IMPROVING THE PUBLIC SERVICE COMMISSION GUIDELINES FOR EVALUATING SUCCESS OF RECLAIMED GRASSLANDS

A Research Proposal Submitted
to the North Dakota Industrial Commission
by the Animal and Range Sciences Department
of the North Dakota Agricultural Experiment Station
and the Lignite Energy Council

Principal Investigator:

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Amount Requested: $5,000

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ABSTRACT

The purpose of this research will be to determine the relationship between precipitation, temperature, growing degree days and herbage yield, seasonality and species diversity for various Range Sites as defined by the USDA, Soil Conservation Service Technical Guides.

NDAC 69-05.2-22-07(4)(a) states that success of revegetation of native grassland and tame pastureland will be determined based on productivity, diversity, seasonality, ground cover and permanence. Determination of reclaimed grassland success is made either by comparison to reference areas of the original grasslands for each range site or by comparison to Technical Guides for Range Sites as published by the USDA, Soil Conservation Service (USDA, SCS 1984). Annual variation in herbage yield, seasonality and species diversity are easily assessed on reference sites by annual sampling of these sites. The Technical Guides (Silty is attached) provide normal production and diversity values for Range Sites, however, they do not provide correlation of these vegetative parameters with annual climatic phenomena.

This proposed research will utilize existing data sets for various range sites in western North Dakota. If relationships can be developed, determination of grassland reclamation success following Public Service Commission Guidelines will be improved.

Data will be gathered from the various western North Dakota locations and reviewed for completeness. Those data deemed adequate for each range site will be used in the model building. Data collection and synthesis should be completed by November 1993. Statistical analyses should be accomplished by March 1994 with a final report completed by June 1994.

Project Summary.

The objective of this research is to determine the relationship between precipitation, temperature and growing degree days, and herbage yield, seasonality and species diversity for various Range Sites as defined by the USDA, Soil Conservation Service Technical Guides.

NDAC 69-05.2-22-07(4)(a) states that success of revegetation of native grassland and tame pastureland will be determined based on productivity, diversity, seasonality, ground cover and permanence. Public Service Commission Guidelines allow determination of reclaimed grassland success by comparison to reference areas of the original grasslands for each range site or by comparison to Technical Guides for Range Sites as published by the USDA, Soil Conservation Service (USDA, SCS 1984). Annual variation in herbage yield, seasonality and species diversity are easily assessed on reference sites by annual sampling of these sites. The Technical Guides (Silty is attached) provide normal production and diversity values for Range Sites, however, they do not provide correlation of these vegetative parameters with annual climatic phenomena.

Reference areas are undisturbed grassland sites (range sites) adjacent to or near similar mined sites. They are selected based upon their similarity in soils, vegetation, topography, etc. to the surrounding lands to be mined. In addition and of equal importance, reference areas are subject to the same climatic (growing) conditions as adjacent reclaimed grasslands making these sites ideal standards for annual comparison.

Evaluation of reclamation success appears easier but in reality is more difficult using USDA Soil Conservation Service Technical Guides for Range Sites. The range

site concept was developed to be able to determine the range condition ("health") of a site (Dyksterhuis 1949). Range sites are defined as areas of uniform potential to produce a certain kind (species composition) and amount (yield) of vegetation. Description of species composition and yield are readily available for each range site which makes them attractive as standards. However, they were developed for complex rangeland sites which have been evolving over thousands of years. In addition, Range Site Technical Guides do not suggest variability in yield or composition due to current growing conditions (drought, etc.). These characteristics put newly reclaimed grasslands at a disadvantage when using Range Site Technical Guides as standards.

This research will utilize existing data sets for various range sites in western North Dakota. If relationships can be developed, determination of grassland reclamation success following the North Dakota Public Service Guidelines will be improved.

Project Description.

The basic premise of this research project is that yield, seasonality and species composition of reclaimed grasslands and range sites (native grasslands) vary similarly to availability of water, the primary limiting growth factor in semi-arid and arid regions. Reclaimed grasslands are also susceptible to periodic droughts under which original rangelands developed (Whitman et al. 1943, Albertson et al. 1957). For this study we propose to use historical data to assess herbage yield, seasonality and species composition of Silty, Sandy, Shallow and Thin Claypan Range Site Technical Guides for the Missouri Slope Vegetation Zone.

Historical data from reference areas on existing coal mines, North Dakota State University's Dickinson Research Center, and the Agricultural Research Service at

Mandan will be used to build statistical models. The model will be used to predict the dependence of forage yield, seasonality and composition of selected range sites to water availability parameters temperature and growing degree days. Categories of seasonal precipitation will be selected such as dormant period, pre-growing season, growing season, May, June, July and various combinations of the above. Temperature categories such as mean monthly, means high monthly, days exceeding 90°F, etc. and growing degree days will be tested. Data will be subjected to linear and multiple regression and correlation analysis to determine the relationship of environmental parameters to total yield, seasonality and species composition.

The Animal and Range Sciences Department of NDSU have the computer, software, labor, library, and any additional computing expertise necessary for completion of this project. The Lignite Energy Council, through its members, can provide necessary data and on-site expertise.

The results of this project will improve North Dakota Public Service Commission Guidelines as standards for evaluating success of reclaimed grasslands. In semi-arid grasslands where most coal reserves exist, climate (mainly precipitation) has been reported to have the major influence on productivity and cover of the vegetation (Van Dyne et al. 1984). USDA, SCS Technical Guides for Range Sites suggest normal yields and species compositions for sites but do not include variation in these values due to annual climatic variation (Van Dyne et al. 1984). The results of this study will allow evaluation of grassland reclamation success to be determined utilizing the correlation of annual climatic data with vegetation yields, seasonality and species composition.

