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## The Mortenson Ranch: Cattle and Trees at Home on the Range. A Restoration Guidebook

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and Scott Fausti



# The **Mortenson Ranch**

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**Cattle and Trees  
at Home  
on the Range**

**A RESTORATION GUIDEBOOK**

SOUTH DAKOTA STATE UNIVERSITY  
College of Agriculture and Biological Sciences  
USDA Sustainable Agriculture Research and Education Program / North Central Region

# The Mortenson Ranch

## Cattle and Trees at Home on the Range

### A RESTORATION GUIDEBOOK

- 1 Where it began . . .  
50 years of rangeland restoration
- 3 What's it all about? . . .  
Restoration goals and a cattle management plan
- 7 An essential first step . . .  
Slowing the speed of water
- 15 Progress . . .  
The trees come back
- 21 Is it worth it? . . .  
Ecology and economics
- 25 Take-home lessons...

Compiled by Susan E. Boettcher, W. Carter Johnson, Scott Kronberg, and F. Robert Gartner, College of Agriculture and Biological Sciences, South Dakota State University, and Clarence, Todd, and Jeff Mortenson, Stanley County, South Dakota. Economic analysis provided by Scott Fausti, SDSU.

Project funded by USDA Sustainable Agriculture Research and Education Program, North Central Region, Lincoln, Nebraska, with additional funding and resources provided by the College of Agriculture and Biological Sciences.

Prepared by Ag Communications Department, Box 2231, SDSU, Brookings, SD 57007.

**Cover:** Mortenson Ranch Home Place, Stanley County, South Dakota. *Tom Bare photo.*

**Graphic on this page and throughout this publication:** Western wheatgrass, *Agropyron smithii*, is a West River staple for livestock. This native, cool-season, perennial is nutritious and readily grazed by livestock early in the growing season.



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7,500 copies at a cost of \$1.33 each. September 1998.

# Where it began. . .

## 50 years of rangeland restoration



Flooded vegetation in the Cheyenne River delta.

Photo: Carter Johnson

Early agriculture on western rangeland met with little success and resulted in serious consequences including soil erosion, loss of native woodlands and wildlife, and economic ruin.

The Mortenson family in Stanley County, South Dakota, has been engaged in restoring degraded rangeland on their ranch for more than 50 years. Their primary goal has been to return the land to its condition prior to white settlement while maintaining a profitable cattle ranching operation. In recent years the ranch has served as a model of successful ranching based on a conservation ethic.



Photo: Todd Epp

*“On a quarter section in this country, no one could’ve or should’ve been expected to make a living.”*

—CLARENCE MORTENSON

Stanley County, South Dakota. The Mortenson Home Place is in the county’s northwest corner. The area comprising Stanley County in 1910 had a population of 14,975. By 1925, there were 2,627 people remaining. (Nelson, P.M. 1986. *After the West Was Won. Homesteaders and Townbuilders in Western South Dakota, 1900-1917.* Iowa City: University of Iowa Press.)

This guidebook summarizes the restoration techniques and grazing regime used by the Mortensons and offers suggestions for applying these ideas to other locations. It is not intended to be a

step-by-step cookbook, an all-complete reference, or a set of hard and fast rules. It is meant to provide an example of land management practices based on sound ecological principles.

The quotes throughout these pages are Clarence Mortenson’s. Since 1941, he has observed the changes taking place on the property described here. Sons Todd, Jeff, and Curt are now involved; Todd manages the land and the cattle operation. The ranch lost extensive bottomland forest to Oahe Reservoir on the nearby Missouri River in the 1950s.





Photo: SCS. Courtesy Ag Heritage Museum.

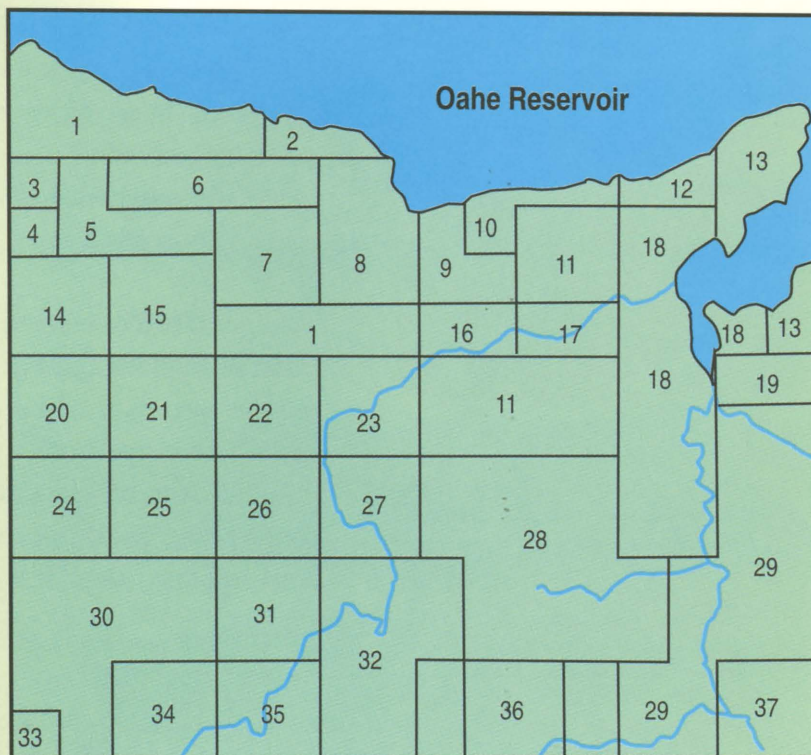
The O.N. Nelson farm, Gregory County, S.D., May 13, 1936. Soil has buried the car, wagon, equipment, and buildings.

**THE HOMESTEAD ACT OF 1862** . . . offered settlers 160 acres and required cultivation of a portion of this property.

Did this encourage over-crowding? Consider . . .

- How many horses and livestock were owned by the settlers . . .
- How quickly trees were cut down for houses, for barns, and for fences . . .
- How cultivation in a country of erodible soils, steep topography, and sparse rainfall made the landscape fragile . . .

**THE RESULT: ecological and economic disaster.**



160  
acres

A map of Spring View Township in Stanley County, where the Mortenson Home Place is located, shows how the area was divided among many settlers in 1890. Each number represents a different homesteader. Oahe Reservoir covers additional homesteads. (Redrawn from Centennial Atlas of Stanley County, 1989.)

# What's it all about?...

## Restoration goals and a cattle management plan

The goals in managing the ranch have evolved gradually since post-depression times:

### High quality range condition

- Improved forage, both quantity and quality, for cattle.
- Increased diversity of wildlife habitat.

### A return of trees and shrubs to draws and riparian (streamside) areas

- Shelter for cattle.
- Shelter for wildlife.

Cattle are rotated among six parcels of land. Throughout the ranch, restoration progress is in various stages. The Home Place has been the scene of the greatest amount of effort, while those on other parcels are less advanced.

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For ecological restoration to take place while maintaining an economically viable cattle ranch, several principles are adopted:

- **Using** a holistic approach whereby cattle, range, riparian areas, and wildlife are considered concurrently.
  - **Striving** for a sustainable, efficient operation with cattle that rebreed consistently.
  - **Obtaining** majority of feed from grazing using a mixture of old and new grass.
  - **Rotating** cattle quickly through pastures.
  - **Avoiding** overuse of riparian areas.
- 



Photo: Carter Johnson



Photo: Todd Epp



Photo: Todd Epp

Todd Mortenson

Photo: Carter Johnson



## TODD MORTENSON MANAGES . . .

approximately 1,500 head of cattle. Of these, about 1,000 are cows that are two years old or older, 250 are yearling heifers, 230 are yearling steers, and 50 are bulls.

