FINAL REPORT

1999 Project Abstract

For the Period Ending June 30, 2001/2

TITLE: Integrated Prairie Management
PROJECT MANAGER: W. Daniel Svedarsky
ORGANIZATION: Northwest Research and Outreach Center (formerly Northwest Experiment Station, University of Minnesota.
ADDRESS: Crookston, MN 56716
WEB SITE ADDRESS: (If applicable)
FUND: Minnesota Environment and Natural Resources Trust Fund
LEGAL CITATION: ML 1999, Chap. 231, Sec. 16, Subd. 7d (Agriculture and Natural Resource Based Industries) INTEGRATED RESOURCE MANAGEMENT.

APPROPRIATION AMOUNT: $ 350,000

This project was made up of 2 subprojects. The first examined challenges of conserving prairie in the Felton Prairie Complex of Clay County where it overlies valuable aggregate resources. This included, 1) an aggregate inventory using rotosonic drilling, 2) the reclamation of an abandoned gravel pit to a wetland and prairie reconstruction to provide a place for public interpretation of the Felton Prairie Complex and adjacent gravel mining activities, and 3) integrated stewardship planning. A site-specific stewardship plan was developed for about 2,000 acres of public land within the Complex with emphasis on developing a conflict resolution process for the 800 acres containing both prairie and gravel. The process recognized society's interest in prairie conservation as well as the need for aggregate resources. The second part of the project researched management effects of fire and grazing on prairie vegetation and grassland birds, and the use of prairie vegetation by livestock at selected sites in a 9-10 county area, including Clay County. Rotational grazing contributed to the maintenance of desirable prairie plants more than continuous grazing or no grazing. In spite of a short study period, prescribed burning increased desirable prairie plants over no-burn controls. The post-burn age of prairie plots affected birds differently depending on their habitat requirements, emphasizing the need for a mosaic of post-burn ages of prairie management units in the landscape. Prairie vegetation can provide desirable livestock forage during the warm part of the grazing season since many native grasses grow best then. Moderately-grazed prairie contained more birds that either heavily grazed or lightly-grazed plots. A landowner's guide to prairie management was prepared and will be widely distributed to individuals and agency prairie managers. It contains finding of this study and other research which is applicable to native prairie management and planting prairie in aggregate-mined areas.

July 1, 2002

LCMR Final Program Report

Project Completion Date: 30 June 2002

LCMR WORK PROGRAM 1999

I. PROJECT TITLE: Ch. 231, Sec. 16, Sub. 7 d ---- INTEGRATED PRAIRIE MANAGEMENT

PROJECT MANAGER: W. Daniel Svedarsky
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TOTAL BIENNIAL PROJECT BUDGET:

$ LCMR:	350,000	$ Match:	(none required)
- $ LCMR Spent	327,074		
$ LCMR Balance	22,926		

A. LEGAL CITATION: ML 1999, Chap. 231, Sec. 16, Subd. 7d (Agriculture and Natural Resource Based Industries) INTEGRATED RESOURCE MANAGEMENT.

Appropriation Language:

$ 175,000 the first year and $ 175,000 the second year are from the trust fund to the Commissioner of Natural Resources for an agreement with the University of Minnesota and Clay County in a cooperative project for an aggregate resource inventory on public lands, prairie restoration and research, and stewardship plans for management options. This appropriation is available until June 30, 2002 at which time the project must be completed and final products delivered, unless an earlier date is specified in the work program.

B. STATUS OF MATCH REQUIREMENT: (None required)

II. and III. PROGRESS SUMMARY:

This project was made up of 2 subprojects. The first examined challenges of conserving prairie in the Felton Prairie Complex of Clay County where it overlies valuable aggregate resources. This included, 1) an aggregate inventory using rotosonic drilling, 2) the reclamation of an abandoned gravel pit to a wetland and prairie reconstruction to provide a place for public interpretation of the Felton Prairie Complex and adjacent gravel mining activities, and 3) integrated stewardship planning. A site-specific stewardship plan was developed for about 2,000 acres of public land within the Complex with emphasis on developing a conflict resolution process for the 800 acres containing both prairie and gravel. The process recognized society's interest in prairie conservation as well as the need for aggregate resources. The second part of the project researched management effects of fire and grazing on prairie vegetation and grassland birds, and the use of prairie vegetation by livestock at selected sites in a 9-10 county area, including Clay County. Rotational grazing contributed to the maintenance of desirable prairie plants more than continuous grazing or no grazing. In spite of a short study period, prescribed burning increased desirable prairie plants over no-burn controls. The post-burn age of prairie plots affected birds differently depending on their habitat requirements, emphasizing the need for a mosaic of post-burn ages of prairie management units in the landscape. Prairie vegetation can provide desirable livestock forage during the warm part of the grazing season since many native grasses grow best then. Moderately-grazed prairie contained more birds that either heavily grazed or lightly-grazed plots. A landowner's guide to prairie management was prepared and will be widely distributed to individuals and agency prairie managers. It contains finding of this study and other research which is applicable to native prairie management and planting prairie in aggregate-mined areas.

IV. OUTLINE OF PROJECT RESULTS.

A. Subproject One – FELTON PRAIRIE STEWARDSHIP PLAN FOR PUBLIC LANDS

Result 1. Aggregate resource inventory on selected public lands (Cindy Buttleman, Leader).

A targeted drilling program on selected public lands was completed in January 2000. Using rotosonic drilling methods, 27 holes were drilled within a 735-acre target area on Felton Prairie for a total of 2,059 linear feet ranging in depth from 25 to 145 feet. From this information, geologic interpretations were developed about the aggregate resource and volume estimates were calculated. The report was completed in May 2000 and delivered to the Felton Prairie Stewardship Committee. The report contains detailed maps, cross-sections, sample analyses, and volumetric calculations describing the quality and quantity of aggregate resources on selected public lands in the Felton Prairie Complex. The drilling was completed under the supervision of professional staff from the DNR Division

of Lands & Minerals. DNR interpreted the data and prepared the final report. Mn/DOT staff performed laboratory analysis on the collected samples. Had this result not been completed, future decisions on the stewardship of public lands would have been based on opinion, supposition, and guesses as to the precise extent of the aggregate resource at Felton Prairie. By using the rotosonic inventory data, the Stewardship Committee was able to bring all parties involved to a consensus as to the aggregate resource present in the study area. Without such a consensus, getting all parties to agree on future stewardship practices for the area would have been very difficult if not impossible. In hindsight, no procedural changes would have been made. Result 1 was successfully accomplished and the report was forwarded to LCMR. The budget for this result was expended and no balance remains.

