North Dakota. It is based on literature review and personal communications.

Analysis of Conclusions

The information presented may be useful for reclamation and revegetation of abandoned mined lands.

Title: **AN IMPROVED ENVIRONMENT THROUGH INTELLIGENT MINED LAND RECLAMATION**

Author: T.A. Gwynn

Organization: Knife River Coal Mining Company, Bismarck, ND

Format: Paper

Reference: AIME 1969 Fall Meeting, Preprint No. 69-F.343, 31p., Salt Lake City, UT, September 1969

Key Index Words: Reclamation Law, Revegetation, Legislation

Brief Description

The author discusses reclamation problems in general and the extent of reclamation conducted in the Northern Rockies and the Great Plains states. Reclamation laws, then in force, in North Dakota, Montana, and Wyoming are discussed. The difference in the reclamation problems and practices in the western and eastern United States are also addressed.

Analysis of Conclusions

This paper is of general information value.

Title: **REVEGETATION OF SOME NORTH DAKOTA LIGNITE STRIP MINE SPOIL BANKS**

Author: K.B. Switzer

Organization: University of North Dakota, Grand Forks, ND

Format: Thesis

Reference: M.S. Thesis, University of North Dakota, Grand Forks, ND, 1969

Key Index Words: Revegetation, Spoil Properties

Brief Description

Reported in this thesis are mine spoil reclamation efforts that were made at the North and South Beulah mines of Knife River Coal Mining Company in Mercer County, North Dakota from 1963 to 1968. The work involved literature research, laboratory analyses of spoil samples and experimentation with field planting techniques.

Analysis of Conclusions

This study was conducted when there were no reclamation laws in North Dakota, and revegetation efforts were mostly conducted directly on the spoil material without any topsoiling.

Title: **THE NORTH DAKOTA SURFACE MINING CONTROL AND RECLAMATION LAW**

Author: R.E. Beck

Organization: University of North Dakota, Grand Forks, ND

Format: Paper

Reference: Some Environmental Aspects of Strip Mining in North Dakota (M.K. Wali, ed.), pp. 109-118. North Dakota Geological Survey Educational Series 5, 1973

Key Index Words: Reclamation Law, Revegetation, Performance Standards, Legislation

Brief Description

This paper reviews North Dakota's reclamation law as of 1973, indicating how it deals with particular reclamation problems. The author supplies his conclusions on the effectiveness of the reclamation law in accomplishing reclamation.

Analysis of Conclusions

This paper has a historical significance only, because since 1973 many changes in the North Dakota reclamation law have occurred.

Title: **A HISTORICAL OVERVIEW OF STRIP MINE RECLAMATION IN NORTH DAKOTA**

Author: I.T. Dietrich

Organization: North Dakota State University, Fargo, ND

Format: Paper

Reference: Some Environmental Aspects of Strip Mining in North Dakota (M.K. Wali, ed.), pp. 49-51. North Dakota Geological Survey, Education Series 5, 1973

Key Index Words: Revegetation, Topsoil

Brief Description

A brief historical overview of reclamation of surface mined lands in North Dakota is presented. The efforts of North Dakota Game and Fish Department and other agencies, dating back to late 1930's, in reclaiming some spoil banks are highlighted. Based on literature research and personal communication with people involved in research, the author has emphasized the importance of leveling and topsoiling in the reclamation of spoil banks.

Analysis of Conclusions

This paper provides some information of historical interest.

Title: **ENVIRONMENTAL IMPLICATIONS OF DEVELOPING OUR COAL RESERVES**

Author: T.A. Gwynn

Organization: Knife River Coal Mining Company, Bismarck, ND

Format: Paper

Reference: Some Environmental Aspects of Surface Mining in North Dakota (M.K. Wali, ed.), pp. 87-107. North Dakota Geological Survey Educational Series 5, 1973

Key Index Words: Revegetation, Legislation

Brief Description

This paper presents a historical overview of mine spoil reclamation problems in western North Dakota and the authors conclusions on the adequacy of present reclamation efforts. A summary of the state's surface mining and reclamation laws as of 1973 and a tabulation of various reclamation costs are also given.

Analysis of Conclusions

Useful for general information about earlier reclamation efforts in North Dakota.

Title: **ENVIRONMENTAL IMPACT OF STRIP MINING: THE ECONOMIC AND SOCIAL VIEWPOINT**

Authors: T.A. Hertsgaard and F.L. Leistritz

Organization: North Dakota State University, Fargo, ND

Format: Paper

Reference: Some Environmental Aspects of Surface Mining in North Dakota (M.K. Wali, ed.), pp. 73-85. North Dakota Geological Survey Educational Series 5, 1973

Key Index Words: Mining Impacts, Environmental Factors

Brief Description

This paper present the authors' conclusions about the economic and social aspects of strip mining in western North Dakota. Market values of farmland in the lignite mining area are discussed in relation to the economics of various reclamation practices. Also, possibility of the development of gasification industry and its socioeconomic impacts are considered.

Analysis of Conclusions

This is an important paper regarding socioeconomic impacts of surface mining in western North Dakota.

Title: **ENVIRONMENTAL IMPACT OF SURFACE MINING: THE BIOLOGIST'S VIEWPOINT**

Author: R.L. Morgan

Organization: North Dakota State Game and Fish Department

Format: Paper

Reference: Some Environmental Aspects of Strip Mining in North Dakota (M.K. Wali, ed.), pp. 61-71, North Dakota Geological Survey Educational Series 5, 1973

Key Index Words: Revegetation, Environmental Factors

Brief Description

This paper presents a brief review of the biological impacts of surface mining in the U.S. and particularly North Dakota. The adequacy of reclamation efforts made during early 70's is also discussed.

Analysis of Conclusions

The information presented is of general interest with emphasis on preserving the environmental quality in areas of surface mining activity.

Title: **RECLAMATION PROCESSES IN THE WESTERN COAL MINES**

Author: T.A. Gwynn

Organization: Knife River Coal Mining Company, Bismarck, ND

Format: Paper

Reference: AIME 1974 Annual Meeting, Preprint No. 74-F-82, 35p., Dallas, TX, February 1974

Key Index Words: Revegetation, Reclamation Law, Mine Inventory, Legislation

Brief Description

This paper itemizes all the surface coal mines in Arizona, Colorado, Montana, New Mexico, North Dakota, and Wyoming. Reclamation laws and statutory requirements of various western states are discussed and their variation from laws in the east are explained. Earth moving and other reclamation costs have been tabulated.

Analysis of Conclusions

This paper provides a general information regarding earlier surface mining laws in western states.

Title: **REHABILITATION POTENTIAL AND LIMITATIONS OF SURFACE MINED LAND IN THE NORTHERN GREAT PLAINS**

Author: P.E. Packer

Organization: USDA-FS, Intermountain Forest and Range Experiment Station, Ogden, UT

Format: Report

Reference: USDA-Forest Service General Technical Report INT-14, pp. 44, July 1974

Key Index Words: Revegetation, Environmental Factors, Spoil Properties

Brief Description

Factors such as the amounts and distribution of precipitation, soil productivity and stability, and suitability and availability of native vegetation for revegetation have been analyzed for each surface mineable coal-bearing area in portions of North Dakota, Montana, and Wyoming, to determine the revegetation potential for each area. Also discussed are the revegetation efforts which were being conducted on most of the mines in the Northern Great Plains, the cost of revegetation, and the legal basis for enforcement of regulations.

Analysis of Conclusions

This paper developed the concept of rehabilitation-response units, based on environmental factors. Much useful information has been presented.

Title: **CAN PRODUCTIVITY OF MINED LAND BE RESTORED IN WESTERN NORTH DAKOTA ?**

Authors: J.F. Power, W.O. Willis, F.M. Sandoval, and J.J. Bond

Organization: USDA-ARS, Northern Great Plains Research Center, Mandan, ND

Format: Paper

Reference: North Dakota Agricultural Experiment Station Farm Research 31(6):30-32, 1974

Key Index Words: Spoil Properties, Productivity

Brief Description

Described in this paper are problems that may be encountered in the reclamation of surface mined land in North Dakota, based mostly on the study of physical and chemical properties of overburden and some field experimentation conducted during 1970-73. Possible ways of correcting these problems to restore productivity are outlined.

Analysis of Conclusions

This is a general article describing the state of our knowledge about reclamation problems and their solutions as understood a couple of decades back; since then a more comprehensive picture about reclamation has emerged.

Title: **MINED LAND RECLAMATION ON THE NORTHERN GREAT PLAINS - INDIAN HEAD MINE**

Authors: T.C. Dudley and J.L. Becker

Organization: North American Coal Corporation, Bismarck, ND

Format: Paper

Reference: Mining Congress Journal 61(4):18-23, 1975

Key Index Words: Reclamation, Revegetation, Geohydrology

Brief Description

This paper presents a general overview of reclamation research that was being conducted in the Northern Great Plains by USDA-ARS, NDSU, and MSU, and discusses the reclamation practices followed at North American Coal Corporation's Indian Head Mine during the mid 70's.

Analysis of Conclusions

This paper is of general interest highlighting the importance of topography, climate, soil, native vegetation and wildlife, spoil properties and ground water hydrology in reclamation of specific areas.

Title: **STRIP MINING TECHNIQUES TO MINIMIZE ENVIRONMENTAL DAMAGE IN THE UPPER MISSOURI BASIN STATES**

Author: F.H. Persee

Organization: USDI, Bureau of Mines

Format: Report

Reference: USDI, Bureau of Mines Information Circular No. 8685, p. 53, 1975

Key Index Words: Waste Disposal, Water Quality

Brief Description

The report reviews both proven and untried methods of mined land reclamation. The information was collected from related literature dealing with mining in Montana, North Dakota, South Dakota, Wyoming and parts of Canada. Disposal of refuse and waste materials is also discussed.

Analysis of Conclusions

The techniques of reclamation and revegetation discussed in this report are based on the state-of-the-art which existed prior to the enactment of federal reclamation law.