## ROTATION AMONG PARCELS

### Older cows

At H: from Dec. 1 to about May 20

At L: from May 20 to beginning of Nov.

(A simple two-pasture rotational system is used on leased land, and it is generally undergrazed.)

At B: from beginning of Nov. until 1 to 6 weeks later

(The length of time spent at the Bursch Place is determined by forage availability.)

At M: from time of leaving Bursch (usually in Nov.) until Dec. 1

(The goal is to use forage at the Maupin Place to the desired level, then bring cattle back to the Home Place by Dec. 1 or as early in Dec. as possible.)


### Younger Cows and Heifers:

At H: from Dec. 1 to May 20


At B and/or M: from May 20 to Dec. 1


## THE HOME PLACE



- Approx. 10,000 acres
- Acquired in pieces over several years' time.
- Grazing plan:

From about Dec. 1 until Mar. 1: (blue hatched areas) 



From Mar. 1 until calving: One or more pastures within green areas (all shades).


With good weather, cows calve on flat pastures (red stippled areas nearest to headquarters). 

In poor weather,  is used.

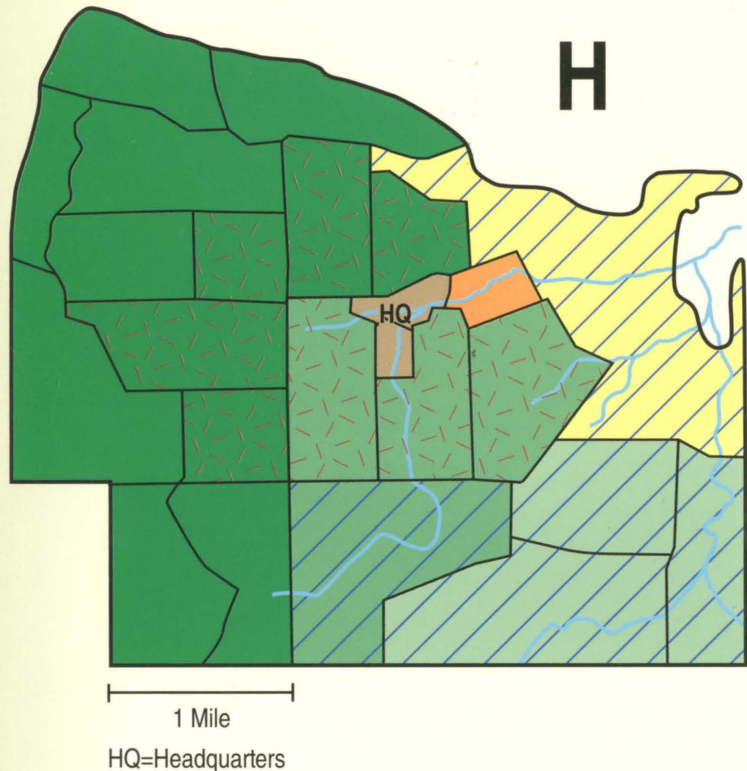
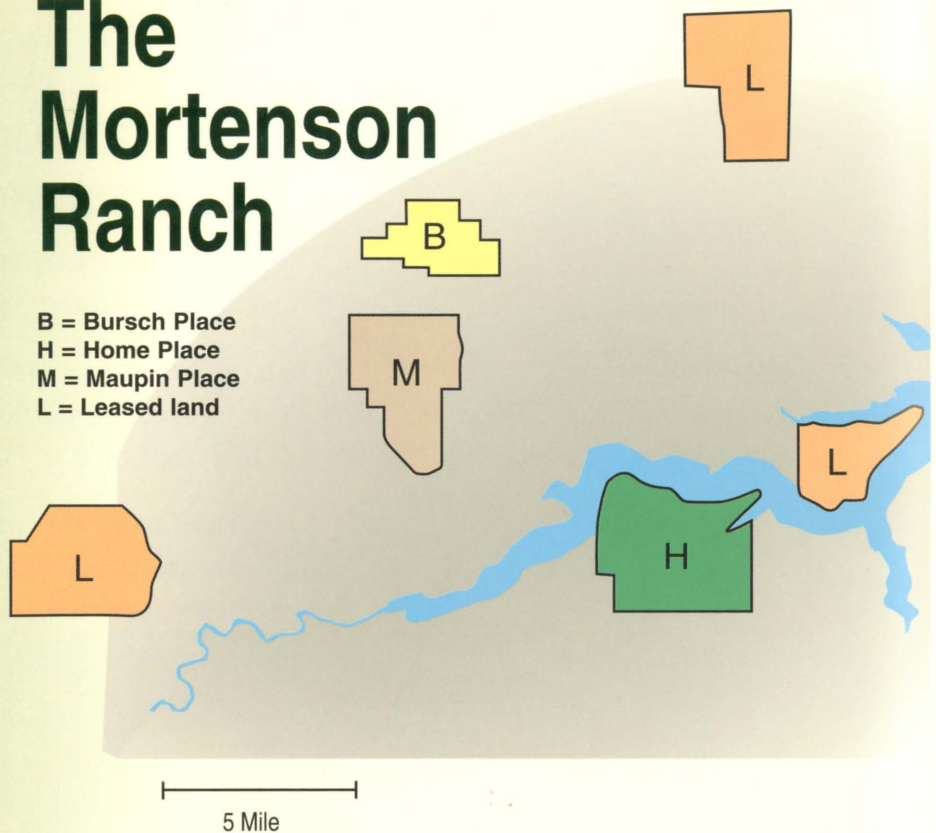
After calving until May 1:  and 

(In the event of a blizzard, younger cows and heifers are brought in close to headquarters. Older cows are left out and find good shelter in the trees of Todd's Draw.)

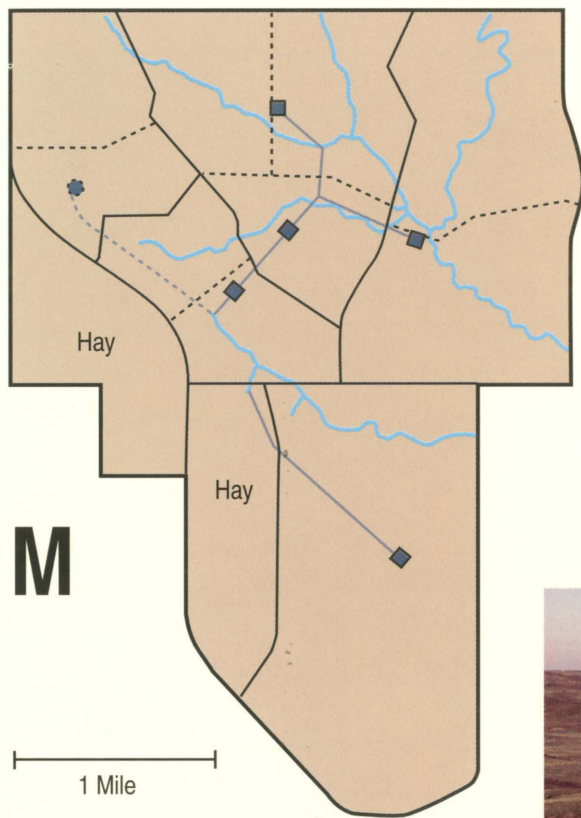
May 1 to May 20: Older cows are moved to one or more pastures within , then to one or more pastures within  for sorting and branding. Cows do not spend more than 3 to 7 days in any one pasture. The time of rotation depends on availability of forage and when 50% of western wheatgrass foliage has been removed.