LCMR BUDGET: 95,000
BALANCE: 0

Result 2. Prairie restoration/gravel pit reclamation (Cindy Buttleman, Leader).

Using aggregate resource information generated from Result 1 and other existing resource information, the Stewardship Committee selected a depleted gravel-mining site on public land known as the "Zilmer Pit" for reclamation. Earthwork was completed in the spring of 2001. Surplus rock from the site was used for 3 DNR stream restoration projects. A parking area was installed that includes 5 interpretative signs (see photo page). Additional funds for the project were provided by Clay County through proceeds from the Aggregate Material Tax. Project partners included the aggregate industry (Aggregate Industries, Northern Improvement, Turner Sand & Gravel, Selin Brothers, Inc.), The Nature Conservancy, U.S. Fish & Wildlife Service, Clay County, MN DNR, Minnesota Conservation Corps, and Ameri-Corp. Seeding of the site with native prairie vegetation was completed in the spring of 2002. This project provided a parking area and vantage point for the public to safely view the Felton Prairie area. Interpretative signs explain the values of both gravel and prairie, and the history of Felton Prairie. This will be the first gravel pit reclamation project on public land in the Felton Prairie area and will serve as an impetus for other reclamation work. This result is significant because it demonstrates how a variety of players, both public and private, can be brought together to restore and reclaim prairie and mining sites located on public land. It also provides the citizens of Minnesota with a gravel/prairie interpretive site that was previously unavailable. This site will be used by the general public and educational institutions, from elementary through college level, to teach students how competing interests -- prairie conservation and gravel mining -- can co-exist more harmoniously and apply integrated land management. The project was completed and the budget was completely expended.

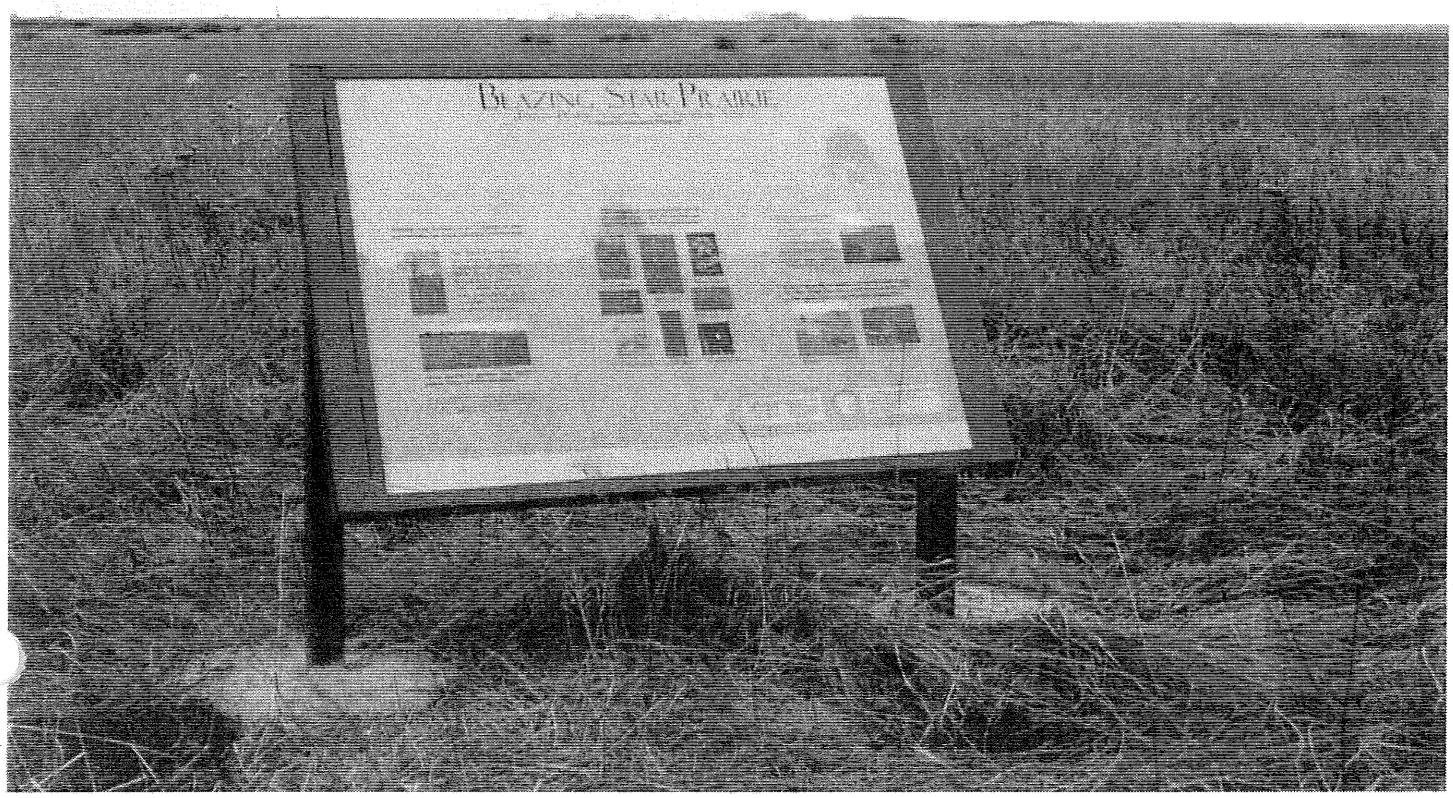
LCMR BUDGET: 35,000
BALANCE : 0

Result 3. Stewardship plan for public land on Felton Prairie (Tim Magnusson, Leader).