Title: **PROGRESS REPORT ON RESEARCH ON RECLAMATION OF STRIP MINED LAND IN THE NORTHERN GREAT PLAINS**

Authors: J.F. Power, R.E. Barker, E.J. Doering, R.E. Ries, F.M. Sandoval, W.O. Willis, A. Bauer, G. Gee, J. Gilley, P. Nyren, F. Schroer, and W. Whitman

Organization: USDA-ARS, Northern Great Plains Research Center, Mandan, ND and NDSU-North Dakota Agricultural Experiment Station, Fargo, ND

Format: Report

Reference: USDA-ARS, Northern Great Plains Research Center, and NDSU-North Dakota Agricultural Experiment Station Progress Report, April 1975

Key Index Words: Spoil Properties, Amendments, Topsoil, Water Management

Brief Description

This report summarizes the results of various reclamation research projects that were being conducted by ARS and NDSU around that time. Limited research was being done in the areas of spoil/overburden characterization, use of amendments and topsoiling, water and nutrient relations of spoil plant systems etc. Plots with 2, 6, and 12 inches of topsoil had been established.

Analysis of Conclusions

Only preliminary findings had been made at this time which provided a basis for additional reclamation research in North Dakota.

Title: **FACTORS RESTRICTING REVEGETATION OF STRIP MINE SPOILS**

Authors: J.F. Power, R.E. Ries, F.M. Sandoval and W.O. Willis

Organization: USDA-ARS, Northern Great Plains Research Center, Mandan, ND

Format: Paper

Reference: Proceedings of the Fort Union Coal Field Symposium (W.F. Clark, ed), pp. 336-346, Montana Academy of Science, Billings, MT, 1975

Key Index Words: Revegetation, Soil Properties, Plant Responses

Brief Description

This paper summarizes the field and laboratory studies initiated in 1970 at the Northern Great Plains Research Center, Mandan, North Dakota to develop technology for reclamation of surface mined lands. The objectives of research were to 1) determine the physical and chemical characteristics of spoils and overburden in major coal fields in the Fort Union Region, 2) evaluate the influences of these properties on the growth of various plant species and 3) develop reclamation methods whereby mined land could be restored to a level of productivity equal to or exceeding that which existed before mining.

Analysis of Conclusions

Studies summarized in this paper provided an impetus for further research work on problems and practices of mined land reclamation.

Title: **ANNUAL MINE MAPS SUBMITTED BY MINE OPERATORS: 1919-1975**

Authors: North Dakota, State Coal Mine Inspection Department

Organization: North Dakota State Coal Mine Inspection Department, Workman's Compensation Safety Division, Bismarck, ND

Format: Reports

Reference: North Dakota State Coal Mine Inspection Department Reports, 1919-1975

Key Index Words: AML, Mine Inventory

Brief Description

During the years that the State Coal Mine Inspection Department regulated mining in North Dakota, (1919-1975), every operator of every active mine was required to submit maps of their mine on a yearly basis. These maps were required for every seam being mined, constructed at a scale not less than 1 inch equals 200 feet and included the mine designation, the county and township it was located in, the north point and scale, the company or owners, and the surveyor's certificate. Maps depicting mines which had underground workings were required to show additionally all shafts, slopes, tunnels or other openings to the surface or other workings, all excavations, entries, rooms and crosscuts, the rise or dip of the seam, the location of permanent equipment, and the location of standing water. A surface map was also required and showed legal boundaries, lots, streets, railroads, rivers, ponds, streams, buildings and land marks. The mapping was required each year the mine was active and just prior to closing or abandoning the mine. There are approximately 190 final maps in the file.

Analysis of Conclusions

These reports provide a valuable source of information particularly for the abandoned mine lands program.

Title: **STATE COAL MINE INSPECTOR'S REPORT (ANNUAL): 1919-1975**

Authors: North Dakota, State Coal Mine Inspection Department

Organization: North Dakota State Coal Mine Inspection Department, Workman's Compensation Safety Division, Bismarck, ND

Format: Reports

Reference: North Dakota State Coal Mine Inspection Department Reports, 1919-1975

Key Index Words: AML, Mine Inventory

Brief Description

These reports contain information about all coal mines operating in the state of North Dakota during the years that mining was regulated by the State Coal Mine Inspection Department (1919-1975). Items contained in these reports include: the name, address, and operator of each mine active during that year, yearly production by county and by mine, the number and type of mines in each county, and the number of employees at each mine.

Analysis of Conclusions

These reports provide a valuable source of information particularly for the abandoned mine land program in North Dakota.

Title: **APPENDIX D: LOCATION OF LANDS DISTURBED BY PRE-1970 LIGNITE MINING**

Author: K. Thompson

Organization: North Dakota State Outdoor Recreation Agency, Mandan, ND

Format: Report

Reference: 1975 North Dakota SCORP: State Comprehensive Outdoor Reclamation Plan, 1975

Key Index Words: AML, Mine Inventory

Brief Description

This appendix is a compilation of data form Soil Conservation Service aerial photos and files. The appendix includes the acreages and legal descriptions of areas disturbed by lignite mining. The areas are presented by county with the mine owner's name given where known and they are divided into those areas disturbed by strip mining and those disturbed by subsidence above underground mines.

Analysis of Conclusions

The information provided in this report should be useful to abandoned mine land program.

Title: **MINING, STRIP -- WESTERN UNITED STATES**

Author: J.F. Power

Organization: USDA-ARS, Northern Great Plains Research Center, Mandan, ND

Format: Article

Reference: McGraw-Hill Yearbook of Science and Technology, pp.303-305, 1976

Key Index Words: Revegetation, Environmental Factors

Brief Description

This article summarizes the problems and requirements for proper reclamation of mind lands in the western United States. The causes of the problems are explained and the available technology of reclaiming mined areas is reviewed.

Analysis of Conclusions

This article is good for general information on the subject of reclamation of surface miend lands in the arid and semi-arid west. However, because of many regulatory changes and technological advances made since 1976, this information is in need of updating.

Title: **MANAGEMENT OF MINE WASTES IN THE WESTERN UNITED STATES**

Authors: G.E. Schuman, W.A. Berg, and J.F. Power

Organization: USDA-ARS, Cheyenne, WY, Colorado State University, Ft. Collins, CO, USDA-ARS, Mandan, ND

Format: Paper

Reference: Land Application of Waste Materials (T.M. McCalla, ed.), pp. 180-184, Soil Conservation Society of America Meeting, Ankeny, IA, 1976

Key Index Words: Environmental Factors, Spoil Properties

Brief Description

This paper contains a compilation of reclamation data for the western United States.

Analysis of Conclusions

This paper is useful for general information on the problems of reclamation of surface mined lands in the western United States. The approaches followed in reclaiming the spoil banks are discussed.

Title: **NORTH DAKOTA PROGRESS REPORT ON RESEARCH ON RECLAMATION OF STRIP MINED LANDS - UPDATE 1977**

Authors: R. Barker, A. Bauer, E. Doering, L. Hofmann, R. Lorenz, J. Power, G. Reichman, R. Ries, F. Sandoval, T. Brown, G. Gee, F. Schroer, and W. Whitman

Organization: USDA-ARS, Northern Great Plains Research Center, Mandan, ND, and NDSU-North Dakota Agricultural Experiment Station, Fargo, ND

Format: Report

Reference: USDA-ARS, Northern Great Plains Research Center, and NDSU-North Dakota Agricultural Experiment Station Progress Report, March 1977

Key Index Words: Spoil Properties, Salinity, Sodicity, Amendments, Topsoil, Fertilizer Use, Water Management

Brief Description

This report provides a summary of the various ARS and NDSU reclamation research projects that were in progress in 1977. Results and preliminary conclusions are given for such studies as pre-mining characterization of the soil, overburden and vegetation resources, soil erosion and land stability, salt and sodium related problems, chemical reclamation, topsoiling, nutrient deficiencies and their correction, and vegetation establishment and utilization. This report contains some of the preliminary results of soil wedge plots set up by the ARS.

Analysis of Conclusions

This report is based on the premise that for successful reclamation of mined lands in the Northern Great Plains, enhancement of vegetative growth through proper understanding and management of soil overburden/spoil and plant resources is necessary. Some of the reported finding should be considered preliminary because the experiments on which they are based were still ongoing. The report recognizes that there are other areas of research (not addressed in the report) which are equally important to the development of reclamation technology.

Title: **RECLAMATION PRACTICES IN THE NORTHERN GREAT PLAINS COAL PROVINCE**

Author: R.C. Barth

Organization: Colorado School of Mines Research Institute, Golden, CO

Format: Paper

Reference: Mining Congress Journal 63(5):60-64, 1977

Key Index Words: Revegetation, Erosion

Brief Description

This paper reviews information, based on field observation, regarding the reclamation practices followed in Montana, North Dakota, South Dakota, Nebraska, and Wyoming.

Analysis of Conclusions

A useful reference for general understanding of the reclamation techniques which were being followed in the northern great plains in mid seventies.

Title: **PROTECTION OF SOIL AND WATER RESOURCES ON LAND DISTURBED BY MINING**

Authors: J.F. Power and O.L. Bennett

Organization: USDA-ARS, Northern Great Plains Research Center, Mandan, ND, and Appalachian Soil and Water Conservation Research Laboratory, Beckley, WV

Format: Paper

Reference: Proceedings of the Second National EPA Conference on Energy/Environment, Washington, DC, pp. 195-201, 1977

Key Index Words: Erosion, Hydrology

Brief Description

This paper discusses problems related to surface mining and reclamation in eastern and western United States. The reclamation research efforts of the USDA-Agricultural Research Service are reviewed and areas needing additional research are pointed out.