Younger cows and heifers are rotated among pastures within  in a manner similar to that for older cows.

# The Mortenson Ranch







**M**

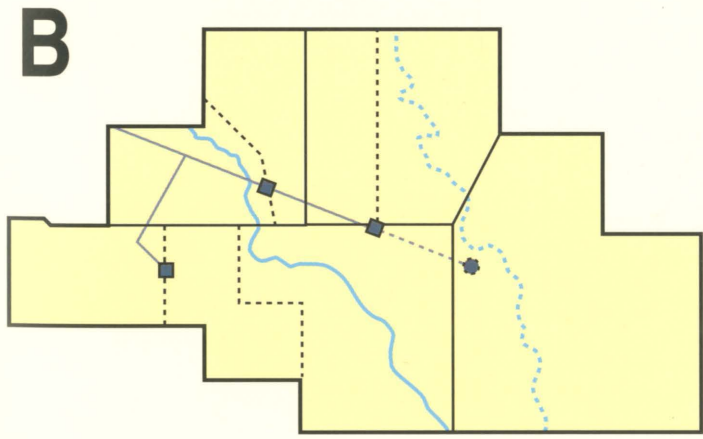
LEGEND	
—	existing fence
- - -	planned fence
—	existing waterline
- - -	planned waterline
■	existing water source
⊛	planned water source
~	creek
...	intermittent creek

**THE MAUPIN PLACE**

- 8,000 acres of grazing land in southeastern Ziebach County
- Acquired in July 1953 as largely undeveloped, partly fenced, and having two pastures (summer and winter)
- During the 1970s, all wintering and calving activities were moved from Maupin to the Home Place where they presently continue.
- Approximately 500 older cows and 250 heifers graze on the Maupin Place during a portion of each year. During some years, about 200 retained yearling steers are kept on Maupin as well.
- Planned improvements include further subdivision of the present 6 pastures into 10 pastures (plus 2 hay lands).
- Planned water sources and smaller pastures will improve cattle distribution, allowing faster rotations and reducing the time cattle spend in creekside vegetation.



Photo: Scott Kronberg



**B**

**THE BURSCH PLACE**

- 3,300 acres of fine grazing land located on middle and east fork of Rudy Creek
- Acquired in April 1953 in good condition
- Three dams were built during the first year of ownership; dam building continued for 10 years until water supplies were adequate.
- For 1 to 6 weeks each year, about 500 older cows are kept at the Bursch place. Either young cows/heifers or yearling steers (but not both) may be kept at Bursch for a portion of the year as well.
- Planned improvements include further subdivision of the present 4 pastures into 8 pastures. Each year, the first pasture grazed is a different one than that grazed first the previous year.
- Planned water sources and smaller pastures will improve cattle distribution, allowing faster rotations and reducing the time cattle spend in creekside vegetation.

Estimates of western wheatgrass utilization using photographic guides.

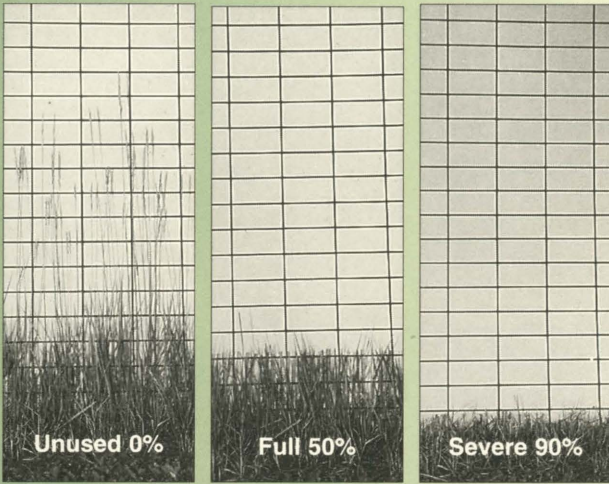
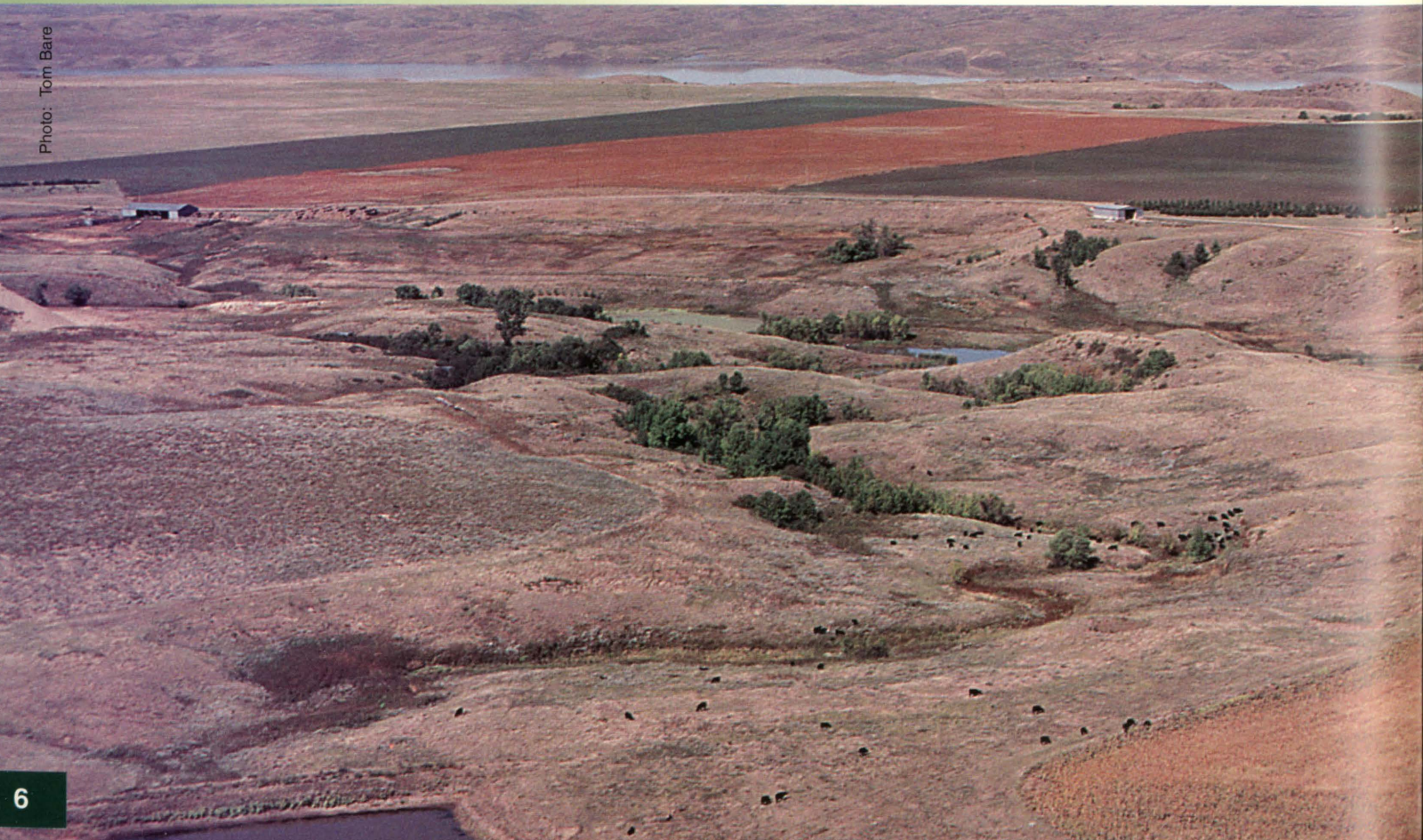


Photo series: James R. Johnson

**Some cattle producers . . .** would consider the Mortensons' rangeland under-utilized. However, plants produce more forage when about half the leaf material is left to grow. Leaving 50% of the photosynthesizing tissue of key forage species maximizes forage production over the long haul.