Standards of Success.

The standard for success of this research effort will be a final report documenting the relationship between annual growing conditions, precipitation, temperature and growing degree days, and yield, seasonality and species composition of reclaimed grasslands.

Background.

The investigators in this proposal have been working in reclamation research since 1988. They have researched soil depth and quality relationships to reclamation success of grasslands (1988-1992) funded by the North Dakota Industrial Commission, Lignite Energy Council (formerly North Dakota Lignite Council), and North Dakota State University's Land Reclamation Research Center and Animal and Range Sciences Department. Numerous reports (10) have been written and presented including soil depth/quality requirements for grassland reclamation success, recolonization of vesicular-arbuscular micorrhizae, levels of plant diversity on reclaimed lands, defining topoedaphic units for land classification purposes, drought effects on reclaimed grasslands and reclamation technique effects on success of reclaimed grasslands.

The investigators received competitive funding from the U.S. Geological Survey in 1991 to study the hydrological and ecological dynamics of a created seasonal wetland on the Falkirk Mine (North American Coal Corporation), Underwood, ND. At present wetland creation has little scientific formulation on which to base confidence in lost function replacement, hence the need for this research. In 1991, baseline soils, topography, and vegetation data were collection. Hydrologic instrumentation will begin in the spring of 1992 and continue through 1993.

Qualifications.

Principal Investigator:

Donald R. Kirby

Present Position: Professor, Animal and Range Sciences Department, North Dakota State University, Fargo, ND 58105.

Education:

B.S. Range and Wildlife Management
Humboldt State University, 1974

M.S. Natural Resources Management
Humboldt State University, 1976

Ph.D. Range Science
Texas A&M University, 1980

Experience:

1974-1976 Research Assistant, Humboldt State University
1976-1978 Research Technician, Texas A&M University
1978-1980 Research Assistant, Texas A&M University
1980-1986 Assistant Professor (NDSU)
1986-1992 Associate Professor (NDSU)
1992-present Professor (NDSU)

Research Experience:

1988-1992 Conducting competitive funded research in grassland reclamation and recreated wetlands in cooperation with the Land Reclamation Research Center and the members of the Lignite Energy Council
1980-1992 Completed 14 graduate research programs
1977-1992 Published 25 research articles
1974-1992 Received over $250,000 in grants

Cooperating Investigator:

Kelly D. Krabbenhoft

Present Position: Research Specialist, Animal and Range Sciences Department, North Dakota State University, Fargo, ND 58105

Education: B.A. Biology
Moorhead State University, 1989

M.S. Animal and Range Sciences
North Dakota State University, 1991

Experience: 1988-1989 Research Technician, NDSU
1989-1991 Research Assistant, NDSU
1991-present Research Specialist, NDSU

Research Experience:

1988-1991 Data collection and analysis of reclaimed grasslands
1991-1992 3 research articles accepted or currently in review from mined land research

Value to North Dakota.

The research results from this project will be used by the members of the Lignite Energy Council and North Dakota Public Service Commission. Evaluation of reclaimed grassland success using present Public Service Commission Guidelines puts the industry at a disadvantage as USDA, SCS Technical Guides for Range Sites do not account for annual variation in growing conditions. This research will improve the use of Technical Guides as standards by determining variation for yields and species composition based on annual precipitation. This will result in a more "fair" assessment of grassland reclamation success.

Management.

The principal investigator will personally oversee the entire project to completion. Project evaluation points used will correspond to the proposed research timetable.

Timetable.

Data will be gathered from the various locations and reviewed for completeness. Those data deemed adequate for each range site will be used in the model building. Data collection and synthesis should be completed by November 1993. Statistical analyses should be accomplished by March 1994 with a final report completed by June 1994.

Budget.

Proposal Budget for July, 1993 - June, 1994

	Hours	Lignite Research Council	Matching Lignite Energy Council	Matching NDSU	Total
A. Salary					
Principal Investigator	150			3,750	3,750
Cooperating Investigator	150			2,250	2,250
Part-time Employees	600	4,000	4,000		8,000
B. Employee Benefits (27% of salary, 10% for technicians)		400	400	1,620	2,420
C. Office Supplies and Computer Analyses		200	200	500	900
D. Travel		400	400		800
E. Indirect Costs				1,880	1,880
TOTAL		$5,000	$5,000	$10,000	$20,000

The level of funding as presented in the budget is the amount necessary to meet the objectives. The research will probably not be initiated without this funding.

Matching funds.

These funds are identified in the budget as **Matching** from the Lignite Energy Council and North Dakota State University.

Tax Liability.

The applicants of this proposed research are employees of North Dakota State University and the State of North Dakota; therefore, this section does not apply.

Literature Cited

Albertson, F.W., G.W. Tomanek and A. Riegel. 1957. Ecology of drought cycles and grazing intensity on grasslands of central Great Plains. Ecol. Monogr. 27(1):27-44.

Dyksterhuis, E.J. 1949. Condition and management of range land based on quantitative ecology. J. Range. Manage. 2:104-115.

USDA, SCS. 1984. North Dakota Range Site Technical Guide Notice ND35, Bismarck.

Van Dyne, G.W., R.L. Hollingsworth II and S.A. Nicholson. 1984. Evaluation of available vegetation data and sampling procedures for pre- and post-mining vegetation assessments in North Dakota. Part II: Yield and composition of vegetation on North Dakota soil series and rangeland sites. Report to the North Dakota Public Service Commission. 86 p.

Whitman, W.C., H.C. Hanson and R. Peterson. 1943. Relation of drouth and grazing to North Dakota range lands. ND Agric. Expt. Sta. Bull. 320.