Analysis of Conclusions

This paper has general information value about the reclamation problems and the research conducted and needed to solve the problems

Title: **STRIP MINING - GETTING THE ENERGY WHILE KEEPING THE ENVIRONMENT**

Authors: J.F. Power, F.M. Sandoval, and R.E. Ries

Organization: USDA-ARS, Northern Great Plains Research Center, Mandan, ND

Format: Article

Reference: Crops and Soils 29(4):12-14, 1977

Key Index Words: Spoil Properties, Topsoil

Brief Description

This article reviews the problems encountered in reclamation and outlines the technologies developed through research to overcome these problems. Included are discussions of current technology, moisture conservation, bulk density, soil fertility, sodicity and salinity of soils and spoils, and some benefits of covering spoils with soil material.

Analysis of Conclusions

Useful for general information on reclamation problems and their mitigation as was possible by the then available technology.

Title: **RECLAMATION OF DISTURBED LANDS IN THE LIGNITE AREA OF THE NORTHERN PLAINS**

Authors: R.E. Ries, F.M. Sandoval, and J.F. Power

Organization: USDA-ARS, Northern Great Plains Research Center, Mandan, ND

Format: Paper

Reference: Technology and Use of Lignite (G.H. Groenewold and W.R. Kube, compliers), pp. 309-327, Energy Research and Development Administration, and University of North Dakota, Grand Forks, ND, GFERC/IC-77/1, 1977

Key Index Words: Soil Properties, Revegetation

Brief Description

This paper gives an overview of the reclamation work that was being conducted by the Northern Great Plains Research Center in 1977. It recommended analyzing soil and overburden in the laboratory before mining, removing and stockpiling suitable soil materials (a layer up to 5 feet thick, if available), removing overburden, extracting coal, reshaping spoil, replacing stockpiled soil material, fertilizing, and seeding to cropland or rangeland mixtures of plant species. Piping erosion, subsidence, and establishing vegetation with sustained productivity are considered as existing problems which would require additional work.

Analysis of Conclusions

This paper is important in that it provided some early guidelines for reclaiming mined lands in the Northern Great Plains.

Title: **KNOWN HISTORIC SITE SURVEY OF 21 WESTERN NORTH DAKOTA COUNTIES**

Author: D.J. Tweton

Organization: Department of History, University of North Dakota, Grand Forks, ND

Format: Report

Reference: North Dakota Regional Environmental Assessment Program Report No. 77-4, 11 p.+ Appendix, 1977

Key Index Words: AML, Historical Sites

Brief Description

The purpose of this study was to survey, locate, and evaluate the known historic sites in the 21 county area west of or east of but bordering the Missouri River. The counties are: Adams, Billings, Bowman, Burke, Burleigh, Divide, Dunn, Emmons, Golden Valley, Grant, Hettinger, McKenzie, McLean, Mercer, Morton, Mountrail, Oliver, Sioux, Slope, Stark, and Williams. Of the 1080 historic sites located by literature search and field verification, 264 were abandoned surface or underground lignite mines. The appendix to the report contains the names of the mines, the years they were actively mined, and legal descriptions of their locations at least to the section and often to the quarter or quarter quarter section.

Analysis of Conclusions

This report presents useful information regarding the location and history of some abandoned mines in western North Dakota.

Title: **ACREAGE AND GENERAL LOCATIONS OF PRE-1970 COAL MINE SPOILS IN NORTH DAKOTA**

Authors: USDA, Soil Conservation Service Staff

Organization: USDA, Soil Conservation Service, Bismarck, ND

Format: Report (unpublished)

Reference: USDA, Soil Conservation Service, unpublished record, 1977

Key Index Words: AML, Mine Inventory

Brief Description

This unpublished document contains inventory of acreages and general locations of areas strip mined in North Dakota prior to 1970. The information is presented by individual counties. This inventory may not contain 100% of the strip mined areas but is believed to be an extensive inventory available.

Analysis of Conclusions

The information provided in this unpublished report should be useful to abandoned mine land program in North Dakota.

Title: **SUMMARY OF CURRENT RECLAMATION RESEARCH OF THE NORTHERN GREAT PLAINS RESEARCH CENTER**

Authors: R.E. Barker, A. Bauer, J.D. Berdahl, E.J. Doering, A.B. Frank, J.E. Gilley, L. Hofmann, S. Melsted, S.D. Merrill, M. Pole, J.F. Power, G.A. Reichman, R.E. Ries, F.M. Sandoval and A.C. Wilton

Organization: USDA-SEA, Northern Great Plains Research Center, Mandan, ND, and North Dakota State University, Fargo, ND

Format: Report

Reference: Science and Education Administration (USDA) and North Dakota State University (soils) Report, March 1978

Key Index Words: Revegetation, Amendments, Irrigation, Topsoil, Grazing

Brief Description

In this report are summarized the objectives and conclusions of the various ARS (USDA-SEA) and NDSU reclamation research projects that were in progress in 1978. The ARS staff was involved in 23 projects which included work on spoil properties, effects of topsoiling, fertilization, mulching, amendments etc. on the establishment and growth of vegetation, and plant responses to salts, soil texture, supplemental irrigation, grazing, etc. The NDSU projects included chemical and physical characterization of shaped mined lands, properties of stockpiled materials, runoff, and erosion, water quality of impoundments, and fertilizer requirements.

Analysis of Conclusions

Some of the conclusions summarized in this report are based on experiments which had not been completed at that time. However, though preliminary in nature, the results and conclusions of these studies are highly useful in understanding the soil and revegetation problems involved in reclamation of mined lands and in providing some answers to these problems.

Title: **ATLAS OF WESTERN SURFACE MINED LANDS: COAL, URANIUM, AND PHOSPHATE**

Authors: A.K. Evans, E.W. Uhleman, and P.A. Eby

Organization: USDI, Fish and Wildlife Service, Office of Biological Services, Western Energy and Land Use Team.

Format: Report

Reference: USDI, Fish and Wildlife Service Coal Project, Contract No. 14-16-0009-77-004, FWS/OBS-78/20, 302 p., 1978

Key Index Words: Mine Inventory, AML

Brief Description

Active and inactive mines in excess of ten acres in western United States have been inventoried in this report. The inventory procedure consisted of agency and owner contacts, literature research and field review of selected mines. Factors inventoried include locations, owners, summaries of mining and reclamation plans, dates and acreage of operation, reclamation histories and current conditions of the mine sites.

Analysis of Conclusions

This report should be highly useful to the abandoned mine land program in North Dakota.

Title: **RECLAMATION RESEARCH ON STRIP MINED LAND IN DRY REGIONS**

Author: J.F. Power

Organization: USDA-ARS, Northern Great Plains Research Center, Mandan, ND

Format: Paper (Chapter)

Reference: Reclamation of Drastically Disturbed Lands (W. Schaller and P. Sutton, eds.), pp. 521-535, SSSA, Madison, WI, 1978

Key Index Words: Revegetation, Natural Resources

Brief Description

This report outlines the history of reclamation research in the western United States and Canada. It describes the natural resources used in reclamation, reviews the kind of research information available and the kind needed to properly utilize each of the natural resources; and shows how this information can be used in developing reclaimed land. This report is an overview of the state of the art and indicates the direction of research needed in the future.

Analysis of Conclusions

Useful for general information on reclamation of arid lands. It does not catalog the various research activities that were in progress at that time.

Title: **RECLAMATION OF COAL MINED LAND IN THE NORTHERN GREAT PLAINS**

Authors: J.F. Power, R.E. Ries, and F.M. Sandoval

Organization: USDA-ARS, Northern Great Plains Research Center, Mandan, ND

Format: Paper

Reference: Journal of Soil and Water Conservation 33(2):69-74, 1978

Key Index Words: Spoil Properties, Water Management, Revegetation

Brief Description

This paper summarizes the problems and techniques of reclaiming mined lands in the Northern Plains. Included is a discussion of available natural resources, water and its limitations, soil fertility, and salinity. Future problems and research needed to overcome these problems are also outlined.

Analysis of Conclusions

Useful for general information on reclamation problems in the Northern Great Plains.

Title: **RESTORATION OF PRODUCTIVITY TO DISTURBED LAND IN THE NORTHERN GREAT PLAINS**

Authors: J.F. Power, F.M. Sandoval and R.E. Ries

Organization: USDA-ARS-Northern Great Plains Research Center, Mandan, ND

Format: Paper

Reference: The Reclamation of Disturbed Arid Lands (R.A. Wright, ed.), pp. 33-49, University of New Mexico Press, Albuquerque, NM, 1978

Key Index Words: Spoil Properties, Erosion, Water Management

Brief Description

This paper reviews information on the effects of mining on natural resources in the Northern Great Plains. The problems associated with conserving these resources are outlined. Research derived technology that can overcome these problems is described along with foreseeable problems that require further research.

Analysis of Conclusions

The information presented is based on the level of understanding and technology which was available prior to 1978. Since then additional knowledge has been gained.

Title: **NORTH DAKOTA LAND USE ELEMENT**

Authors: State Planning Division, State of North Dakota

Organization: State Planning Division, Bismarck, ND

Format: Report

Reference: Published by State Planning Division, April 1978

Key Index Words: Land Use, Natural Resources, Resource Management

Brief Description

This document was written to provide recommended state goals, objectives, and policies for land use and natural resource management. The intent is to encourage and promote proper management of land and related resources to meet the needs of the people of North Dakota now and in the future.

Analysis of Conclusions

The contents of this document have little relevance to the reclamation of mined lands. As a philosophical statement, regarding the State's land use policy in 1978, the "North Dakota Land Use Element" succeeds well.