Work on the Stewardship Plan final draft was completed in late April, 2002 by Alison Krohn, Landscape Architect at North Dakota State University. The plan considered provisions for gravel mining, gravel pit reclamation, prairie conservation, and prairie restoration. Inventory drilling data from Result 1, which delineated gravel quantity and quality, provided a basis for identifying areas of high conflict (good prairie, good gravel) and low conflict (good prairie, limited gravel) and also helped determine what stewardship method would be applicable for each area. The Stewardship Committee held approximately 32 meetings to discuss methods and elements of the stewardship plan. Publicly-owned tracts were identified where natural values are such to preclude gravel mining and others where mining would be the most appropriate use. The Committee reviewed results of a DNR fen habitat study conducted in the area in order to determine the impact said study would have on the final stewardship plan and deep aggregate mining proposed in the Felton Prairie area. This integrated stewardship plan is significant because it is, to the best of our knowledge, the first of its kind in Minnesota. It was developed by a committee whose membership contained aggregate industry representatives, conservationists, local jurisdiction staff and elected officials, and representatives of state and federal agencies. What resulted was a stewardship plan that addressed the primary interests and concerns of all parties involved. It is hoped that the process followed by the Felton Prairie Stewardship Committee can be adapted across the state of Minnesota when an array of conflict issues are encountered. The Plan will also be used in migation by Clay County for a MN DNR Special Taking Permit necessary to allow the County to expand its current gravel mining operation in the Felton Prairie area. This work benefited all Minnesotans by providing a blueprint for preservation of one of the most significant prairie areas left in the state. It provided the MN DNR and other conservation groups with data necessary to consider acquisition of some portions of the Felton Prairie area by the Scientific and Natural Area program or The Nature Conservancy. Clay County benefited from this project by learning the full extent of aggregate resources and by being able to continue its aggregate mining operations in the Felton Prairie area with minimal impact to the adjacent prairie and natural areas.

After approval by the Stewardship Committee, a final draft of the Plan was presented to the Clay County Board of Commissioners where it was formally adopted on 21 May 2002. Due to the Committee's ability to contract for consulting services through North Dakota State University, costs for such services were greatly reduced and a balance of $11,249 remains.

LCMR BUDGET: 62,308
BALANCE: 11,249



Entrance and parking area for Zilmer Pit Reclamation Project (above) and example of signage used in the area (below).

B. Subproject Two – EFFECTS OF FIRE AND GRAZING ON PRAIRIE VEGETATION, LIVESTOCK, AND BIRDS IN WESTERN MINNESOTA

Result 1. Fire and grazing effects on prairie vegetation (Margaret Kuchenreuther, Leader).

Four cooperators who have each implemented different types of grazing systems on native prairie were identified to participate in this on-farm study. Grazing systems on the properties ranged from ungrazed to season-long grazing to rotational grazing using 3 to 10 paddocks. In August 1999, 6 permanent plots for vegetation measurements were established in native pastures on each farm (with the exception of the Dean Elmer farm where experimental manipulations were planned; there 6 plots were established in each of 2 grazed and 2 ungrazed paddocks). Each plot was sampled to record the frequency of a list of 51 indicator taxa. Relative basal cover of native grasses, introduced grasses, forbs, woody plants, rocks, litter, and bare ground also were recorded. All sampling was done so it could be repeated in the same locations in following years. These measurements were repeated during the 2000 and 2001 growing seasons.

At the end of the 1999 growing season, 3 fenced exclosures were built in each of 4 paddocks on the Elmer farm in 2 of 10 rotationally-grazed paddocks and in 2 ungrazed paddocks. We originally intended to burn 1 of the grazed and 1 of the ungrazed paddock and then introduce grazing into the 2 formerly ungrazed paddocks. However, our plans changed when we were unable to obtain permission to begin grazing the ungrazed paddocks because they had been enrolled in the CRP program during the first year of the study. Instead, we burned half of the plots in the ungrazed paddocks at the Elmer farm in May 2001. Subsequently, we repeated the measurements noted above, as well as assessing the effects of fire on woody vegetation in the plots by scoring each woody stem as healthy, dead or sprout.

Additionally, in summer 2000 we clipped biomass at the Elmer farm several times during the growing season both inside and outside of the exclosures and in the ungrazed paddocks to estimate forage production and forage quality. The forage production samples were sent out for analysis but an inexplicable and serious error on the part of the contractor rendered most of the data unusable. Therefore, we have no results to report for this part of the project.

<u>Effects of grazing rotation system on prairie vegetation</u>

Several important trends associated with grazing system were observed. The farms with the shortest rotations (i.e., rotation through the largest number of paddocks) had significantly lower frequencies of the annual weeds, plumeless thistle (*Carduus acanthoides*), foxtail (*Setaria* spp.) and prostrate spurge (*Euphorbia* sp.), and of the perennial exotic species, smooth brome grass (*Bromus inermis*), than farms with the longest grazing rotations. Of particular note is the continuously-grazed pasture, which had a serious thistle infestation

(43.7 % of the quadrats sampled contained one or more thistles). In contrast, the farm with a 3-paddock rotation had the lowest frequency of thistles (only 3.9%), perhaps as a result of its low relative cover value for bare ground (~ 10%). Other clear trends were seen in the frequency of the native legume, leadplant (*Amorpha canescens*), which significantly increased in frequency as paddock number increased, and the frequency of the native grass, sideoats grama (*Bouteloua curtipendula*), which decreased in frequency as paddock number increased. No other large-scale differences in taxon richness, taxon frequency or vegetative cover were found on farms studied.

The general conclusions of this part of the study correspond with the results of studies of grazing systems in other parts of the tallgrass prairie, which have found little effect of grazing regime on standing crop or on the dominance of broad vegetation categories, such as tall grasses, mid-grasses and forbs. However, the results of this study should raise concerns about the efficacy of continuous grazing in native prairies, as it appears to promote high frequencies of noxious weeds and the reduced frequency of desirable native legumes, compared to prairies that are rotationally grazed.

