

Geographical Information System Technology for Developing a Conservation Plan for the Northern Cheyenne Tribe in Montana

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In 1993 the Northern Cheyenne Tribal Council requested assistance from the Natural Resources Conservation Service (NRCS) in Montana to develop a comprehensive conservation plan for the Northern Cheyenne Reservation. Objectives for this project had been established in the *Northern Cheyenne Reservation Integrated Resource Management Plan* developed by the Tribe and the Bureau of Indian Affairs (BIA) to provide direction and policy for natural resources. Specific goals are to manage grazing lands in a sustainable and productive manner and to enhance wildlife habitat for several species.

Concerns on grazing lands that are addressed by the Tribe include the need for range improvements to enhance livestock grazing distribution, particularly livestock water developments. Other concerns are the need to develop grazing strategies which improve the forage resources, reduce noxious weeds, manage prairie dog towns, and enhance riparian and wetland areas for wildlife and improved water quality.

The Montana NRCS agreed to provide the Tribe with a comprehensive resource inventory and assist in developing a complete conservation plan. Faced with performing a complex inventory on over 400,000 acres of rangeland and forestland, NRCS staff needed a creative way to accomplish this task, and also provide the Tribe with high quality data.

The Northern Cheyenne Reservation lies within the Tongue River and Rosebud Creek Watersheds in south central Montana. The project covers an area of approximately 680 square miles of diverse rangeland and forestland. The Tongue River Watershed encompasses 187,075 acres and the Rosebud Watershed encompasses 249,873 acres. Sixty-five percent of the land base is rangeland, and twenty-five percent is forestland or grazeable woodland. The grazing lands were

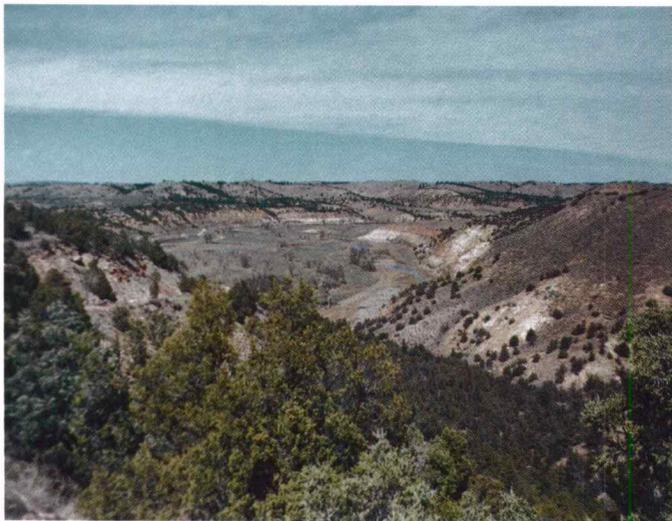
originally divided into 101 range units, i.e. pastures, for livestock grazing, varying in size from 300 acres to 19,000 acres.

Soils, topography, and climate are diverse in these watersheds. Soils vary from gently sloping to very steep, shallow to very deep, sandy, loamy, and clayey textures. Annual precipitation varies from 10 inches per year in the valley bottoms to over 20 inches in the mountains. Elevation ranges from 4,707 feet at Bull Creek Lookout, to 2,850 feet along the Tongue River. Vegetation communities include 40 ecological sites for rangeland and 25 distinct forest understory communities.

To assess resource conditions on the Reservation, items that required inventory were range condition, productivity, and apparent trend; forest understory condition; identification and location of noxious weeds, water developments, fences, and prairie dog towns; wildlife habitat elements; riparian and wetland vegetation and condition; and cultural resources.