Efforts to provide well-wooded riparian areas have paid off during winter storms. During a severe, unexpected blizzard on April 6, 1997, many cattle died in South Dakota. The Mortensons lost only one animal, a calf that was weak before the storm hit. The older cows weathering the storm in Todd's Draw (page 17) looked better afterwards than younger animals that stayed near the buildings.

Photo: Tom Bare



# An essential first step...

## Slowing the speed of water



Photo: Tom Bare



Photo: Carter Johnson

Dams that allow recharge of groundwater act as silt traps, increasing the percolation of runoff and rainwater, thus healing riparian areas. These sites are once again sub-irrigated, supporting trees and shrubs.

Louis Young, one of the first homesteaders near Foster Creek in the early 1890s, described the countryside's initial conditions to Clarence in 1942: "The creeks could be crossed with team and buggy at a trot, and they were tree-lined. Water holes that never went dry existed about every mile along the creek, and the grass was belly-deep on a team of horses."

This was a far different picture than the deep gullies that were present in the 1940s, and it was this description that provided a goal for Clarence. Re-creating the scene described by Louis Young became an on-going effort of the next several decades.

The first step toward reaching this picture was the design and construction of a dam to control gully erosion . . . then another, then another, and another . . . .

*"The winter of 1949-50 was one of above-normal snowfall. As the waters rushed by and washed out two 24-inch culverts between the house and barn in late March, I thought of what it would be like if all the water originating on the ranch could be kept there for use over an extended period of time."*

-CLARENCE MORTENSON

Photo: Carter Johnson



**Dams were built for the following purposes:**

- Groundwater replenishment
- Stock water
- Multiuse -- groundwater, stock water, and wildlife

*“The 1940s, one of the wettest periods in Stanley County history arrived . . . The rains, however welcome, only exacerbated the problem of water erosion on the erodible soils.”*

—CLARENCE MORTENSON

**THE IMPORTANCE OF VEGETATION WHEN IT RAINS . . .**

A 25-year storm was created with a rainfall simulator near the Mortenson Ranch, Stanley County, 1996 (Data from Robert Kohl, SDSU):



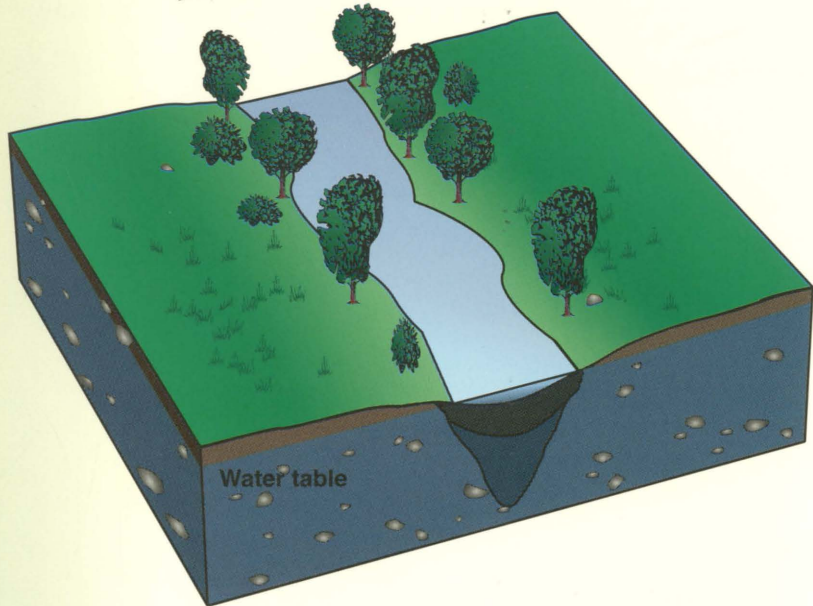
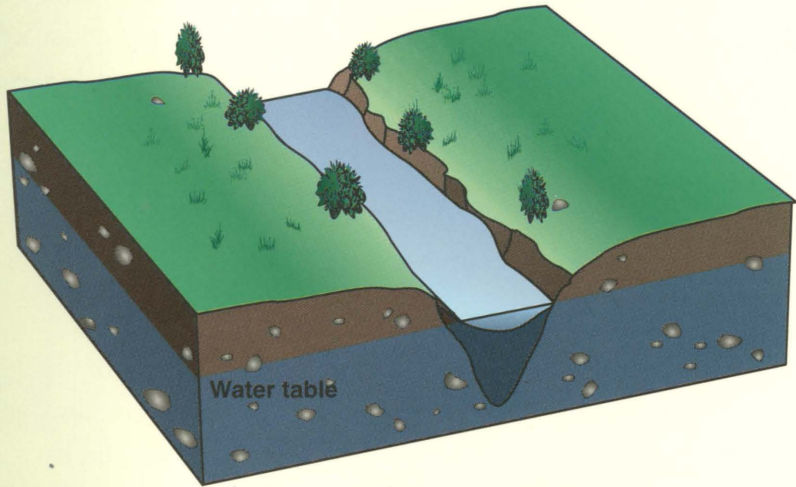
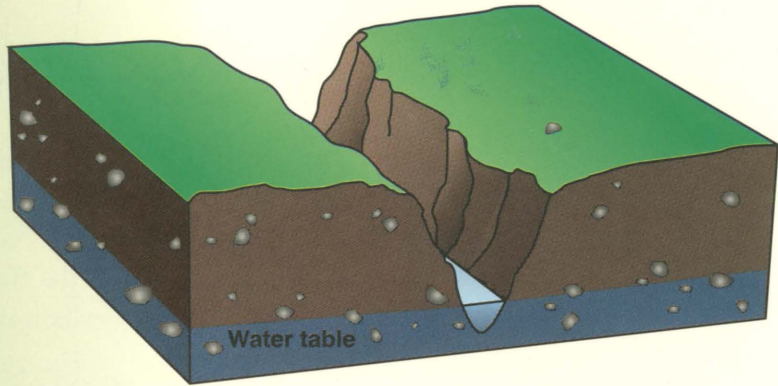
Photo: Robert Kohl