Title: **1979 RECLAMATION RESEARCH SUPPLEMENT TO NORTH DAKOTA PROGRESS REPORT ON RESEARCH ON RECLAMATION OF STRIP MINED LANDS - UPDATE 1977**

Authors: R. Barker, E. Doering, L. Hofmann, R. Lorenz, S. Merrill, J. Power, G. Reichman, R. Ries, F. Sandoval, A. Wilton, H. Carvallo, M. Pole, S. Melsted, F. Shorer, and C.M. Smith

Organization: USDA-SEA, Northern Great Plains Research Center, Mandan, ND and North Dakota Agricultural Experiment Station, Department of Soils, Fargo, ND

Format: Report

Reference: Agricultural Research (USDA-SEA) and North Dakota Agricultural Experiment Station, Department of Soils Report, July 1979

Key Index Words: Revegetation, Nutrient Deficiencies, Erosion, Amendments, Fertilizer Use

Brief Description

This published report provides an update to the reclamation research progress report published in 1977. Included in this report is a summary of ARS wedge plot results which indicated upward migration of sodium. The use of at least four feet of replaced soil on regraded spoil was recommended.

Analysis of Conclusions

The results and conclusions of the studies summarized in this report are very important for the development of suitable methods of reclaiming mined lands to agricultural land uses.

Title: **RANGELAND ANALYSIS AND LAND COVER: A COMPUTERIZED APPROACH**

Author: L.A. Ogaard

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

Format: Ph.D Dissertation

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

Key Index Words: Land Use, Computer Application

Brief Description

A portion of this dissertation involves a comparison of several land cover studies conducted for the primary coal impact region of Mercer, McLean, and Oliver Counties. The author postulates why acreage discrepancies for land cover categories occur between these studies. The other facet of this treatise is the computerization of Soil Conservation Service technical guide data and logic to provide a quick way to characterize rangeland in terms of potential forage production and carrying capacity.

Analysis of Conclusions

Land cover acreage is tabulated and graphically depicted on a section-by-section basis at a scale of one inch to two miles for over 3000 square miles. This examination of land use in the mid-1970's provides an historic record to which reclaimed land in the future may be compared.

Title: **LAND USE ANALYSIS/TECHNICAL EXAMINATION/ENVIRONMENTAL ASSESSMENT RECORD: FALKIRK COAL LEASE APPLICATION M-31053 (ND)**

Authors: C. Steele, J. Pittman, R. Gunnufson, L. Chase, D. Rufledt, C. Pettee, K. Burke, A. Caldwell, M. Richmond, L. Cabe, B. Williams, and M. Ingeroi

Organization: Bureau of Land Management, U.S. Department of Interior

Format: Report

Reference: Bureau of Land Management Report No. MT-030-48-9-3, July 1979

Key Index Words: Land Use, Legislation, Coal Leasing

Brief Description

Land use planning, technical examination, and environmental assessment are prerequisites to federal coal leasing. This document is a record of those actions for the Falkirk Mining Company's mine near Underwood, ND. Application of unsuitability criteria, resource trade-offs, surface owner views, relationship to state and local planning and initial leasing and special stipulation recommendations are the general topics addressed within this report.

Analysis of Conclusions

This is a site specific characterization of land use at the Falkirk Mine. This report is a typical example of the land use analysis process that is triggered when federal coal is encountered.

Title: **ANNUAL REPORT, 1981: LAND RECLAMATION RESEARCH CENTER**

Authors: Land Reclamation Research Center Staff

Organization: NDSU-Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: Land Reclamation Research Center Annual Report, 1981

Key Index Words: Topsoil, Prime Farmland, Spoil Properties, Erosion

Brief Description

This report contains summary of the research projects that the LRRC was conducting in 1981. These include investigations on the chemical and physical characteristics, surface and root zone hydrology, and plant establishment and culture on shaped surface mined lands. Also, surface and ground water problems associated with potential strip mine sites were investigated. The report also provides a discussion on the agricultural research needs for mined land reclamation.

Analysis of Conclusions

The results and conclusions provided in this report are preliminary but very useful in understanding the nature of some of the reclamation problems of reshaped mined lands and their possible solutions.

Title: **ANNUAL REPORT, 1982: LAND RECLAMATION RESEARCH CENTER**

Authors: Land Reclamation Research Center Staff

Organization: NDSU-Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: Land Reclamation Research Center Annual Report, 1982

Key Index Words: Topsoil, Prime Farmland, Spoil Properties, Erosion

Brief Description

This report contains a summary of the LRRC research projects being conducted in 1982, projects proposed for 1983, and agricultural research needs for mined land reclamation. Additional data on the projects listed in the 1981 Annual Report is presented. This report also includes a summary of LRRC's initial prime farmland research projects and a discussion of sodium migration in reclaimed soils .

Analysis of Conclusions

The results and conclusions provided in this report are very useful in understanding the nature of some of the reclamation problems of reshaped mined lands and their possible solutions.

Title: **A DECADE OF RESEARCH ON RECLAMATION OF SURFACE COAL MINED LANDS IN NORTH DAKOTA**

Author: N.M. Safaya

Organization: North Dakota Public Service Commission, Bismarck, ND

Format: Paper

Reference: Agronomy Abstract p. 37-38, 1982

Key Index Words: Revegetation, Research Needs

Brief Description

This paper, presented in the American Society of Agronomy meeting in Anaheim, CA, provided an overview of the reclamation research conducted in North Dakota. Developments in research on the problems and practices of surface mined land reclamation were traced from those of the earlier efforts at soil and overburden characterization to the currently followed multidisciplinary approach involving research on landscape stability, hydrogeochemistry, soil reconstruction and amelioration, soil - plant relations and plant adaptability, revegetation methods and management, and plant succession on abandoned and active mined lands. Additionally, an elaborate list of current and future reclamation research needs was also presented.

Analysis of Conclusions

The review of reclamation research conducted in North Dakota indicated that there is a tremendous need for synthesizing the available data and develop additional information in a number of areas in a manner that makes the development of predictive models possible. Future research needs should be carefully evaluated and geared to provide solutions to high priority problems. The necessity for shifting the emphasis from analytical to synthetical type of research was stressed.

Title: **RECLAMATION RESEARCH IN NORTH DAKOTA**

Authors: E.C. Doll, G.A. Halvorson, S.A. Schroeder, and N.C. Wollenhaupt

Organization NDSU-Land Reclamation Research Center, Mandan, ND

Format: Paper

Reference: North Dakota Agricultural Experiment Station Farm Research 41(6):36-39, 1983

Key Index Words: Research Needs, Soil Replacement, Soil Water, Topography

Brief Description

This paper provides an overview of LRRC reclamation research program in North Dakota. Mining impacts to the state, the development of reclamation technology, and the history of USDA/ARS reclamation research in North Dakota are briefly discussed. Future research programs need to focus on the interrelationships between topographic configuration, soil respread depths, postmining land use planning, and other factors in order to suggest ways to achieve optimum reclamation at the lowest practical cost.

Analysis of Conclusions:

Useful for general information on past and present LRRC research programs and specific future research needs in mined land reclamation.

Title: **COMPUTER APPLICATIONS IN THE REGULATION OF SURFACE COAL MINING AND RECLAMATION: THE NORTH DAKOTA EXPERIENCE**

Authors: L.A. Ogaard and N.M. Safaya

Organization: North Dakota Public Service Commission, Bismarck, ND

Format: Paper

Reference: Agronomy Abstract P. 39, 1983

Key Index Words: Computer Application,

Brief Description

This paper presentation, made in the American Society of America Meeting in Washington, D.C., discusses the North Dakota Public Service Commission's computerized system for management of data bases on ground and surface water monitoring and bonding information, and for the development of pre- and post-mining topography, area slope, difference, and other maps with the use of interactive graphics. The functional aspects of this computerized data processing system were discussed in relation to the regulatory needs.

Analysis of Conclusions

The importance of computerization for regulatory purposes is emphasized.

Title: **ANNUAL REPORT, 1984: LAND RECLAMATION RESEARCH CENTER**

Authors: Land Reclamation Research Center Staff

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: Unpublished Progress Report

Key Index Word: Research Needs, Soil Development, Water Use, Revegetation

Brief Description

This report summarizes the results of research projects conducted by LRRC during 1984. These projects included investigations of soil development and stability, water relations and vegetative reestablishment on reshaped mined lands. Also included is a summary of predictive model development for reclamation planning.

Analysis of Conclusions:

The information which is presented is not conclusive, but is useful for understanding research problems and approaches.

Title: **LRRC REPORT TO NORTH DAKOTA LEGISLATIVE COUNCIL, 1984**

Authors: Land Reclamation Research Center Staff

Organization: NDSU-Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: Unpublished Progress Report

Key Index Word: Sodium Migration, Prime Farmland, Runoff, Erosion

Brief Description

This report summarizes the results of research projects on optimum depths of soil replacement, sodium and salt movement in reclaimed soils, prime farmland, runoff and erosion, and restoration of productivity on reclaimed soils. Recommendations for implementation of the results of some of these studies are also given.

Analysis of Conclusions:

This report is an excellent summary of recent LRRC research projects and also provides useful recommendations for application of results in policy making.

Title: **PHYSICAL AND CHEMICAL METHODS FOR ENHANCING PRODUCTIVITY OF ABANDONED MINE LANDS IN THE NORTHERN GREAT PLAINS**

Authors: S.D. Merrill and N.M. Safaya

Organization: USDA-ARS Northern Great Plains Research Center, Mandan, ND, and Public Service Commission, Bismarck, ND

Format: Paper

Reference: Proceedings of the National Symposium and Workshops on Abandoned Mine Land Reclamation (L.L. Schloesser, G.S. Anderson, N.M. Safaya, D.J. Thompson, eds.), pp. 563-600, Bismarck, ND, 1984

Key Index Words: Abandoned Mine Land, Amendments, Topsoil, Nutrient Deficiencies

Brief Description

This paper describes the methods of reclaiming abandoned mine lands, with emphasis on landscape restoration, surface manipulation, and ameliorative additives. The use of soil and good quality overburden materials, organic and inorganic amendments and fertilizers in enhancing vegetation establishment and productivity are discussed.

Analysis of Conclusions

The reclamation techniques discussed in this paper apply to a wide range of conditions encountered at both abandoned and currently mined lands. Some of these techniques have proved quite successful.