The strategy which was developed to accomplish this complex task utilized digital orthophotoquads and existing digital data from the Bureau of Indian Affairs, specifically soils and rangeland ecological site data layers. The inventory was then performed using the following process: 1) The Reservation land base was separated into two distinct watershed areas and inventoried separately in 1994 and 1995. 2) Inventory base maps were created from existing digital data of soils, rangeland ecological sites, forest habitat types, and range unit boundaries. 3) A team of rangeland and resource specialists from NRCS, BIA, and the Tribe, performed the inventories within a three week time frame each year. 4) Data collected from the field inventory was transferred onto mylar overlays of the base maps. 5) A Geographic Information System (GIS) was used to digitize inventory data and develop specific maps of data items, such as range condition or location of noxious weeds. 6) A GIS was used to calculate total available forage in Animal Unit Months (AUM's) per acre for each range unit and watershed area. 7) Adjustments were made to total available forage based on a matrix of factors which affect livestock forage use, specifically season of grazing use, steepness of slope, and distance to livestock water.

The Tongue River Watershed portion of the inventory was performed in 1994. An oversight team was established to maintain consistency and quality control of data collection. Once the inventory was complete and all data transferred to the mylar overlays, the data elements were input into the GIS. Maps were then generated to summarize inventory information at both a small scale to show the entire watershed, and at larger scales to show individual range units. Key maps included landuse/cover, range condition, locations of both functional and nonfunctional water developments, locations of noxious weeds, potential areas for reseeding, and riparian vegetation types. (Figure 1).



Overview of Northern Cheyenne Reservation showing diversity of soils, topography, and vegetation.

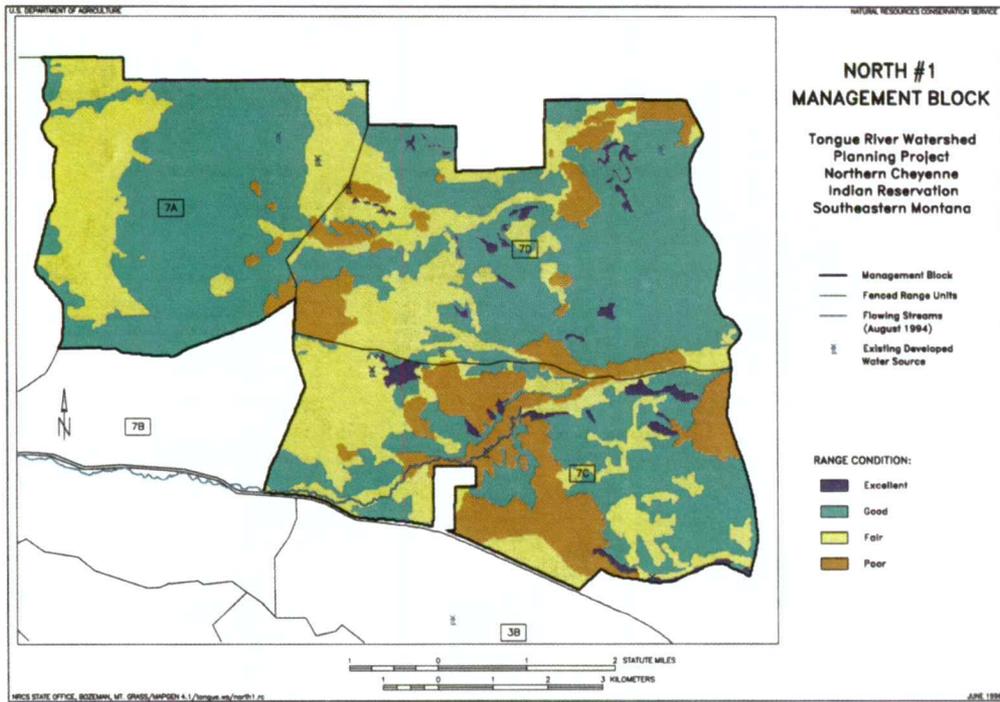


Fig. 1: GIS generated map of Range Condition and Existing Water Developments for selected range units.