**POORLY-VEGETATED PLOT . . .** Soil was lost at a rate of 4,300 lbs/acre, and 80% of the applied rainfall ran off.



Photo: Robert Kohl

**WELL-VEGETATED PLOT . . .** Soil was lost at a rate of 170 lbs/acre, and 58% of the applied rainfall ran off.



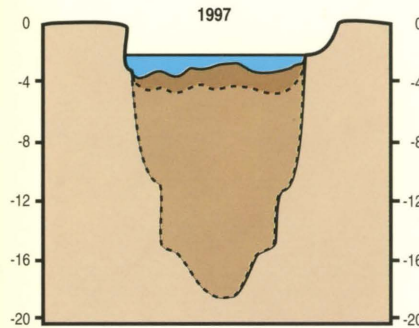
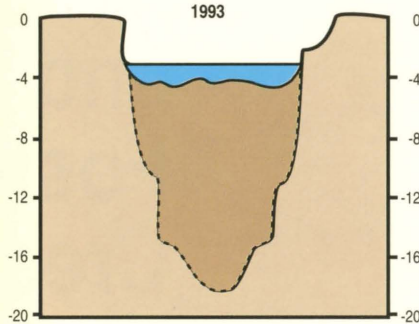
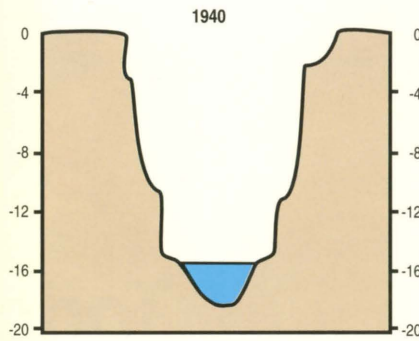
Process of riparian zone healing. Dams and new vegetation collect sediment and raise the floodplain level, building the stream-side aquifer and sustaining woody vegetation during droughts.

### THE HEALING PROCESS . . .

Turning an eroded gully into a sub-irrigated, vegetated area requires time. Shape of the stream channel constantly changes as silt is deposited.

*“ The channel at that time was very narrow and steep-sided, the banks were vertical, no vegetation grew in the creek bed. Following a heavy rain, the channel would be almost bank-full and huge chunks of soil continually fell into the current and were dissolved and carried away. ”*

—CLARENCE MORTENSON  
REFERRING TO FOSTER CREEK IN 1941



The shape of Foster Creek was estimated for the 1940's and measured in 1993 and in 1997. (1993 and 1997 data courtesy of Natural Resources Conservation Service Grazling Lands / Wetlands Regional Technical Team, Rapid City, and North Central Resource Conservation and Development Project, Pierre. 1940s estimate from Clarence Mortenson.)

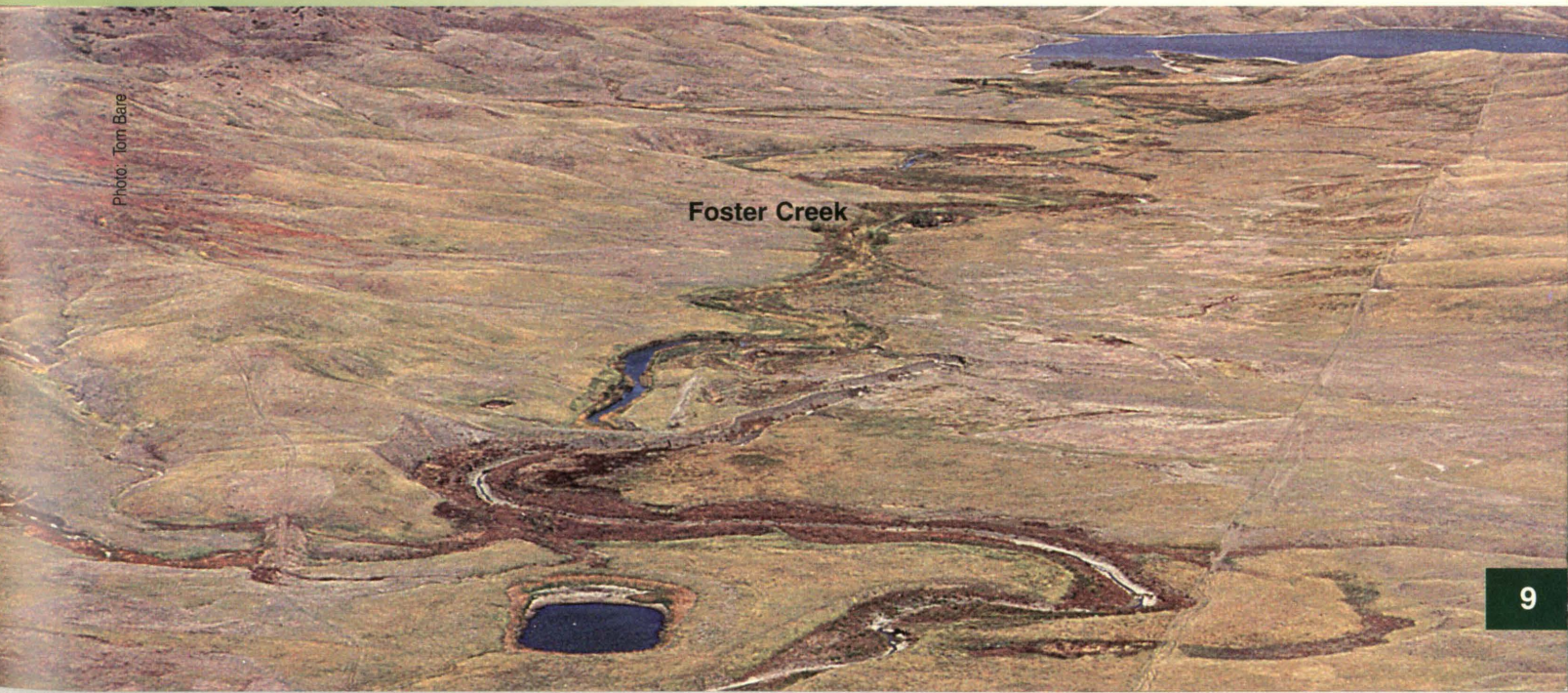


Photo: Tom Bare

Foster Creek

## THE FIRST LARGE DAMS

### Dam 1

- Built in 1950 for the purpose of groundwater recharge
- Backs water over 20 to 30 acres when full

### Dam 2

- Built originally as a stock dam in 1948, rebuilt in 1955

Dams 1 and 2 washed out one spring following record snowfalls. They were subsequently enlarged and gravel was stripped to allow holding of more runoff.

Spreader dams with dikes were built in 1958, allowing water to be diverted into them. Pipes (12") with gates allow drainage as needed.