Effects of experimental manipulations

The results of this part of the study compared vegetation in plots exposed to long-term rapid rotational grazing, similarly grazed plots from which cattle were excluded in 2000 and 2001, long-term ungrazed plots, and long-term ungrazed plots that were burned in 2001.

The number of forb taxa was somewhat lower in the ungrazed plots than grazed plots (26-27 vs. 23-24). The application of fire increased the number of forbs decreased by grazing relative to the number seen before the burn (5 taxa pre-burn vs. 8 post-burn). However, release from grazing resulted in no significant change in the number of forb taxa counted.

Long-term grazed paddocks had greater frequencies of some weedy taxa (*Euphorbia* and *Setaria* spp.) as well as rossette-forming species (*Geum triflorum* and *Antennaria* sp.), the native grama grasses (Bouteloua spp.), and junegrass (*Koleria cristata*) than ungrazed paddocks. The high frequency of weedy species is likely a result of the high proportion of bare ground measured in grazed paddocks (26-35%) versus ungrazed paddocks (5-9%). Long-term ungrazed paddocks had higher frequencies of the native forbs, frost aster (*Aster ericoides*) and ground cherry (*Physalis* spp.), native grass prairie dropseed (*Sporobolus heterolepis*) and the non-native grass, smooth brome grass.

Release from grazing caused few measurable changes in plant frequency. Establishment of exclosures resulted in a small increase the frequency of leadplant and a 1 year increase in the frequency of flax (*Linum* sp.). It reduced the frequency of prostrate spurge and eliminated non-native foxtail species.

Burning previously ungrazed plots resulted in large increases in the frequencies of 2 weedy taxa, prostrate spurge and foxtail, probably as a result of an increase in light after the removal of a deep litter layer. It also resulted in small increases in the frequency of the native forbs, leadplant and ground cherry, and a small decrease in the frequency of smooth brome grass. Contrary to expectation, fire did not measurably increase the relative basal cover of native grasses or decrease the cover of introduced grasses. The most dramatic effect of fire was its effect on woody taxa. A high proportion of the stems of 11 shrub species were killed (mean = 70%). However, fire did not eliminate these woody taxa because most species responded by vigorously resprouting. Nonetheless, while fire does not remove shrubs from the prairie, it can improve pasture by making species such as western snowberry (*Symphoriocarpos*) much more palatable to cattle as tender young sprouts rather than tough, woody stems.

The results of this manipulative experiment reveal that long-term management of the paddocks is responsible for the clearest trends seen. Long-term grazed paddocks had higher frequencies of weedy species, rosette-forming species and grasses, such as *Bouteloua*, that are known to respond positively to grazing. They also maintained a greater diversity of forbs than did ungrazed paddocks. Release from grazing caused few measurable changes; this may be because this prairie has maintained a relatively high quality under the rapid-rotation grazing system employed there.

Other published research indicates that both grazing and fire, and ideally a combination of both, can be used to maintain the diversity of prairie plant communities. It also shows that complete neglect or excessive grazing will lead to the long-term erosion of the quality of prairie vegetation. This study, though not documenting dramatic effects of different grazing systems or spring fire, concurs with those conclusions. A more detailed description of results can be found in the research report entitled, "Response of tallgrass prairie vegetation to rotational versus season-long grazing systems and spring fire," included in Research Addendum.

In retrospect, we would have allowed more lead time to secure permission to experimentally graze paddocks which had been enrolled in the CRP. Otherwise procedures were implemented largely according to plan.

The substantial balance remaining in this budget is partially due to the savings in publication costs for the booklet, *Landowner's Guide To Prairie Management In Minnesota* because of production details being done in conjunction with University Relations staff at the University of Minnesota, Crookston. Had this work been done by a private vendor, it would have been considerably more expensive.

LCMR BUDGET: 52,563
BALANCE: 11,106

Result 2. Livestock production using prairie species (Greg Cuomo, Leader).

Warm-season native grasses once dominated the landscape of western Minnesota. In recent times they have been replaced with annual grain crops and cool-season grass pastures. Native grasses can play an important role in livestock operations in this region. In addition, native warm-season grasses provide habitat and food for wildlife, have aesthetic value, conserve soil by reducing erosion, serve as water filters to help ensure a clean water supply, and can economically and efficiently recycle human and livestock waste as fertilizer in an environmentally friendly manner.

The goal of this research was to identify effective grazing management strategies for warm-season grass pastures in the North Central Region. Previous research and experience suggested that neither continuous grazing nor a complete absence of grazing is conducive to the persistence of warm-season, native tallgrass plant communities. However, it is not well understood what grazing management strategies will lead to the persistence of desirable plant communities. In addition, different grazing management strategies may favor some native grass plants over others. Specific objectives of this research were to evaluate effects of grazing management on species composition, persistence, and productivity of native warm-season grass plant communities.

A grazing experiment evaluated effects of high and low stocking rates and continuous and rotational grazing systems. Yearling dairy heifers grazed warm-season grasses at high and low stocking rates under continuous grazing or in 2, 4, 8, 16, or 32-paddock grazing systems. Native grasses were established in 1997 and included big bluestem, Indian grass, switchgrass, sideoats grama, and little bluestem. These pastures were grazed for 48 days from late-June through mid-August in 1999 and 2000.

At the initiation of the study, big bluestem, Indian grass, and sideoats grams dominated the native grass pastures used in this trial. During the 2 years of this study, animal performance data were collected. Average daily gain over the 2 years averaged 1.41 lb/d. This is below the goal of 2 lb/d set by many livestock producers. However, 1.41 lb/d is greater than the daily gain of animals grazing cool-season pastures at the West Central Research and Outreach Center at Morris during the same mid-summer time period. Average daily gains were similar among grazing treatments averaging 1.41, 1.42, 1.45, and 1.38 lb/d for high and low stocking rates and for continuous and rotational grazing over the 2 grazing seasons, respectively. If animal performance is similar across grazing systems, as suggested by these data, then grazing system impact on plant communities and wildlife habitat could be used as the determining factor when selecting a grazing system for warm-season native grasses.