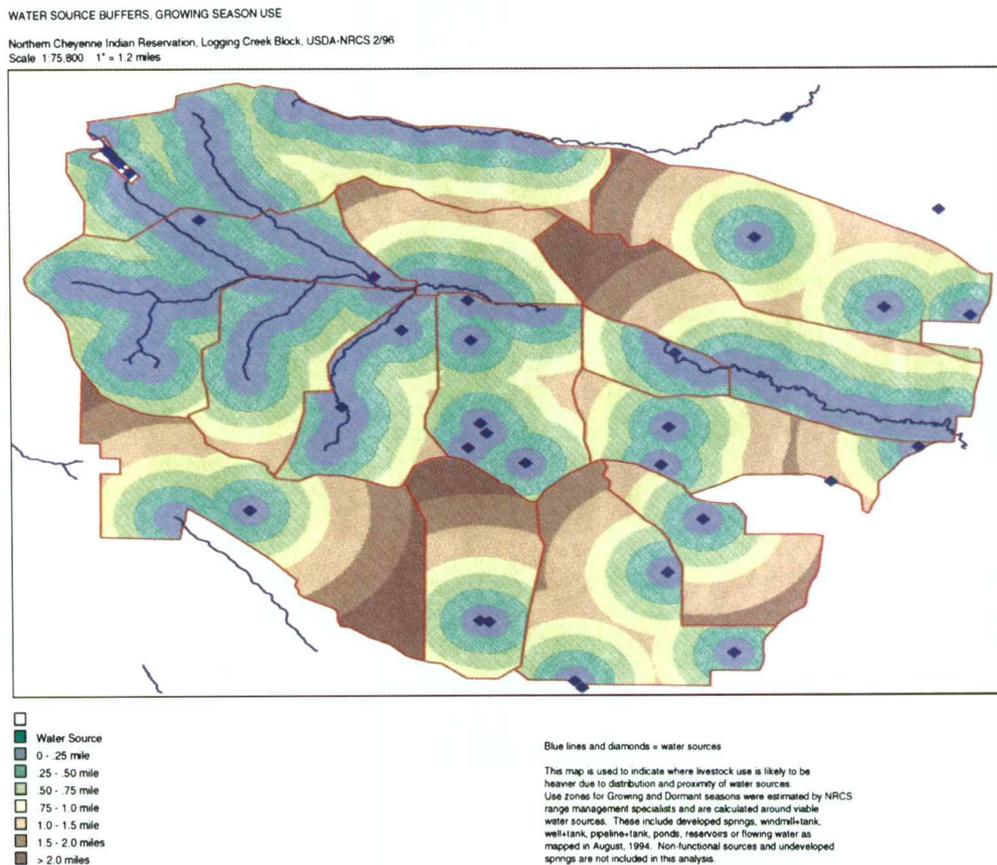


Fig. 2: GIS was used to measure distance from water sources in 1/4 mile intervals to account for livestock use patterns and to calculate total available forage.