Title: **ANNUAL REPORT-1985, LAND RECLAMATION RESEARCH CENTER**

Authors: Land Reclamation Research Center Staff

Organization: NDSU - Land Reclamation Research Center

Format: Report

Reference: Land Reclamation Research Center Annual Report, 1985

Key Index Words: Revegetation, Prime Farmland, Productivity, Soil Development, Topography, Runoff, Erosion

Brief Description

This report summarizes the results of ongoing research projects conducted by NDSU-LRRC during 1985, and provides some background information about the center's scientists, advisory committee, and general objectives. Specific projects include: 1) soil development and stability on reclaimed lands, 2) management and water relations of reshaped minelands, 3) vegetative establishment on mined lands, and 4) site specific land reclamation systems. These projects were aimed to address prime farmland soil productivity, development of productivity indices for reclaimed lands, soil replacement depths, and erosion and runoff on reclaimed lands.

Analysis of Conclusions:

The results of the completed and ongoing studies presented in this paper are very useful to the mining industry as well as the regulatory agency. Continuation of these studies, with the exception of determining optimum soil replacement thicknesses for graded spoils of different quality, is strongly urged.

Title: **LRRC REPORT TO NORTH DAKOTA LEGISLATIVE COUNCIL, 1985**

Authors: Land Reclamation Research Center Staff

Organization: NDSU-Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: LRRC Report to North Dakota Legislative Council, 1985

Key Index Words: Revegetation, Prime Farmland, Productivity, Soil Development, Topography, Runoff, Erosion

Brief Description

This report summarizes the results and conclusions of studies conducted on: 1) prime farmland soil productivity, 2) productivity indices for reclaimed lands, 3) depth of soil replacement, and 4) erosion and runoff from reclaimed lands. Recommendations made included: 1) that mixing of similar prime and nonprime subsoil materials should be allowed, 2) the requirements for segregating prime and nonprime topsoil materials should be relaxed, 3) soil parameters and vegetative vigor should be used to evaluate reclamation success, 4) soil replacement depths should be adjusted based on physical and chemical properties of the underlying spoil, and 5) runoff and erosion data should be used to adjust constants in equations used for determining the size of sediment ponds.

Analysis of Conclusions:

The results and conclusions presented in this report are the same as given in the 1985 LRRC annual report.

Title: **1985 MINE-LAND RECLAMATION RESEARCH REVIEW**

Authors: Land Reclamation Research Center and Northern Great Plains Research Laboratory Staff

Organization: NDSU - Land Reclamation Research Center, and USDA-ARS Northern Great Plains Research Center, Mandan, ND

Format: Report

Reference: Presented at: Reclamation Research Review, Bismarck, ND, March 19, 1985

Key Index Word: Spoil Properties, Productivity, Water Use

Brief Description

This report summarizes research results from ongoing projects conducted by USDA-ARS and NDSU-LRRC as presented at the Reclamation Research Review meeting held in Bismarck in March 1985.

Analysis of Conclusions:

The results and conclusions which are presented are only tentative, but provide useful information about current problems in reclamation research and approaches being taken to study those problems.

Title: **PRIME LAND RECLAMATION IN NORTH DAKOTA - A STATUS REPORT**

Authors: E.C. Doll

Organization: NDSU-Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: Land Reclamation Research Center Technical Report No. 7, 1986

Key Index Words: Prime Soils, Prime Farmland, Revegetation, Topsoil, Topography, Reclamation Law

Brief Description

This report presents: 1) a brief discussion of the laws and rules governing reclamation of prime farmland, 2) an overview of research on prime soils conducted in North Dakota, and 3) a proposed experimental program for additional research needed to improve reclamation of prime farmlands in terms of both quality and cost. Factors related to the productivity of western North Dakota soils are also discussed.

Analysis of Conclusions:

The need for additional research on prime soils has been emphasized. The author has suggested that at least three factors must be studied to determine the reasons for productivity differences that exist between prime and non-prime soils. These factors include: 1) topographic position effects on soil moisture, 2) differences in prime and non-prime topsoil characteristics and their relation to productivity, and 3) the effect of prime topsoil depths on productivity. The research program proposed in this report deserves funding and support.

Title: **ANNUAL REPORT-1986, LAND RECLAMATION RESEARCH CENTER**

Authors: Land Reclamation Research Center Staff

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: Land Reclamation Research Center Annual Report, 1986

Key Index Words: Revegetation, Prime Farmland, Productivity, Soil Development, Topography, Runoff, Erosion.

Brief Description

This report summarizes the results of ongoing research projects conducted by LRRC during 1986, and provides some background information about the Center's scientists, advisory committee, and other professional activities. The overall objectives were the same as given in LRRC's 1985 annual report. However, the specific projects conducted to meet those objectives included: 1) topographic control of soil-water content, 2) management and water relations of reshaped minelands, 3) vegetative re-establishment on mine lands, and 4) site specific land reclamation systems.

Analysis of Conclusions:

As ongoing studies from previous years, the general methodology of these projects has remained largely unchanged. Some new data has been added, but the need for continued research on these projects has been indicated.

Title: **LRRC REPORT TO NORTH DAKOTA LEGISLATIVE COUNCIL, 1986**

Authors: Land Reclamation Research Center Staff

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: LRRC Report to North Dakota Legislative Council, 1986

Key Index Words: Revegetation, Productivity, Prime soils, Erosion, Runoff

Brief Description

This report contains research findings and recommendations regarding: 1) prime farmland soil productivity, 2) productivity indices for reclaimed lands, 3) soil replacement depths, and 4) Runoff and erosion from reclaimed lands. Productivity difference in prime and non-prime soils were attributed to moisture differences due to topographic position. Research on the development of productivity indices included data collection for quantification and modeling of topography - soil water relationships. Studies on the development of a model which would predict the properties of regraded spoils based on pre-mine overburden data continued. runoff and erosion studies revealed that hte constants now being used for the Universal Soil Loss Equation (USLE) are not adequate for use on reshaped spoil.

Analysis of Conclusions:

The report recommends that requirements for segregation of prime and non-prime topsoil materials should be allowed; evaluation of reclamation success should be made on the basis of soil parameters and plant vigor and production; OSM should approve adoption of new regulations allowing soil replacement thickensses to be based on the properties of regraded spoils; and new constants developed by LRRC for the USLE should be used. The report also mentions that erosion and runoff from the reclaimed lands is effectively controlled when the total ground cover is 70% or more.

Title: **ENVIRONMENTAL TRAINING TO MAINTAIN REGULATORY COMPLIANCE AT A SURFACE COAL MINE**

Authors: J.D. Friedlander

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

Format: Paper

Reference: Proceedings of the Fourth Biennial Symposium on Surface Mining and Reclamation on the Great Plains, and Fourth Annual Meeting of the American Society for Surface Mining and Reclamation, pp. c-1-1 to c-1-3, Billings, MO, 1987

Key Index Words: Training, Safety, Policy

Brief Description

This paper describes the importance and actual procedures of training followed at the Coteau Properties Company's Freedom Mine in North Dakota. Coteau provides all new miners general environmental training, focusing on soil and water handling, history of reclamation, regulatory inspection procedures, permit requirements, dust control, blasting operations, sign and setback requirements, and handling of hazardous wastes. Refresher courses in each operation and engineering area are given annually, and continuos training is provided through memo, news flyers, displays, and a bulletin board. Personal responsibility and team effort for environmental compliance is stressed.

Analysis of Conclusions

The information provided in this paper is very useful in that it can serve as a model for other mining companies to tailor their training programs. A well trained mining and reclamation staff is essential for meeting the high standards of compliance, preventing environmental damage, and reducing the risks to human health and safety.

Title: **ANNUAL REPORT- 1987: LAND RECLAMATION RESEARCH CENTER**

Authors: Land Reclamation Research Center Staff

Organization: NDSU - Land Reclamation Research Center, Mandan, ND40

Format: Report

Reference: Land Reclamation Research Center Annual Report, 1987

Key Index Words: Revegetation, Prime Farmland, Productivity, Soil Development, Topography, Runoff, Erosion

Brief Description

This report summarizes the results of four ongoing research projects conducted by LRRC during 1987, and provides some background information about the Center's staff and facilities, advisory committee, and other professional activities. The main objectives of research were the same as reported for 1985 and 1986; e.g., prime farmland soil productivity; development of productivity indices for reclaimed land; soil replacement depths; and runoff and erosion on reclaimed land. However, the specific studies to meet these objectives included: 1) soil development and stability on reclaimed minelands, 2) management of water relations of reshaped minelands, 3) vegetative reestablishment on mined lands, and 4) site specific land reclamation systems. These studies concentrated on determining the effects of soil construction and age, and initial cropping on physical properties of mine soils, comparisons of physical properties of soil reclaimed under prime and nonprime regulations; soil properties and root distribution in reclaimed and undisturbed soils, spatial variability in the properties of regraded spoils; and topographic effects on erosion, runoff, soil moisture, productivity etc.

Analysis of Conclusions:

These studies showed that during the reclamation process, soil compaction and disruption of macropore channels result in the respread subsoil. Therefore, critical levels for bulk density and saturation conductivity need to be established. The effects of deep tillage and different methods of respreading soil materials on compaction were initiated. Regarding the productivity of prime VS: nonprime soils, it was concluded that topography plays a more important role than the soil materials themselves. Attempts to predict properties of regraded spoil from the pre-mine overburden data were not successful.