Change in species composition was not detected in this study. Factors which may account for this include, short duration (2 years) of the study, 2) animals were removed from the trial in mid-August allowing plants to have a lengthy

period to mediate negative effects of grazing and restore energy reserves before frost, and 3) a fairly heavy infestation of quackgrass which may have impacted community dynamics.

Previous research and experience indicated that grazing management does affect native grass plant communities. In this study, stands were managed as per conventional recommendations (grazed in mid-summer, with a late-season rest). Perhaps if grazing would have been continued later in the season, an impact of grazing management on native grass plant communities would have been evident. Also, it has been shown that native grass plant communities may be fairly stable over long periods of time, even under some mismanagement. The 2 years in which this study was conducted may not have been enough to detect impacts of grazing management on these plant communities.

The similar animal performance and short-term plant community stability demonstrated in this study suggests that when a late-summer rest period is provided before frost, management for wildlife habitat could be used as the determining factor when identifying a grazing system for native grass pastures. The native grass mixture used in this study was relatively simple, and did not include forbs. The persistence of desirable, but minor, species could also be a criterion used for selecting grazing systems in native grass pastures.

LCMR BUDGET: 52,563
BALANCE: 534

Result 3. Fire and grazing effects on breeding prairie birds (Daniel Svedarsky, Leader).

Burning effects on birds

We evaluated effects of post-burn age (year of burn, 1 year post-burn, and 3+ years post-burn) on breeding grassland birds in dry, moist, wet, and brush prairie habitats. A total of 27 plots, 3.5-16 hectares in size, were distributed throughout the study area. Breeding bird richness and density were determined by the Stewart and Kantrud strip transect census. Surveys were conducted twice on each plot from late-May through June during peak singing periods, between sunrise and 1000 hr. Vegetation measurements were taken from mid-June through mid-July to determine how bird density and species richness may be related to vegetation variables. Twenty to 40 systematically located Robel pole and Daubenmire plot readings were taken to estimate vegetation height, percent cover by growth form (graminoid, forb, woody), visual obstruction reading, and litter depth. Post-burn ages of study sites were determined from prescribed burning/wildfire records from the Department of Natural Resources, The Nature Conservancy, and private landowners.

We recorded 45 species of birds on plots in 2000 and 41 in 1999. The 4 most common species were savannah sparrow, LeConte's sparrow, bobolink, and clay-colored sparrow. Savannah sparrows and LeConte's sparrows occurred in

relatively high densities on each of the habitat types. LeConte's sparrows, however, appeared to strongly select against Year-0 burn-age plots during both 1999 and 2000. Le Conte's and Clay-colored Sparrows appeared to strongly select against Year-0 burn-age plots. Clay-colored Sparrows preferred brush prairie to other prairie types. While Bobolinks selected against brush prairie plots in both years of the study, they showed mixed results in their selection for burn age. To improve conditions for more grassland bird species, grassland units should be rotationally burned and in a mosaic pattern so that a variety of post-burn age grassland units are available within a management area. These data will be part of a Master's thesis at the University of North Dakota and will be disseminated to agency and private prairie managers.

Grazing effects on birds

Sampling procedures and design were similar in evaluating grazing effects as the burn effects study. The highest number of individuals on any plot was 26 on a moderately-grazed, dry prairie. Species richness was highest (10) on a moderately-grazed brush plot, while 2 other plots (moderately-grazed, mesic and heavily-grazed dry) tied for the lowest with 2 species. Savannah sparrows were the most abundant bird species (~37% of total) and occurred in all prairie types. Grasshopper sparrows were the second most abundant and were found on dry and brush prairie types, a small portion on mesic prairies, and none on wet prairie plots. Clay-colored sparrows, western meadowlarks, and bobolinks were similar in abundance. Clay-colored sparrows were found primarily on brush plots but on other plots if there was brush present. They had a high frequency of occurrence on lightly-grazed pastures (~92%). Western meadowlarks were never very abundant on any site, but were present at least once on every prairie type and grazing intensity category. Bobolinks occurred mostly on wet, brush, and mesic prairie under light to moderate grazing, and were always observed perching at a height of 3 feet or so from the ground. Le Conte's sparrows were the 7th most abundant and were present in all prairie types, but none were observed in heavily-grazed pastures. Sedge wrens were generally quite abundant throughout the study area on wetter prairies.

Effects of rapid rotation grazing on nesting grassland birds were evaluated on the 645-acre Dean Elmer Farm near Evansville, MN. A Savory-cell grazing system is in operation there with triangular-shaped grazing paddocks radiating outward from a centrally positioned water source. Cattle graze a paddock for 2-3 days and are then moved to another paddock, allowing a 20-30 day rest period between grazing sessions. A stocking density of about 1.7 animal units/acre was applied using mostly Simmental cow/calf pairs. The terrain is quite rolling on gravelly substrate and is composed of largely native vegetation typical of dry prairies except for interspersed flatter areas that were once cultivated and have since reverted to mostly bluestem grasses, smooth brome and quackgrass. Two paddocks were ungrazed for 12+ years and served as locations for control plots. Sixty-two nests were found by systematically searching 14, 2.47-acre (1-hectare) plots and monitored every 3 days through fledging, abandonment, or depredation. Clay-colored sparrows, vesper sparrows, and grasshopper

sparrows comprised 92% of all nests monitored. Mayfield nest success for these 3 species was 0.93 (n=51) in grazed plots, and 0.94 (n=11) in ungrazed plots ($p>.05$). There were no apparent differences in nesting success between grazed and ungrazed plots in this study area in 2001.

In hindsight, more lead time for data analysis should have been planned. Project leader Svedarsky was ill during May and June and this unexpected emergency caused a backlog in bird data analysis which is on-going (See Research Addendum). The budget for bird research was mostly expended.