### Dam 3

- Built in 1964, multipurpose
- Spilled only once in 33 years

### Dam 4

- Built in 1951, enlarged in 1959
- Spilled twice in 46 years

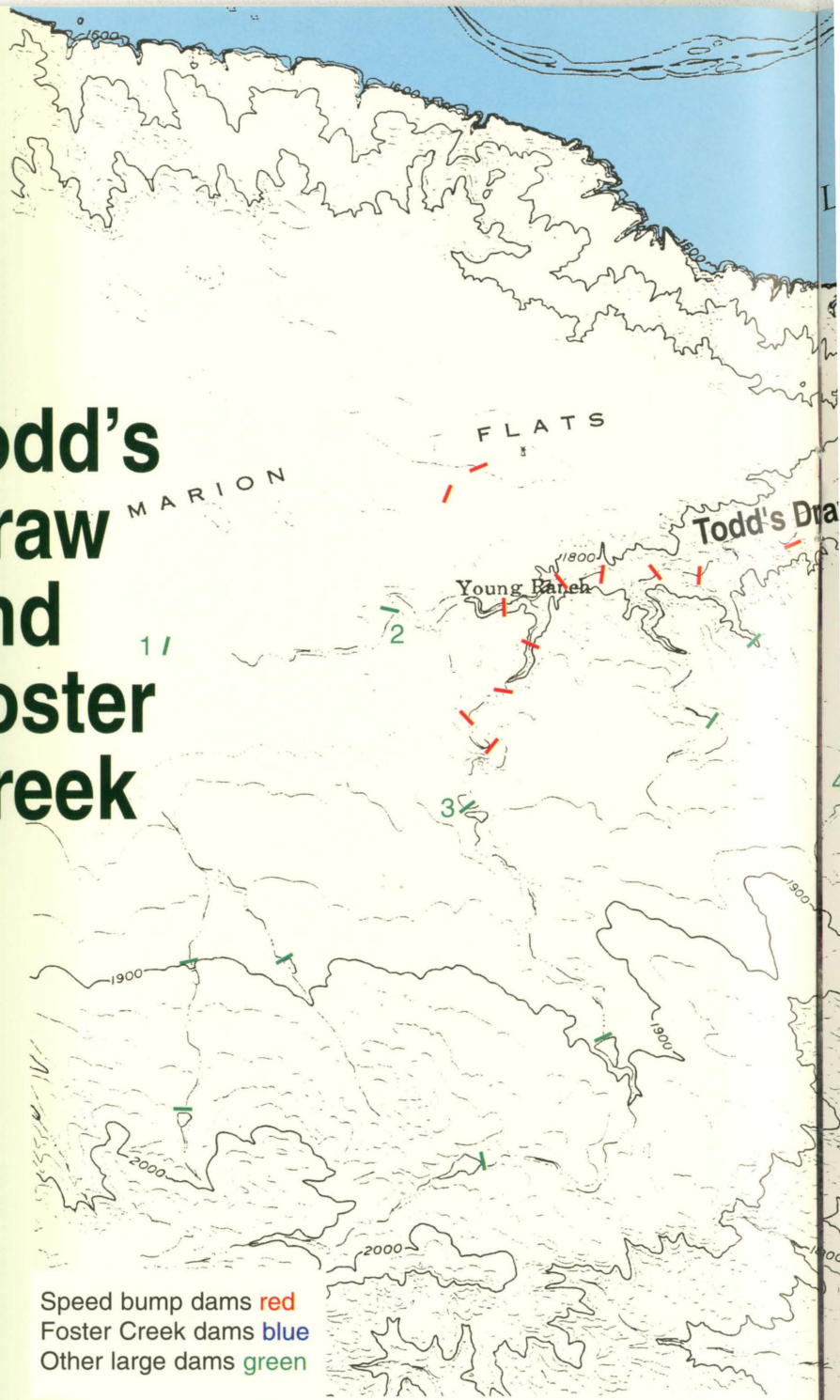


Photo: Tom Bare



Photo: Bob Gartner

# Todd's Draw and Foster Creek



Speed bump dams **red**  
Foster Creek dams **blue**  
Other large dams **green**

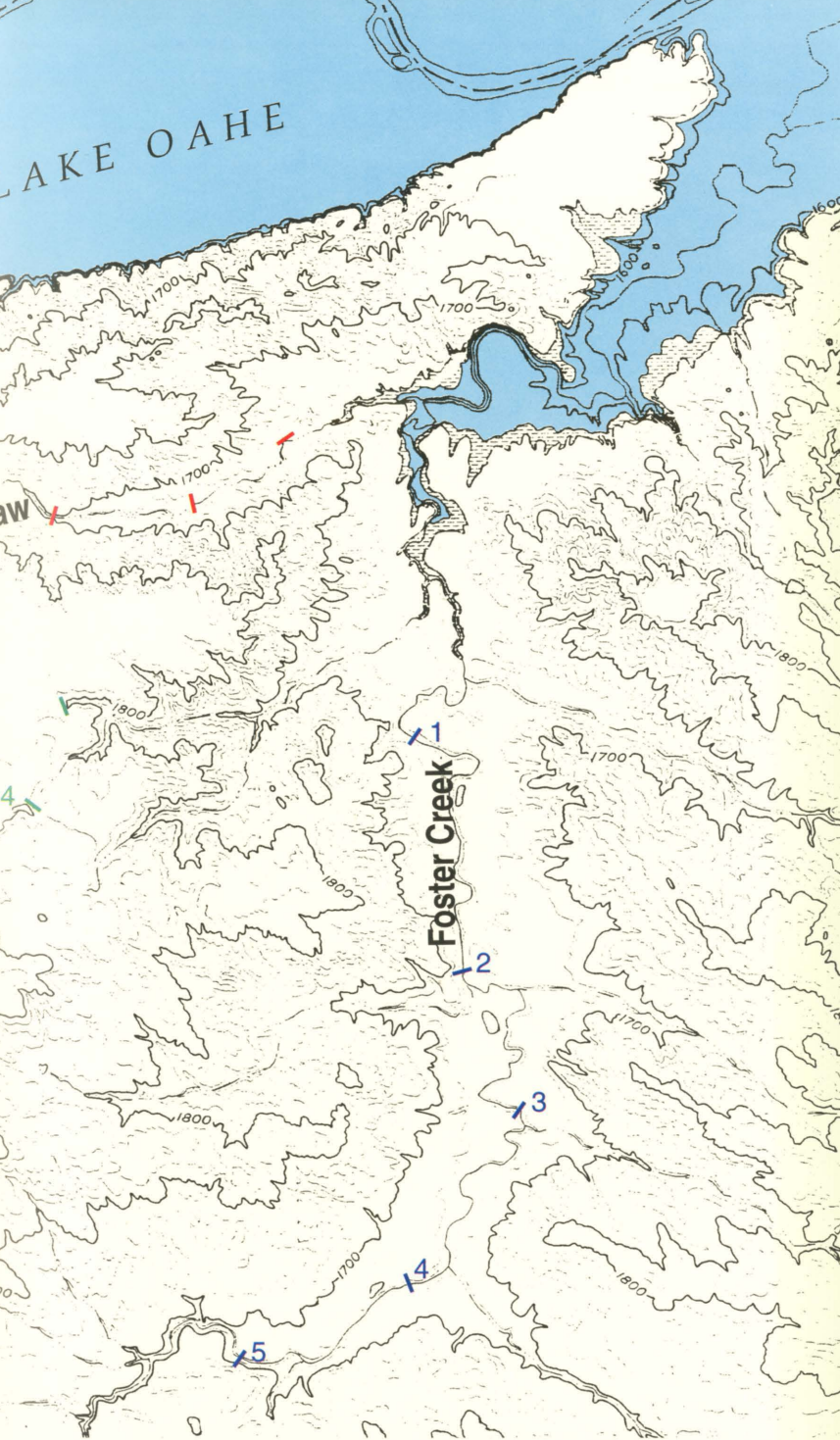
## SPEED BUMP SYSTEM IN TODD'S DRAW

*"I started planting trees in 1950, hand-planting them down the length of Todd's Draw. In 1961, a very dry summer destroyed them all. I realized that without restoring the water table under the riparian area, tree planting was a futile effort."*

-- CLARENCE MORTENSON

**SOLUTION:** A series of relatively small dams (speed bumps) that hold silt, yet leak enough water to allow flow during dry times.