Title: **LRRC REPORT TO NORTH DAKOTA LEGISLATIVE COUNCIL, 1987**

Authors: Land Reclamation Research Center Staf

f

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: LRRC Report to North Dakota Legislative Council, 1987

Key Index Words: Revegetation, Productivity, Prime Soils, Erosion, Runoff, Saturation Percentage, Compaction, Bulk Density

Brief Description

This report contains research findings and recommendations regarding: 1) prime farmland soil productivity, 2) productivity indices, 3) soil replacement depths and 4), runoff and erosion from reclaimed lands. The 1987 results of these ongoing studies were similar to those reported to the legislative committee in 1986. Differences in soil moisture because of topographic position was formed as the main cause for differences in the productivity of prime and non-prime soils. Work on development of productivity indices continued and included evaluation of bulk density, pore-size distribution and hydraulic conductivity. Studies on the spatial variability in regraded-spoil properties, and attempts to develop a model which could predict these properties on the basis of pre-mine overburden characteristics, indicated that the current methods of regrading spoils make it difficult to apply such a model. Use of saturation percentage (SP) as a parameter for determining respread thicknesses of topsoil plus subsoil was considered as an unnecessary cost to reclamation. Higher runoff from reclaimed areas was found to be due to higher bulk density, lower macropore content, and lower rate of water movement in the reclaimed soils.

Analysis of Conclusions:

The recommendations made in this report are essentially the same as those made in the 1986 report. However, this report also recommended that the use of SP parameter for determining soil respread depths be dropped because SP evaluation has very little practical value. However, this recommendation is based on the fact that 58% of spoil samples, whose SAR was between 12 - 20, had SP values less than 95. Since there were about 42% samples (SAR 12 - 20) which had SP values greater than 95, the recommendation to drop SP parameter seems to be premature.

Title: **1987 MINE-LAND RECLAMATION RESEARCH REVIEW**

Authors: Land Reclamation Research Center and Northern Great Plains Research Center Staff

Organization: NDSU - Land Reclamation Research Center and USDA-ARS Northern Great Plains Research Center, Mandan, ND

Format: Report

Reference: Mined-Land Reclamation Research Review, Bismarck, ND, February 24, 1987

Key Index Words: Revegetation, Spatial Variability, Bulk Density, Topography, Water Use, Sodicity, Saturation Percentage

Brief Description

This report contains thirteen presentations that were made at the Reclamation Research Review held in Bismarck in February 1987. Each presentation summarized the results of a specific reclamation research project conducted by the LRRC or ARS staff. The subjects covered include soil, spoil and revegetation studies conducted on North Dakota mined lands.

Analysis of Conclusions:

The results reported are from completed as well as ongoing studies. Some of these results were previously published. The conclusions drawn from the unpublished results are only tentative and subject to change. Overall, the report contains much useful information, which will be helpful to the lignite industry, regulatory agency and the scientist working on reclamation research.

Title: **LRRC REPORT TO NORTH DAKOTA LEGISLATIVE COUNCIL, 1988**

Authors: Land Reclamation Research Center staff

Organization: NDSU-Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: LRRC Report to North Dakota Legislative Council, 1988

Key Index Words: Revegetation, Productivity, Prime Soils, Erosion, Runoff, Saturation Percentage, Compaction, Bulk Density

Brief Description

This report contains research findings and recommendations regarding: 1) prime farmland soil productivity, 2) productivity indices, 3) soil replacement depths, and 4) runoff and erosion. The 1988 results of these ongoing studies were similar to those reported to the legislative committee in 1986 and 1987.

Analysis of Conclusions:

This report reiterates the conclusions and recommendations that were made in the previous years' reports to the Legislative Council. Consideration to topographic configuration for returning prime soils to original productivity is emphasized. It is recommended that the PSC Reclamation Division, coal companies, and LRRC research staff should develop tentative criteria for bond release evaluations. Elimination of saturation percentage parameter for determining soil respread depths is also recommended again in this report.

Title: **AN OVERVIEW OF TWO DECADES OF REGULATION OF SURFACE COAL MINING AND RECLAMATION IN NORTH DAKOTA**

Authors: W.E. Dodd, J.R. Deutsch, E.E. Englerth, and N.M. Safaya

Organization: North Dakota Public Service Commission, Reclamation Division, Bismarck, ND

Format: Paper

Reference: Proceedings of the Conference "Reclamation, A Global Perspective," (D.G.Walker, C.B.Powter and M.W. Pole, eds.), pp. 471-479, Calgary, Alberta, August 1989

Key Index Words: Reclamation Law, Resource Management, Lignite

Brief Description

This paper presents information on the history, importance, and impacts of lignite mining in North Dakota, and on the development of a regulatory program to control the environmental impacts of mining. Mining and reclamation laws enacted by the state since 1969 are reviewed, and their impacts on the state's lignite industry and on the environment are discussed.

Analysis of Conclusions

Lignite coal mining and its regulation in North Dakota has had a unique history. This paper is recommended to those with an interest in the development of the state's lignite industry and the parallel development of a regulatory program to control the environmental impacts of mining.

Title: **MINING AND RECLAMATION OF PRIME FARMLANDS IN WESTERN NORTH DAKOTA**

Authors: J.D. Friedlander

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

Format: Paper

Reference: Proceedings of the Conference "Reclamation, A Global Perspective," (D.G.Walker, C.B.Powter and M.W. Pole, eds.), pp. 447-457, Calgary, Alberta, August 1989

Key Index Words: Prime Farmland, Prime Soils, Reclamation Law

Brief Description

Federal and state regulations for prime farmland reclamation are more stringent than those for non-prime areas. These entail special segregation of prime topsoils and a minimum total respread depth of 48" on reclaimed prime farmland areas. Since previous research indicates that favorable landscape position is the most important factor in distinguishing prime from non-prime areas in North Dakota, it is suggested that some of the special requirements for prime farmlands are unnecessary and sometimes counterproductive. Data comparing prime and non-prime soils and illustrations of the operational inefficiency of prime farmland reclamation are presented. Recommendations for statutory changes that would enhance reclamation, reduce environmental disturbance, and lower costs for prime farmland reclamation are also given.

Analysis of Conclusions:

Federal and state agencies that regulate mining place high value on prime farmlands. Therefore a high emphasis is placed on conservation of these areas. This paper is important in identifying the characteristics of prime farmlands in North Dakota and in suggesting more efficient ways of enhancing success of the reclamation of cropland areas, both prime and non-prime, in the state.

Title: **LRRC REPORT TO NORTH DAKOTA LEGISLATIVE COUNCIL, 1989**

Authors: NDSU - Land Reclamation Research Center Staff

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: LRRC Report to North Dakota Legislative Council, 1989

Key Index Words: Revegetation, Productivity, Prime Soils, Erosion, Runoff, Saturation Percentage, Compaction, Bulk Density

Brief Description

This report contains research findings and recommendations regarding: 1) prime farmland reclamation, 2) productivity indices, 3) soil replacement depths and 4), runoff and erosion from reclaimed lands. It is concluded that the yield differences between the prime and the nonprime soils are primarily due to their topographical location. Therefore, it is recommended that the USDA Soil Conservation Service should be urged to approve mixing of prime and suitable non-prime topsoils. The research on productivity indices showed that in most cases complete restoration of properties (viz. bulk density, pore size distribution, and hydraulic conductivity) in the reclaimed soils to their premine levels is not needed for optimum production. It is claimed that the data on productivity indices research and that obtained from run off and erosion studies will help LRRC to develop criteria for evaluation of reclamation success for bond release. Research on predicting soil replacement requirement for graded and recontoured spoils based on overburden properties has not yielded easily useable results. However, the report recommends that the parameter of Saturation Percentage is not needed for determining soil respread thicknesses and must be eliminated from the existing reclamation rules. No recommendations have been made in the report based on runoff and erosion studies.

Analysis of Conclusions:

The recommendations made in this report are essentially the same as those made in the 1986, '87, and '88 reports to the North Dakota Legislative Council.

Title: **1989 MINED-LAND RECLAMATION RESEARCH REVIEW**

Authors: Land Reclamation Research Center and Northern Great Plains Research Center Staff

Organization: NDSU - Land Reclamation Research Center, and USDA - ARS Northern Great Plains Research Center, Mandan, ND

Format: Report

Reference: Mined-Land Reclamation Research Review, Bismarck, ND, March 21, 1989

Key Index Words: Revegetation, Spatial Variability, Bulk Density, Topography, Water Use, Grazing, Sodicity, Hydraulic Conductivity

Brief Description

This report contains eleven presentations that were made at the Reclamation Review held in Bismarck in March 1989. Each presentation summarized the results of a specific reclamation research project conducted by the LRRC and ARS staff. The subjects covered include soil, spoil, revegetation, and animal production studies conducted on North Dakota mined lands. One of the presentations was based on a growth chamber study of morphology of grass seedlings as affected by planting depth.

Analysis of Conclusions:

The results reported are from completed as well as ongoing research projects. Some of these results were previously published. The conclusions drawn from the unpublished results are only tentative and subject to change. Overall, the report contains much useful information, which will be helpful to the lignite industry, regulatory agency and the scientists working on reclamation research.

Title: **LRRC REPORT TO NORTH DAKOTA LEGISLATIVE COUNCIL, 1990**

Authors: Land Reclamation Research Center Staff

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: LRRC Report to North Dakota Legislative Council, 1990

Key Index Words: Revegetation, Productivity, Prime Soils, Erosion, Runoff, Saturation Percentage, Compaction, Bulk Density

Brief Description

This report contains research findings on the following mining and reclamation aspects, and provides suggestions for implementing these into the regulatory program: 1) criteria for evaluating reclamation success for bond release based on vegetative reestablishment and soil parameters, 2) effect of postmine topography on soil moisture levels and crop yields, 3) effects of reclamation techniques on soil compaction and productivity, and 4), methods of evaluating and controlling run-off and erosion from reclaimed lands. The results of an experiment on water infiltration at the Indian Head mine, and the studies conducted at the Center and Glenharold mines on soil parameters related to grassland productivity, would be used to establish optimum levels of the soil parameters critical to productivity on reclaimed lands. Research on topographical effects on soil moisture and yield were conducted at the Center, Falkirk, and Freedom Mines. Drought conditions in 1989 caused poor yields and the results were inconclusive. Tillage treatments to alleviate compaction were conducted at the Center, Freedom, Beulah and Glenharold Mines, but the results were again inconclusive. No runoff/erosion studies were conducted in 1989.