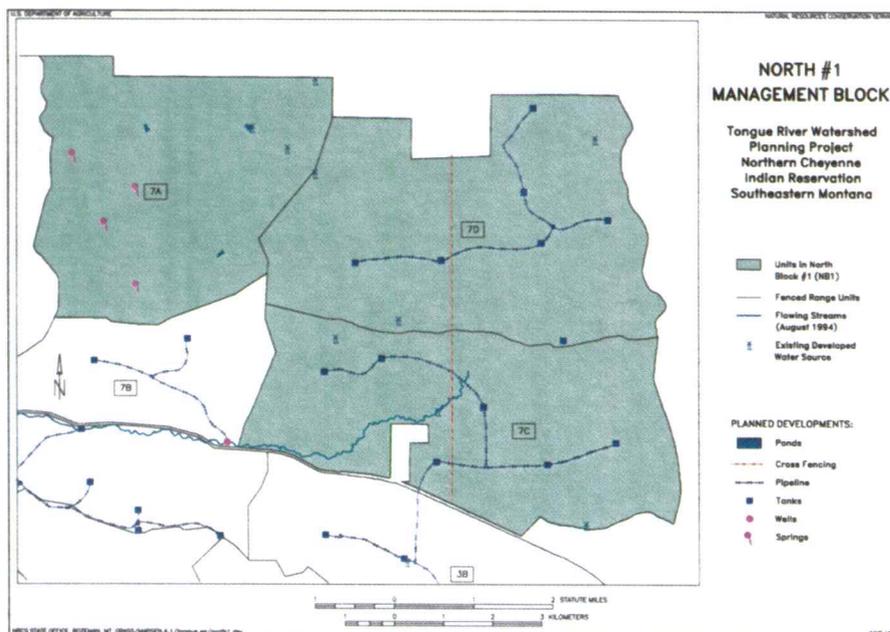


Fig 3: GIS map of planned improvements for water developments and cross fencing.

Forage production data was collected on every ecological site and computed to provide the carrying capacity for each range unit on an Animal Unit Month per acre basis. Local ranchers assisted NRCS in developing a matrix for adjustments in stocking rates based on their experience with livestock in the area. Adjustments to available forage were made according to a matrix combining season of use (growing season or dormant season), steepness of slope (slope classes at 15% increments), and distance to livestock water, to account for livestock distribution factors. GIS maps were generated for each range unit which displayed slope classes and/or distance from water in one-quarter mile increments. (Figure 2). These maps were also used to attain a visual picture of factors which potentially influence livestock distribution and forage use.

Results of the inventory indicate that range condition classes within the Tongue River Watershed are 59 percent good and excellent, and 41 percent fair and poor. Apparent trend is either downward or not apparent for most range units, due to selective grazing of preferred species, undergrazing in areas with no livestock water, and invasion of noxious weeds. Resource concerns attributed to current grazing management are high utilization of and a decline of the warm season grasses, and poor condition of both the herbaceous and woody components of riparian areas, resulting from insufficient control of livestock distribution. Information generated through the GIS indicates that an additional 3,000 existing Animal Unit Months could be available through more efficient use of forage resources, utilizing additional livestock water and fencing. There is also a potential to increase AUM's an additional twenty percent as plant communities and forage quality improve with management.

NRCS staff and tribal resource managers developed a set of three alternatives for grazing management that all address the need to control the time of exposure of forage to livestock, alternate the season of use, and incorporate growing season rest for each range unit. Individual strategies will now be developed for each range unit based on acceptability and ease of

operation for the livestock manager.

Several structural range improvements are planned to facilitate grazing management. These include 182 miles of stock-water pipeline, 30 miles of cross fences, development of 30 water sources, 10 wildlife watering sites, and 2,000 acres of noxious weed control. GIS data layers were used to generate maps of all improvement practices. (Figure 3).

Development of the *Tongue River Watershed Conservation Plan* has allowed the Northern Cheyenne Tribe to become eligible for several grant funds to assist them in improving their resources. The plan has encouraged strategies for wildlife habitat development and improvement, and enhancement of quaking aspen (*Populus tremuloides*) and Plains cottonwood (*Populus deltoides*) stands. Educational workshops for ranchers have been offered by Montana State University Extension personnel and NRCS staff, through the Montana Grazing Lands Conservation Initiative. The Rosebud Creek Watershed inventory was completed in 1995, and the Northern Cheyenne Tribe and NRCS staff are now in the process of analyzing the data for and developing the management plan for this area.

The NRCS range specialists have expanded the use of this inventory and planning technology to several other watersheds in Montana and feel it is an effective and efficient way to accomplish high quality rangeland resource inventories within a reasonable amount of time. Geospatial datasets provide a solid baseline for resource data elements, and provide a foundation for future analyses. The GIS generated maps are an effective visual tool to help explain complex resource data to landowners to assist them in making sound management decisions.

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