LCMR BUDGET: 52,566
BALANCE: 37

Result 4. Publication of bulletin, LANDOWNER'S GUIDE TO MANAGEMENT OF PRAIRIE IN MINNESOTA (formerly proposed as FIRE AND GRAZING MANAGEMENT OF PRAIRIE IN MINNESOTA.

In press. Three copies of prepublication proofs are enclosed and publication of 3500 copies is scheduled for completion by 15 August.

There was not a separate account established for this result. Publication funds came from budgets managed by Svedarsky (Northwest Research and Outreach Center, U of MN, Crookston) and Kuchenreuther (U of MN, Morris).

Subproject One – FELTON PRAIRIE STEWARDSHIP PLAN FOR PUBLIC LANDS

V. DISSEMINATION:

Results of *subproject one* (Aggregate Resource Evaluation Report: Rotosonic drilling and Stewardship Plan) were disseminated to members of the aggregate industry, conservation groups, members of the broad group of stakeholders involved in the Clay County Beach Ridges Forum, and other citizen groups. The Stewardship Plan will also be posted to the Clay County web site (http://www.co.clay.mn.us/AboutUs/CurEvent.html) and the Red River Basin Information Network website maintained by D.N.R. Prairie Biologist Peter Buesseler.

Workshops:

Felton Prairie will be the official site to host **Minnesota Prairie Day 2002** on 10 August 2002 (<http://www.dnr.state.mn.us/snas/prairieday/index.html>). This project will be profiled at this event (See enclosed program). Prairie Day is an annual event sponsored by MN DNR, conservation groups, and local government jurisdictions.

Paper presentations:

Krohn, A. *How a landscape architect views ecosystem restoration.* Annual meeting of The Wildlife Society. Bismarck, ND. 22-27 September 2002. (Presentation at national meeting which will profile the Clay County Stewardship Plan and its development.)

Magnusson, T. The results from this project will also be used as part of a presentation at the statewide Aggregate Materials Conference in St. Cloud. 6-7 March 2003.

VI. CONTEXT:

a. Significance: This project is significant for the following reasons:

- it built on the work of the Clay County Beach Ridges Forum
- it used the knowledge and expertise of local partners
- it is a large scale demonstration of sustainable development with public agencies in a leadership role
- it served as a positive example for the entire Red River Valley and significantly added to the base of knowledge
- the Felton Prairie Complex has statewide significance
- timeliness - rebuilding after the flood of 1997 as well as construction of future flood control projects in the Red River Valley will add to the increasing demand for aggregate materials

b. Time: This project did not exceed 3 years.

c. Budget Context:

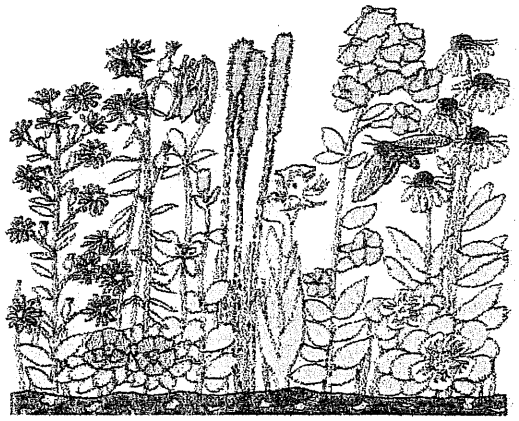
1. LCMR Budget History:

- 1995 to 1997, Clay County Beach Ridges Forum funded at $85,000

2. Non-LCMR Budget History:

- 1994, Minerals Team of the Sustainable Development Initiative toured Clay County and referenced Felton Prairie in their report.
- 1995, cooperative project to restore 2 gravel pits to prairie in Buffalo River State Park. Funding came from Minerals Environmental Cooperative Research at DNR and the Aggregate Material Tax in Clay County. Other contributors were The Nature Conservancy and Kost Brothers, Inc. (aka CAMAS, Inc.) Estimated project cost was $60,000.
- 1995 - 1997, DNR completed map coverages in Clay County including Public Land Survey data layer, aggregate resources, and County Biological Survey information.
- 1997, ad hoc committee established to act on recommendations from the Clay County Beach Ridges Forum. Ad hoc committee now known as the **Felton Prairie Stewardship Committee**.
- 1997, under leadership of ad hoc committee, cooperative drilling program conducted by MnDOT and DNR on selected public lands in the Felton Prairie Complex at an estimated cost of $7,500.

Minnesota Prairie Day
Felton Prairie, August 10, 2002



The event 'headquarters' will be located 2 miles south of the town on Felton on US Hwy 9. Then go 3 miles east on County Road 108 to the end of the road. Signs will direct visitors to a tent and display area. We'll also have refreshments for Prairie Day visitors at the tent.

10:00 - Welcome and Recognition Ceremony

- We will be acknowledging over a half-century of prairie stewardship at Felton and inviting many of the past landowners and groups who have played a role here. We will also be recognizing Clay County Board's adoption of the new *Felton Stewardship Plan*.
- The Nature Conservancy will be presenting it's *2002 Government Relations Award* to Senator Keith Langseth, from Glyndon

11:00 - 12:00 Prairie Activities Concurrent 45-minute field presentations on:

- Prairie Plants – Dr. Richard Pemble will lead a walk focusing on prairie plants and their uses by Native Americans
- Pyro-botany – TNC will demonstrate prescribed burning and discuss other aspects of managing prairies to keep them healthy
- Prairie Birds – Felton Prairie is a nationally recognized destination for 'birders'. The Fargo/Moorhead Chapter of the Audubon Society will lead this hike.
- "Roaming the Prairie" – Joe Gartner, Red River Interpretive Services, will lead a family & kid oriented exploration of the prairie.