Analysis of Conclusions

No specific or new conclusions have been drawn. Although four recommendations have been made, they are non-specific and essentially promissory of working closely with the regulatory agency and the lignite industry.

Title: **1991 MINE-LAND RECLAMATION RESEARCH REVIEW**

Authors: Land Reclamation Research Center and Northern Great Plains Research Center Staff

Organization: NDSU - Land Reclamation Research Center, and USDA - ARS Northern Great Plains Research Center, Mandan, ND

Format: Report

Reference: Mined-Land Reclamation Research Review, Bismarck, ND, March 21, 1991

Key Index Words: Revegetation, Spatial Variability, Bulk Density, Topography, Water Use, Grazing, Sodicity, Hydraulic Conductivity

Brief Description

This report contains twelve presentations that were made at the Reclamation Review conference held in Bismarck in March 1991. Each presentation summarized the results of a specific reclamation research project conducted by the LRRC and ARS staff. The topics covered include: 1) use of alternative soil materials and chemicals in reclamation, 2) sample adequacy for ground cover, 3) relation of cover to erosion, 4) relation of topography to moisture and yield, 5) soil moisture in undisturbed lands, 6) root zone hydrology, 7) compaction, root development and yield, 8) relation of soil depth to cover, yield and diversity of reclaimed grasslands, 9) water infiltration in mineland profiles, 10) physical properties on prime and nonprime soils, 11) reclamation of brine contaminated soils, 12) grass seedling establishment.

Analysis of Conclusions:

The report contains much useful information, which will be helpful to the lignite industry, regulatory agency and the scientists working on reclamation research. However, the conclusions drawn in some studies were tentative and subject to change because the project was not completed.

Title: **TOPOGRAPHIC EFFECTS ON SPRING WHEAT YIELDS AND WATER USE**

Authors: G.A. Halvorson and E.C. Doll

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Paper

Reference: Soil Science Society of America Journal 55(6) 1680-1685, 1991

Key Index Words: Topographic Factor, Topography, Water Use, Productivity

Brief Description

The effects of landscape (hence, water distribution) on water use and wheat yield were studied over a period of five years at two locations in North Dakota. At each location, four soil series (Tonka, Bowbells, Williams and Zahl) occupying different topographic positions were monitored. Topographic factor was calculated at each site by measuring the slope in four directions and adding the slopes together. A positive topographic number would indicate that the site would receive water by runon, and a negative number would indicate that water would runoff from the site. Topographic factors were calculated for field locations 3, 6, 15, and 30 m apart from each other. Wheat yields were generally correlated to water use, but when the topographic factor was included in the regression of yield vs. total water use , the coefficient of determination increased, especially in the normal wet years.

Analysis of Conclusions:

The topographic factor provides a quantitative method to measure water distribution in a landscape. In mineland reclamation where the disturbed land has to be graded to a specified topography, this line of research will help develop better productivity models. Conversely, it will also help to make decisions as to the type of topography a mined area may need to be returned to.

Title: **LRRC REPORT TO NORTH DAKOTA LEGISLATIVE COUNCIL, 1991**

Authors: NDSU - Land Reclamation Research Center Staff

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: LRRC Report to North Dakota Legislative Council, 1991

Key Index Words: Revegetation, Productivity, Prime Soils, Erosion, Runoff, Saturation Percentage, Compaction, Bulk Density

Brief Description

This report contains research findings on the following mining and reclamation aspects, and provides suggestions for implementing these into the regulatory program: 1) criteria for evaluating reclamation success for bond release based on vegetative re-establishment and soil parameters, 2) effect of postmine topography on soil moisture levels and crop yields, 3) effects of reclamation techniques on soil compaction and productivity, and 4), methods of evaluating and controlling run-off and erosion from reclaimed lands. Infiltration studies at Indian Head and velva Mines showed that hydraulic conductivity of reclaimed soils are significantly lower than the undisturbed soils. This was attributed to low permeability of micropores and lack of macropores due to spreading, layering and compaction during reclamation. Grassland productivity was found to be related more to the topographic position than to the thickness of replaced soil. However, unlike wheat, forage yields were unaffected by topographic position. In experiments with different tillage treatments (applied to respread subsoil and topsoil) compaction was not alleviated in subsoil. Work on estimation of soil losses from reclaimed lands continued.

Analysis of Conclusions

A model to quantify the relationship of soil and landscape factors to productivity was developed. If future testing validates the model, it will be of much use to the industry. Beta or mosaic diversity was rated as a better index of diversity large reclaimed tracts than alpha diversity. Alleviation of compaction by topsoil or subsoil tillage methods was found to be ineffective. These and other conclusions discussed in this report make it valuable to the industry and the regulatory agency

Title: **LRRC REPORT TO NORTH DAKOTA LEGISLATIVE COUNCIL, 1992**

Authors: Land Reclamation Research Center Staff

Organization: NDSU- Land Reclamation Research Center and Agricultural Experiment Station , Mandan, ND

Format: Report

Reference: LRRC Report to North Dakota Legislative Council, 1992

Key Index Words: Revegetation, Productivity, Prime Soils, Erosion, Runoff, Saturation Percentage, Compaction, Bulk Density

Brief Description

Like the 1991 report presented to the North Dakota Legislative Council, this report contains research findings on the following mining and reclamation aspects, and provides suggestions for implementing these into the regulatory program: 1) criteria for evaluating reclamation success for bond release based on vegetative re-establishment and soil parameters, 2) effect of postmine topography on soil moisture levels and crop yields, 3) effects of reclamation techniques on soil compaction and productivity, and 4), methods of evaluating and controlling run-off and erosion from reclaimed lands.

Analysis of Conclusions

A model to quantify the relationship of soil and landscape factors to productivity was developed. If future testing validates the model, it will be of much use to the industry. Beta or mosaic diversity was rated as a better index of diversity large reclaimed tracts than alpha diversity. Alleviation of compaction by topsoil or subsoil tillage methods was found to be ineffective. These and other conclusions discussed in this report make it valuable to the industry and the regulatory agency.

Title: **ANNUAL REPORT- 1992, LAND RECLAMATION RESEARCH CENTER**

Authors: Land Reclamation Research Center Staff

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: Land Reclamation Research Center Annual Report, 1992

Key Index Words: Revegetation, Prime Farmland, Productivity, Soil Development, Topography, Runoff, Erosion

Brief Description

This report summarizes the results of seven ongoing research projects conducted by LRRC during 1992. Three of the projects (6101, 6102, 6103) were supported by state appropriated moneys and the remaining (5801, 5802, 5804, and 5805) by grant funds. Project 5801: Relations of compaction and soil physical parameters to productivity of reclaimed soils. --No consistent effects on soil bulk density or productivity were noted following different tillage treatments. Project 5802: Surface and root zone hydrology of mined lands. --Research conducted at the Indian Head and Velva Mines indicated that the hydraulic conductivity and hence subsoil recharge of reclaimed mine lands is significantly lower than the undisturbed lands due to low permeability of miropores and lack of macropores. Project 5804: Seedstocks enhancement for conservation reserve program. --Near infrared reflectance spectroscopy (NIRS) technique for plant material analysis for various quality components was used to develop calibration equations for western grasses. Project 5805: Wetland hydrology of minelands. -- Initiated in 1992, this project aims to investigate the groundwater recharge potential of natural, reclaimed and abandoned mineland wetlands. Project 6101: Soil development on reclaimed minelands. --Started in 1986 and continued through 1992, this project studied temporal changes in soil properties of reclaimed prime and nonprime soils. Bulk density of replaced topsoils decreased over time due to organic matter accumulation. No significant changes occurred in the respread subsoils. Project 6102: Management and water relations of reshaped mineland. --Soil loss from reclaimed areas was in linear proportion to the extent of bare surface. Project 6103: Vegetative reestablishment on mined lands. Includes several independent studies - effects of topography on grain yield, effects of good quality spoil on wheatgrass and alfalfa, comparisons of premine overburden properties with those of the graded spoil, etc.

Analysis of Conclusions:

The report contains much useful information, which will be helpful to the lignite industry, regulatory agency and the scientists working on reclamation research.

Title: **APPLICABILITY OF U.S. ENVIRONMENTAL LAWS IN THE DEVELOPING COUNTIRES: AN ANALYSIS OF ECOLOGICAL AND REGULATORY CONCEPTS**

Authors: N.M. Safaya and M.K. Wali

Organization: North Dakota Public Service Commission, Bismarck, ND, and State University of New York, Syracuse, NY

Format: Paper (Chapter)

Reference: Environmental Rehabilitation; Preamble to Sustainable Development (M.K. Wali, ed.), pp. 143-155, SPB Academic Publishing bv, The Hague, The Netherlands, 1992

Key Index Words: Environmental Laws, Environmental Regulations, Developing Countries

Brief Description

The objectives of the paper were: 1) to provide a broad outline of four U.S. environmental laws that have a direct relevance to the degradation and rehabilitation of ecosystems, and 2) to explore ways in which the concepts and mechanisms of environmental protection in these laws can be of relevance to the developing countries. Laws pertaining to clean air, clean water, waste disposal and mining and reclamation have been briefly discussed, and the applicability of their ethics to other countries explored. The paper also provides a brief discussion on the problems, policies and perceptions currently prevailing in the U.S. and some of the developing countries in the world.

Analysis of Conclusions:

This paper provides a broad outline of some of the present day environmental concerns, and the policies and regulatory mechanisms that have been developed in the U.S. and other countries to mitigate these concerns. By focusing discussions on air, water, waste disposal, and mining and reclamation - environmental issues of closely related significance - the authors advocate that several developing countries will benefit from U.S. experience in developing policies and regulatory mechanisms designed to meet the specific problems faced by these countries.