In 1962, Clarence hired a local contractor to drive a bulldozer, then walked ahead of him down Todd's Draw selecting sites for speed bumps. Sites were selected by looking for . . .



## MAJOR DAMS OF FOSTER CREEK

**Dam 1** (built in 1986) and **Dam 2** (1988)

- In the late 1980s, Foster Creek once again had trees for the first time in many years. Germination of willows and cottonwoods was rapid following dam building.

### **Dam 3**

- Built in 1993

### **Dam 4**

- Built in 1993

### **Site 5**

- Possible site of future dam if need arises

- The largest possible remnants of the old meander channel of pre-gully times
- Areas lower than the surrounding bottom and with good grass cover
- Nearby available soil for building the speed bumps

***"This plan has worked beyond my greatest expectations. Up to 1997, less than \$1,000 had been spent on repairs to the original dams, a period of 35 years. The results speak for themselves."***

-- CLARENCE MORTENSON



Foster Creek dam shortly after its construction in 1986.



The same dam in 1992.

Photo: Clarence Mortenson

Photo: Clarence Mortenson

**LOOKING toward  
the Cheyenne River  
arm of Oahe Reservoir**







**EXPANSION** of woody plants  
in a Mortenson Ranch draw.

1992



# Progress...

## The trees come back

... and the grasses...

...and the wildflowers...

With water supplies replenished and grazing intensity reduced, trees begin to thrive in draws and in riparian areas.

In Todd's Draw, a few trees surviving since the 1930s produced seed. Some of those seeds germinated, became trees, and by the mid-1970s were producing seed of their own. By the early 1990s, the spread of trees was rapid.

Trees, vines, and shrubs found on the Mortenson Ranch:



Photo: Carter Johnson



Photo: Carter Johnson

### TREES

- American elm
- Cottonwood
- Green ash
- Hackberry
- Peachleaf willow
- Rocky Mountain juniper
- Creeping juniper

### VINES

- Winter grape
- Woodbine

### SHRUBS

- Buffaloberry
- Buffalo currant
- Choke cherry
- Creeping juniper
- Dwarf sagebrush
- Dwarf wild indigo
- False indigo
- Lead plant
- Missouri gooseberry
- Northern hawthorn
- Sandbar willow
- Prairie wild rose
- Saskatoon serviceberry
- Skunkbush sumac
- Western snowberry
- Western wild rose
- Wild plum

Photo: Carter Johnson



# Woody Plants...



Photo: Carter Johnson

Young ash trees on the Mortenson Ranch.



Photo: Carter Johnson

Rocky Mountain juniper



Photo: Robert Gartner

Lead plant



Photo: Carter Johnson

Creeping juniper

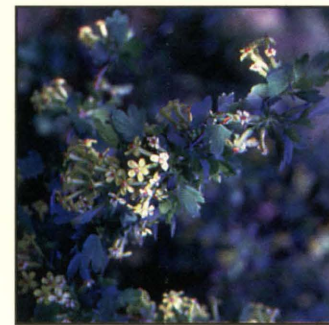


Photo: Todd Epp

Buffalo currant



Photo: Carter Johnson

Green ash

A healthy tree population is continuously producing new seedlings. It has individuals of all sizes and ages.

## TREE DENSITY by age class from five sites\*

**Seedlings -- 46,560 per acre**  
less than 3 ft tall

**Saplings -- 230 per acre**  
over 3 ft tall, 2.5 inches  
in diameter  
at breast height (dbh)

**Mature trees -- 107 per acre**  
over 2.5 inches in diameter  
at breast height

\*Data from Mortenson Ranch 1992-1994.



Photo: Carter Johnson



1986

Photo: Robert Gartner



1997

Photo: Tom Blare

**A KEY TO RAPID SPREAD of any species:** Native, local seed sources will produce the best-adapted plants.

**Points to remember . . .**

- Encourage established plants to reproduce.
- Plant seed harvested locally.
- Let birds and mammals of newly established habitats do some of the dispersing.

# Grasses and Forbs...



Photo: James R. Johnson

Western wheatgrass



Photo: James R. Johnson

Maximilian sunflower



Photo: Robert Gartner

Purple prairie clover

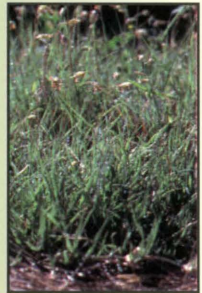


Photo: James R. Johnson

Buffalo grass



Photo: Carter Johnson

Bush morning glory



Photo: Carter Johnson

Prairie smoke



Photo: James R. Johnson

Green needlegrass



Photo: James R. Johnson

Purple coneflower



Photo: Carter Johnson

Breadroot



Photo: James R. Johnson

Blue grama



Photo: Robert Gartner

Sensitive briar



Photo: Carter Johnson

On uplands, the seeds of grasses and forbs are harvested and scattered. Jeff Mortenson harvests and sells seed from a variety of these species to native plant nurseries.



Photo: Carol Johnson

# Wildlife...



## NATURE'S ENGINEERS

A key factor in stream maintenance was lost when beavers were trapped in the early 1800's. With restoration of groundwater sources and woody vegetation, the beaver has returned.

Much of the dam-building accomplished by man-powered bulldozers can now be turned over to the landscape's native engineer, the beaver.



Photo: Carter Johnson



Photo: Carter Johnson

As native vegetation returns, so does native wildlife. During a three-day survey of the Mortenson ranch in 1997 conducted by ornithologist Bruce Harris, 67 bird species were observed. Many of these were neotropical migrants that have lost critical areas of their native habitat throughout the Americas.

Upland game birds and mammals are present as well. Their numbers are abundant enough to allow operation of a fee hunting business by the Mortensons.



Blue Grosbeak



Baltimore Oriole



Orchard Oriole



Bell's Vireo



Sharp-tailed Grouse



Yellow Warbler

Photos: Woodland bird species courtesy of B.J. Rose. Sharp-tailed grouse courtesy of Dave Ode, South Dakota Game, Fish, and Parks.



# Is it worth it?...

## Ecology and economics

Some costs and benefits of the Mortensons' management practices include:

### Costs

- Dam building
- Fencing
- Time and effort of cattle rotation
- Initial reduction of stock

### Benefits

- Sustainability of rangeland
- Ecological diversity
- Income from native seed and fee hunting enterprises
- Far fewer livestock losses in severe winter weather
- Greater capacity of rangeland to support cattle

Ascribing a monetary value to all of the benefits would be difficult or impossible. Important measures of economic improvement include animal unit months (AUMs)\*, cash rent, and land values (1960 vs 1996), based on range condition. Range condition surveys were conducted at the Mortensons' in 1960 and in 1996.\*\* These measures are shown in the graphs on the following pages for the Home Place, Maupin Place, and Bursch Place.

\*An AUM is generally defined as the amount of forage utilized by a cow and her calf during one month.

\*\*Rainfall during 1993-1996 was among the greatest ever received in Stanley County. The increased land productivity in 1996 is a reflection of this in addition to the Mortensons' management.