12:00 – 1:00 Lunch (box lunches available for purchase, free refreshments)

- Prairie History – Stories of our prairie past. Mark Peihl, Clay County Historical Society

1:00 – 2:00 Prairie Activities Concurrent 45-minute field presentations on:

- Prairie Insects – Dr. David Rider has a long-term research project going on at Felton. He will show participants his active traps, what we are collecting, and explain why this research is important.
- Going underground: A visit to a gravel pit – Gravel industry representatives will take us into the Clay County gravel pit to explain the geology of the area and show 'how gravel is made'
- Prairie Reconstruction – The US FWS will explain the prairie reconstruction project underway at Felton, discuss techniques and equipment for planting prairie grasses and flowers.
- "Roaming the Prairie" – Joe Gartner, Red River Interpretive Services, will lead a family & kid oriented exploration of the prairie.

- 1998, same committee initiated a cooperative project to reclaim a 77-acre gravel pit to prairie. Estimated cost is $100,000 with funding from the county gravel tax and DNR, and in-kind support from aggregate industry and The Nature Conservancy.

3. **Budget summary for the subproject period:**

Personnel	**$ 50,000**
Equipment	**$ 3,000**
Acquisition	**$ 0**
Development	**$ 30,000**
Other	**$ 109,308**
TOTAL	**$ 192,308**

VII. COOPERATION: Members of the Felton Prairie Stewardship Committee included:

Clay County: Jon Evert, Jack Cousins, **TIM MAGNUSSON** (Subproject coordinator)
Department of Natural Resources: Walt Johnson, Martin Wiley, Doug Hedtke, Peter Buesseler, Cindy Buttleman
U. S. Fish and Wildlife Service: Doug Wells
Department of Transportation: Paul Munsterteiger
Aggregate Industry: Leroy Turner, Dan Ames, Bruce Squires, Mike Rose, Bob Bieraugel, Norman Jagger,
The Nature Conservancy - Brian Winter
University of Minnesota – Daniel Svedarsky
Minnesota State University, Moorhead – Richard Pemble

VIII. LOCATION:

The project area is the Felton Prairie Complex in Clay County, 4 miles east of Felton on the Glacial Lake Agassiz beach ridge. Due to the natural heritage significance and the economic importance of Felton Prairie, this work will have an impact throughout the Red River Valley and the state.

Subproject Two - EFFECTS OF FIRE AND GRAZING ON PRAIRIE VEGETATION, LIVESTOCK PRODUCTION AND BIRDS IN WESTERN MINNESOTA

V. DISSEMINATION:

Information gained from these results has been and will be disseminated to livestock producers, conservation personnel (U.S. Fish and Wildlife Service, Natural Resource Conservation Service, and the Minnesota Department of

Natural Resources, The Nature Conservancy), U of MN Extension personnel, and interested citizen groups through a variety of field days, popular and technical publications, and meetings/conferences.

Publications:

Svedarsky, W.D., M.A. Kuchenreuther, G.J. Cuomo, P. Buesseler, H. Moechnig, and A. Singh. 2002. *A landowner's guide to prairie management in Minnesota.* Northwest Research and Outreach Center, University of Minnesota, Crookston, MN 36 p. **In press**. To be initially distributed at the Minnesota Prairie Day celebration on 10 August 2002 at the Felton Prairie in Clay County (http://www.dnr.state.mn.us/snas/prairieday/index.html) and thereafter widely distributed via agency and University contacts. A pdf copy will be posted on the web site of the Northern Prairie Wildlife Research Center, U.S.G.S., Jamestown, ND - http://www.npsc.nbs.gov/, and also on the MN DNR web site at **http://www.dnr.state.mn.us/ecological_services/prairies.html.**

Svedarsky, W. D., J. E. Toepfer, R. L. Westemeier, and R. J. Robel. 2002. *Effects of management practices on grassland birds: greater prairie-chicken.* Northern Prairie Wildlife Research Center, U.S.G.S., Jamestown, ND. 37 p. Partial support. **In press**.

Driscoll, M.A, J. P. Loegering, V. B. Cardwell, and W. D. Svedarsky. *Grassland bird reproductive success on rotationally grazed CRP prairie in western Minnesota.* Manuscript in preparation for submission to The Loon.

Engelstad, J.L. *Effects of postburn age and prairie type on breeding birds in northwest Minnesota.* Master's thesis in preparation. University of North Dakota, Grand Forks.

Svedarsky, W.D., R. Sayre, and J. L. Engelstad. 2001. *The Mentor Prairie Wildlife Management Area: Assessment and management considerations.* A management plan for a DNR wildlife management area. Northwest Research and Outreach Center, University of Minnesota, Crookston. 70 pages plus Appendix. Partial support.

Reports: (Also see Research Addendum)

Cuomo, G. J. and A. Singh. *Livestock performance and plant persistence when grazing warm-season native grasses.*

Driscoll, M.A, J. P. Loegering, V. B. Cardwell, and W. D. Svedarsky. *Grassland bird reproductive success on rotationally grazed CRP prairie in western Minnesota.*

Engelstad, J. L., W. D. Svedarsky, and R. D. Crawford. *Effects of pos-tburn age and prairie type on breeding birds in northwest Minnesota.*

Kuchenreuther, M. A. *Response of tallgrass prairie vegetation to rotational versus season-long grazing systems and spring fire.*

Weltikol, M.L. and W. D. Svedarsky. *Effects of grazing intensity and prairie type on breeding birds in northwest Minnesota.*

Workshops:

Prescribed prairie burning: the principles and practice. A professional training workshop for resource specialists of the Natural Resources Conservation Service. 7-9 May 2001. Presented at University of Minnesota, Crookston. Partial support.

Paper presentations:

Driscoll, M.A, J. P. Loegering, and V. B. Cardwell. *Grassland bird reproductive success on rotationally grazed CRP prairie in western Minnesota*. Midwest Fish and Wildlife Conference, Des Moines, IA. 9-12 December 2001.

Engelstad, J. L., W. D. Svedarsky, and R. D. Crawford. *Effects of post-burn age and prairie type on breeding birds in northwest Minnesota*. Midwest Fish and Wildlife Conference, Des Moines, IA. 9-12 December 2001.

Svedarsky, W. D. *The greater prairie chicken*. Presentation at 3rd annual Sully's Hill Birding and Nature Festival. Devil's Lake, ND. 1-4 August 2002.