Title: **PRESSURE GROUT RECLAMATION PROCESSES CONDUCTED INSIDE A BUILDING**

Author: B.E. Beechie

Organization: North Dakota Public Service Commission, Bismarck, ND

Format: Paper

Reference: Presented at the 15th Annual Meeting of the Association of Abandoned Mine Land Programs, Jackson, WY, September 13-15, 1993

Key Index Words: AML, Subsidence, Pressure Grouting

Brief Description

A pressure grouting reclamation project was conducted by the Public Service Commission's AML Division in the fall of 1992 at Beulah, ND. This paper describes the methodology followed in the investigation and implementation of the reclamation project. The objective of the project was to stabilize and prevent collapsing of a high use area over a 60 acre underground mine in the town of Beulah, ND. A total of 12,000 cubic yards of cementitious grout was injected into the abandoned mine workings, of which 500 cubic yards was injected from inside the Eagles Club building. The grout used consisted of powdered sodium bentonite, portland cement and sufficient water to produce a ten inch slump grout.

Analysis of Conclusions

Large scale drilling and grouting projects from inside buildings are an exception rather than the rule. Conventional methods of rotary drilling, angle drilling and grouting will suffice in most situations. However, in situations where large structures are located over a collapsing mine, conventional methods may not work and grouting from inside such structures may become necessary.

Title: **TOPOEDAPHIC UNIT ANALYSIS: A SITE CLASSIFICATION SYSTEM FOR RECLAIMED MINED LANDS**

Authors: K. Krabbenhoft, D. Kirby, M. Biondini, G. Halvorson, and D. Nilson

Organization: NDSU, LRRC, and Basin Cooperative

Format: Paper

Reference: Catena 20:289-301,1993

Key Index Words: Topoedaphic Units, Revegetation

Brief Description

This paper provides a land classification system for reclaimed mined lands based on delineation of topoedaphic units. The validity and usefulness of this classification system for evaluating revegetation success was field tested at the Glenharold Mine. Topoedaphic Units are delineated on the basis of soil physical, chemical and topographic characteristics of a reclaimed mine site. The authors claim that vegetation sampling of topoedaphic units or stratified sampling of topographic positions will provide a more objective analysis of reclamation success.

Analysis of Conclusions:

The general approach followed in this study is in agreement with the existing concept of stratified sampling. In the present case two topoedaphic units were identified, one restricted to upper slope positions and the other to the more mesic downslope positions. The authors contend that vegetation measurements and analyses required for evaluation of reclamation success, would be best done by stratifying the sampling area into topoedaphic units

Title: **LRRC REPORT TO NORTH DAKOTA LEGISLATIVE COUNCIL, 1993**

Authors: Land Reclamation Research Center Staff

Organization: NDSU- Land Reclamation Research Center and Agricultural Experiment Station , Mandan, ND

Format: Report

Reference: LRRC Report to North Dakota Legislative Council, 1993

Key Index Words: Revegetation, Productivity, Prime Soils, Erosion, Runoff, Saturation Percentage, Compaction, Bulk Density

Brief Description

This report provides data, conclusions, and recommendations based on the following 11 major projects: 1) Influence of revegetation on reclaimed mineland erosion, 2) Relation of compaction and soil physical parameters to productivity of reclaimed soils, 3) Soil development on reclaimed Minelands, 4) Predicting required spoil quality from overburden quality, 5) Use of good quality spoil and chemical amendments on abandoned minelands, 6)Comparison of the productivity of prime and nonprime topsoils, 7) Spatial variability of spring wheat yields from small watershed, 8) Topographical effects on reclaimed soils, 9) Soil depth and quality requirements for reclamation of rangeland, 10) Surface and rootzone hydrology of Minelands.'

Analysis of Conclusions

The recommendation made in this report are noteworthy. Soil loss through erosion was found to decrease linearly as the vegetative cover increases beyond 30 percent. Subsoil tillage to alleviate compaction is not effective. Predicting the quality of regraded spoil from overdurden data is difficult. Respreading good quality spoil on sodic spoil facilitates to establish vegetation on abandoned mines. The difference in prime and non prime soils with regard to crop yield is primarily water related. Lesser respread soil depths may be needed for rangeland. Reclaimed soils have less macropores which lowers their permeability.

Title: **1993 MINE-LAND RECLAMATION RESEARCH REVIEW**

Authors: Land Reclamation Research Center and Northern Great Plains Research Center Staff

Organization: NDSU - Land Reclamation Research Center, and USDA - ARS Northern Great Plains Research Center, Mandan, ND

Format: Report

Reference: Mined-Land Reclamation Research Review, Bismarck, ND, March 15, 1993

Key Index Words: Revegetation, Infiltration, Tillage, Prime soils, Spatial Variability, Cover, Erosion

Brief Description

This report contains eleven scientific papers presented at the Reclamation Review conference held in Bismarck in March 1993. Each presentation summarized the results of a specific reclamation research project conducted by the LRRC and ARS staff. The topics covered include: 1) Infiltration and soil water distribution of pre- and post-mine soil profiles, 2) Tillage influences on physical properties and forage yields, 3) soil physical properties and crop yields, 4) Effect of time after reclamation on physical properties of prime and nonprime soils, 5)Spatial variability of spring wheat yields from a small watershed, 6) Wetland hydrology of minelands, 7) Topsoil depth on reclaimed rangelands, 8) Forage & beef production and water use from seasonlong reclaimed & native pasture, 9) Erosion versus cover on revegetated reclaimed areas, 10) Comparison of premine bore hole data with regraded spoil characteristics, 11) Use of good quality spoil and chemical amendments on abandoned minelands.

Analysis of Conclusions:

The report contains much useful information, which will be helpful to the lignite industry, regulatory agency and the scientists working on reclamation research.

Title: **ANNUAL REPORT- 1994, LAND RECLAMATION RESEARCH CENTER**

Authors: Land Reclamation Research Center Staff

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: Land Reclamation Research Center Annual Report, 1994

Key Index Words: Revegetation, Prime Farmland, Productivity, Soil Development, Topography, Runoff, Erosion

Brief Description

In this brief report, LRRC has listed the programmatic areas, goals, and accomplishments of their current reclamation research activity. The programmatic areas were divided into: 1)Effects of Reclamation on soil physical properties and land productivity; 2) Management of water relations of reshaped minelands; 3) Vegetative establishment of mined lands. Several goals are listed under each programmatic area. Crop yield data collected from compaction studies showed no consistent differences between chiseling and subsoiling (ripping), nor was there any effect produced by prior forage crops on wheat. Research on surface and root zone hydrology indicated severe lack of effective pore space at deeper depths in reclaimed lands. Comparative evaluation of wetland hydrology continued to be studied. Experiments on prime and nonprime soils placed at different topographical locations needed one more year of study. A new project to review soil depth requirements was initiated.

Analysis of Conclusions:

As mentioned above, some of the projects had not been completed to derive any meaningful conclusions. Research on alleviation of compaction gave disappointing results, which raises the question how this problem can be dealt with. Obviously research will have to continue on this important issue. The conclusions drawn from root zone hydrology work are very cogent and must be considered when developing reclamation plans.

Title: **QUANTIFYING TOPOGRAPHIC DIFFERENCES BETWEEN PREMINING AND RECLAIMED LANDSCAPES AT A LARGE SURFACE COAL**

Authors: J. D. Friedlander

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

Format: Paper

Reference: Presented at the International Land Reclamation and Mine Drainage Conference and the Third International Conference on the Abatement of Acidic Drainage, Pittsburgh, PA, April 24-29, 1994

Key Index Words: Topography, Landuse

Brief Description

Topographic comparision of premine and reclaimed landscape was made for 2300 acres at the Freedom Mine. Weighted average slope of the entire premine acreage was 3.8% compared to 3.0% for the reclaimed. The average slope for the premine cropland was 2.7% and for the reclaimed cropland 2.1%., and for rangeland 7.0% and 5.5%, respectively. There was a 50% decrease in the rangeland acreage with slopes >9%. Thus mining and reclamation at the Freedom Mine have allowed some flattening of the topography and, thereby, loss of topographic diversity.

Analysis of Conclusions

The author believes that landscape improvement with reclamation causes loss of diversity in the terrain, which may conflict with the regulatory requirement of vegetation diversity for successful reclamation. This conclusion is not completely valid because the AOC and landuse requirements will not allow acute changes in the postmining landscapes from those existing before mining.

Title: **1995 MINELAND RECLAMATION RESEARCH REVIEW**

Authors: Land Reclamation Research Center and Northern Great Plains Research Center Staff

Organization: NDSU - Land Reclamation Research Center, Mandan, ND

Format: Report

Reference: Mined-Land Reclamation Research Review, Bismarck, ND, March 29, 1995

Key Index Words: Revegetation, Infiltration, Tillage, Prime Soils, Spatial Variability, Cover, Erosion

Brief Description

This report contains abstracts of fourteen scientific papers presented by the NDSU-LRRC, PSC, OSM, NRCS and USDA-ARS staff, at the Reclamation Review conference held in Bismarck in March 1995. The topics covered include: 1) Flyash grout testing in a simulated wet mine environment, 2) Wetland hydrology of minelands, 3) Proposal for classifying and mapping disturbed lands in North Dakota, 4) Soil pore characteristics as measures of quality of minesoil, 5) Reclamation of prime and nonprime soils, 6) Reliability of SCS curve number method on semi-arid reclaimed minelands, 7) Success of current soil depth requirements, 8) Tillage and prior cropping effects on soil physical properties and production, 9) Plant diversity of reclaimed grasslands, 10) Woodland reclamation on reclaimed mineland lands, 11) Historical development of ecological reclamation, 12) OSM's technology transfer program, 13) Electronic permitting, 14) A fresh look at reclamation research needs.

Analysis of Conclusions

The report does not contain all the information and data that were presented in the conference. However, it is an excellent source for obtaining further information from the authors on the wide variety of reclamation topics that were discussed in the conference. The conclusions drawn in the report are based on several years of research work and, therefore, quite important for the lignite industry and the state and federal regulatory agencies as such.

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