Photo: Tom Bare

Photo: Todd Epp

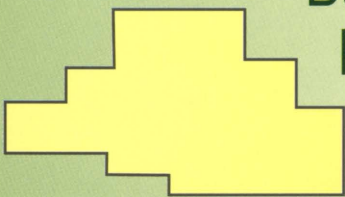
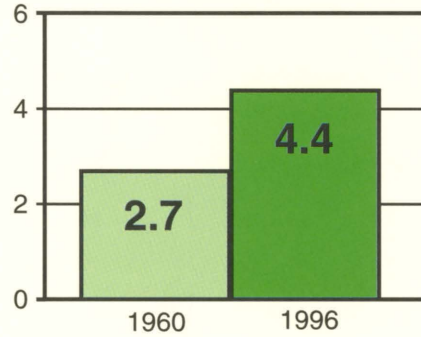


# Measuring economic improvement

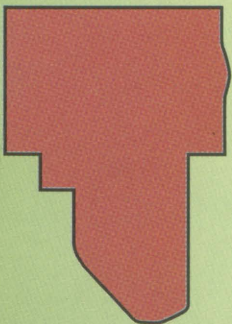
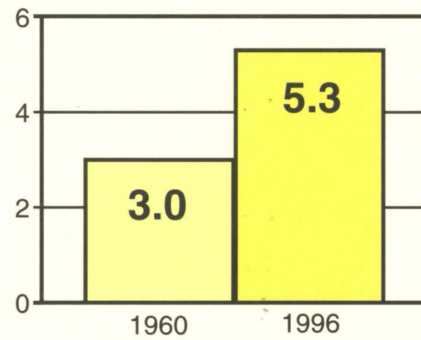


The Home Place

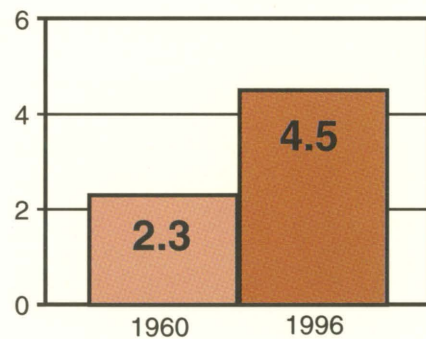
AUMs per 10 acres



The Bursch Place

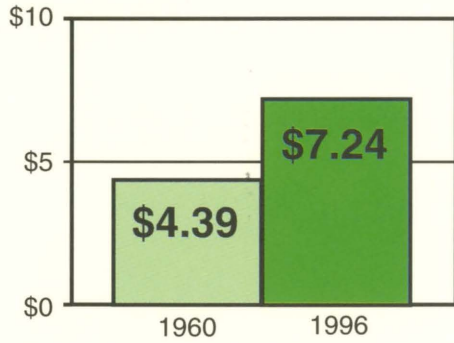


The Maupin Place



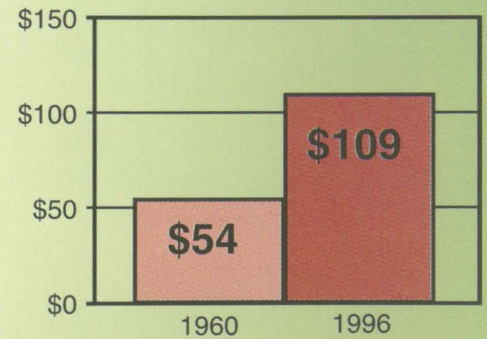
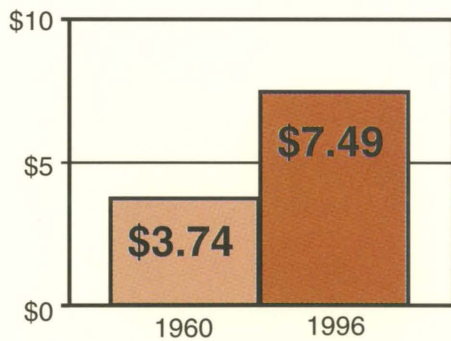
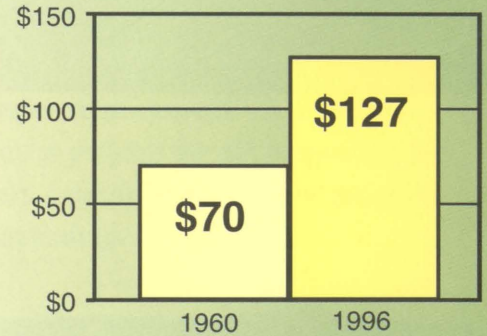
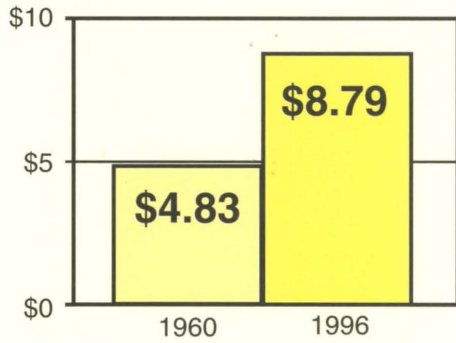
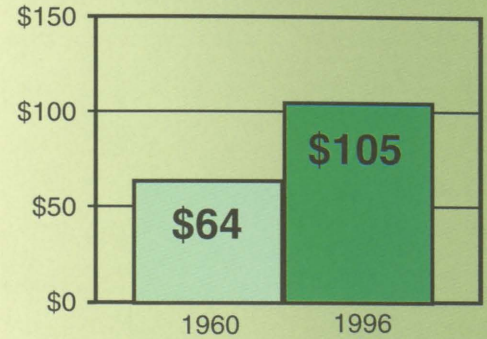
## CASH RENT

Based on an estimate of \$16.50 per AUM for the Stanley County area in 1997 dollars (*South Dakota Farmland Market Trends: 1991 -1997*. South Dakota Agricultural Experiment Station Report C-260 by L. Janssen and B. Pflueger.)



## LAND VALUE

Determined by dividing the estimated cash rent by a 6.9% average rate of return per acre (*South Dakota Farmland Market Trends: 1991 -1997*. South Dakota Agricultural Experiment Station Report C-260 by L. Janssen and B. Pflueger.)



Compare the size of young trees along the dam in this 1993 photo with their size four years later in 1997.

1993



1997



# Take-home lessons...

A few principles used successfully by the Mortensons:

- Rotate cattle quickly early in the growing season.
- Recharge groundwater **first, THEN** revegetate.
- Native, local seed sources are best adapted.

## **Tailor these ideas.**

Obviously, every ranch or farm is unique. So is every grazing plan, dam-building plan, and revegetation project. Each land manager has to develop his or her own plan. The ideas presented here are adaptable examples rather than foolproof recommendations.

## **Think big, start small.**

The Mortensons' work has been in progress over several decades, with only small portions begun at any one time. Developing a master plan with attainable goals, then starting with just one goal is the best way for future restorationists to begin.

## **Understand that time is a major requirement.**

Results of most land improvement projects are not immediate but will be more obvious with every passing year. Even if progress isn't rapid at first, it is still happening.

## **Keep trying.**

When Clarence's tree plantings of the 1950s were killed by drought, it led to construction of a "speed bump" dam system. Other efforts that initially fail will likely lead to better results after re-thinking the original plans.

## **Get it together**

An overall key to success is a holistic approach. Managing cattle, vegetation, water resources, and wildlife are achieved simultaneously.



Photo: Scott Kronberg

Clarence Mortenson speaking with students on a tour of the ranch.