Cuomo, G. 2001. *Pasture management*. Minnesota Dairy Forage Conference. St. Cloud, MN 2001.

Other presentations:

Kuchenreuther: Meeting of CURE (Clean Up the River Environment), public programs at Big Stone National Wildlife Refuge, and meetings of local farmers interested in sustainable agriculture, as well as through courses taught at the University of Minnesota, Morris (e.g., Ecology, a course for Biology majors; and Conservation Biology, a general education course for non-majors).

Svedarsky: Annual conference of the Minnesota Prairie Chicken Society, discussion meeting regarding the Prairie Passage initiative, and classes at the University of Minnesota, Crookston (Land Use Planning, Integrated Resource Management, and Wildlife Habitat Management Techniques).

Cuomo: At the West Central Research and Outreach Center there was a series of 6 "pasture walks" in 2001 where changing forage management throughout the year was discussed and growers were exposed to the integration of native grasses into grazing management systems. Also participated in 6 pasture walks on producer farms in western Minnesota.

VI. CONTEXT:

a. **Significance:** This project was significant for the following reasons:

- Management effects of burning and grazing on prairie vegetation and birds in the Northern Tallgrass Prairie are poorly understood and this subproject made a contribution toward that information base.

- The largest proportion (75%) of remaining native prairie in Minnesota is privately owned and much is in need of better management to enhance plant diversity, wildlife habitat, and livestock production. The landowner guide will help fill that information void.
- This subproject is helping to synthesize existing published and unpublished information on prairie management in western Minnesota to make it available to user groups for application and to serve as a base to add further research findings to.
- The information developed in this subproject will complement that developed in other studies underway in northwest Minnesota; particularly a U.S.G.S. effort investigating prairie birds vs. habitat size and landscape matrix relationships and another evaluating management effects on prairie insects.

b. **Time:** Outreach activity and data collection in this subproject took place over the time span of 3 years.

c. **Budget Context:** This subproject had some relationship with past work funded by LCMR and NON-LCMR projects. Following is a summary of those projects with respective funding levels, and a detailed budget for this subproject:

1. **LCMR.** Similar to, MINNESOTA FOREST BIRD DIVERSITY INITIATIVE = $750,000. Extension of, SUSTAINABLE GRASSLAND CONSERVATION AND UTILIZATION = $125,000 and PRAIRIE-GRASSLAND LANDSCAPES = $125,000. Will use partial results of, COUNTY BIOLOGICAL SURVEY = $2,100,000.

2. **NON-LCMR.** Development of management plan for the Mentor Prairie Wildlife Management Area (Source = North Am. Waterfowl Conservation Act) = $30,000. A grant to Daniel Svedarsky concluded August, 1997. Although not a specified match requirement for this subproject funding, all 3 cooperating University units (Northwest Research and Outreach Center (ROC), West Central Research and Outreach Center, and U of Minnesota, Morris) contributed salary time, phone, and other support during the project and in-kind support in the use of equipment. The Northwest ROC provided a total value of $10,000 over the 3-year funding cycle; the West Central ROC, a total of $77,300; and the University of Minnesota, Morris, ~ $10,000 from in-kind and other support. In addition, a sum of $8,000 was available through a grant awarded to Margaret Kuchenreuther, U of Minnesota, Morris. These funds were a cooperative agreement with the U.S. Fish and Wildlife Service (USFWS), with the purpose of implementing a monitoring system to compare effects of rotational and year-long grazing on native prairie vegetation and grassland bird communities. The period covered by this agreement extended until 30 September 1999. Because of the similarity of that project to this one funded by LCMR, the same sites were used for each, the same sampling methods were employed,

and some of the same personnel worked on both projects. Funds from the USFWS project were used to establish and sample permanent plots prior to the beginning of LCMR funding (thus reducing start-up costs the first year of this project). LCMR funds were used to continue monitoring of sites beyond September 1999 when funding from the USFWS ended. In this way, longer term monitoring enhanced both projects.

3. **The budget summary for the subproject is as follows:**

Item	Percent effort	Cost
Personnel:		
Overall project manager & bird research leader, **Daniel Svedarsky**	10%	8,300
Graduate student (birds)	43%	24,080
Undergraduate student (birds)	25%	7,680
Vegetation research leader, **Margaret Kuchenreuther**	25%	26,000
Undergraduate assistants (2) (vegetation)	20%	11,900
Livestock research leader, **Greg Cuomo**		0
Assistant scientist (livestock)	40%	29,800
Summer assistant (livestock)	25%	6,000
Equipment (prescribed burning hand tools, marking stakes, electric fencing supplies)		1,500
Acquisition		0
Development		0
Other		
Printing / advertising		15,000
Total travel		16,250
Vehicle and equipment lease (pickup, tractor and gyromower for firebreak installation, ATV)		2,800
Office supplies		1,272
Miscellaneous supplies / maintenance		5,730
Communications		750
Data analysis		630
	TOTAL	**$157,692**

VII. COOPERATION:

This subproject had a number of cooperators who providing input to subproject development and implementation, including private landowners

who allowed data collection on their property. Principal cooperators included:

Peter Buesseler, Prairie Biologist
Minnesota Department of Natural Resources
Fergus Falls, MN

Dean Elmer, Livestock Producer
Evansville, MN

Doug Johnson, Biometrician/Ornithologist
Northern Prairie Wildlife Research Center
Jamestown, ND

Brian Winter, Stewardship Director
The Nature Conservancy
Glyndon, MN

Terry Wolfe, Wildlife Manager
Minnesota Department of Natural Resources
Crookston, MN

VIII. LOCATION:

Field work for this subproject was carried out in a tier of counties from Stevens County in the south and north to Polk County. Study sites included the West Central Research and Outreach Center at Morris, Dean Elmer farm in Douglas County, 3 privately-owned native pastures in Pope County, the Felton Prairie Complex in Clay County, and the Mentor Prairie Wildlife Management Area in Polk County.