The ecology of reintroduced elk in Theodore Roosevelt National Park, North Dakota
by Jerry Allen Westfall

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Fish and Wildlife Management
Montana State University

Abstract:
The ecology of a population of Rocky Mountain elk (Cervus elaphus nelsoni), reintroduced into the South Unit (SU) of Theodore Roosevelt National Park (TRNP) in 1985, was studied from 1987-1988. Eight elk, previously equipped with radio-collars, were relocated daily during 4 seasons. At each observation, location, activity, habitat use, and behavior were noted. The population grew at a logarithmic growth rate of 0.31 over 4 years. Elk were segregated into a bull and a cow-calf group that only associated during the rut. Home ranges were largest in winter for the cow-calf group (62.6 km^2) and in summer for the bull group (80.0 km^2). Adult and yearling males preferred more rugged habitats than females. Elk exhibited crepuscular activity during spring and summer but remained active throughout diurnal hours in winter. Elk fed primarily in upland grasslands in all seasons. Rocky Mountain juniper (Juniperus scopulorum), in breaks habitats, was used as overhead cover during midday hours in spring and summer. Elk did not use overhead cover in winter but bedded near foraging areas.

Humans on foot were more disturbing to elk than stationary vehicles or horseback riders. Elk did not respond to humans >1,000 m away, but always displaced when approached <100 m. A dominance hierarchy of bison (Bison bison) > feral horses (Equus caballus) > elk > mule deer (Odocoileus hemionus) was observed at TRNP. Elk habitat selection was most correlated to horses during the growing season and to mule deer over the entire study. Diet composition for elk, bison, feral horses, mule deer, and white-tailed deer was determined from fecal microhistological analysis. Total elk diets were most correlated to total feral horse diets, but were not significantly correlated to the diets of any ungulate species for major forage items. Diet composition, distribution, and vegetative production were used in a computer model to determine the optimum carrying capacity for elk, bison, feral horses, and mule deer. Winterfat (Ceratoides lanata) was the forage item that most limited ungulate numbers.

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APPROVAL

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Jerry Allen Westfall, Jr.

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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ABSTRACT

The ecology of a population of Rocky Mountain elk (Cervus elaphus nelsoni), reintroduced into the South Unit (SU) of Theodore Roosevelt National Park (TRNP) in 1985, was studied from 1987-1988. Eight elk, previously equipped with radio-collars, were relocated daily during 4 seasons. At each observation, location, activity, habitat use, and behavior were noted. The population grew at a logarithmic growth rate of 0.31 over 4 years. Elk were segregated into a bull and a cow-calf group that only associated during the rut. Home ranges were largest in winter for the cow-calf group (62.6 km^2) and in summer for the bull group (80.0 km^2). Adult and yearling males preferred more rugged habitats than females. Elk exhibited crepuscular activity during spring and summer but remained active throughout diurnal hours in winter. Elk fed primarily in upland grasslands in all seasons. Rocky Mountain juniper (Juniperus scopulorum), in breaks habitats, was used as overhead cover during midday hours in spring and summer. Elk did not use overhead cover in winter but bedded near foraging areas. Humans on foot were more disturbing to elk than stationary vehicles or horseback riders. Elk did not respond to humans >1,000 m away, but always displaced when approached <100 m. A dominance hierarchy of bison (Bison bison) > feral horses (Equus caballus) > elk > mule deer (Odocoileus hemionus) was observed at TRNP. Elk habitat selection was most correlated to horses during the growing season and to mule deer over the entire study. Diet composition for elk, bison, feral horses, mule deer, and white-tailed deer was determined from fecal microhistological analysis. Total elk diets were most correlated to total feral horse diets, but were not significantly correlated to the diets of any ungulate species for major forage items. Diet composition, distribution, and vegetative production were used in a computer model to determine the optimum carrying capacity for elk, bison, feral horses, and mule deer. Winterfat (Ceratoides lanata) was the forage item that most limited ungulate numbers.

INTRODUCTION

With the recession of glaciers at the end of the Wisconsin glacial stage 10,000 years ago, elk spread south and east from non-glaciated Alaskan refugia to inhabit prairies, parks, and open forests. Elk became the most widely distributed North American cervid, extending their range as far south as northern Mexico, Louisiana, and Alabama (Hall and Kelson 1959, Curren 1977, and Boyd 1978). By the end of the Wisconsin glacial stage, elk were segregated into 4 geographic regions: 1) the northwestern Pacific coast; 2) western and central California; 3) the southwestern United States and northern Mexico; 4) the area east of the Cascade and Sierra Nevada ranges (Guthrie 1966).

The ranges of three presently recognized subspecies of the North American elk: Rocky Mountain elk, Manitoban elk (C. e. manitobensis), and Eastern elk (C. e. canadensis), overlapped in the area of the Northern Great Plains (Guthrie 1966). Guthrie (1966) suggested that a distinct subspecies uniquely adapted to the environment of the Great Plains may have been forming. However, Bryant and Maser (1982) asserted that elk in the Northern Great Plains were Manitoban elk. With the extirpation of elk in the eastern 2/3 of the continent, any subspeciation that may have been occurring was forever halted.

In North Dakota, elk were abundant before European settlement. Audubon, Lewis and Clark, and Alexander Henry all reported seeing vast

herds along the Missouri River. Remington Kellogg hypothesized, based on reports of early explorers and settlers of the region, that elk migrated to river bottoms in the fall and back to the open prairies in late spring (Bryant and Maser 1982). Riparian areas presumably provided ideal winter range, with thermal cover and abundant browse. However, the last reported elk killed in North Dakota occurred in Cavalier County in 1883, precluding any further research into this phenomenon (Kruckenberg 1973).

In 1942, 25 Rocky Mountain elk were released in the Killdeer mountains, western North Dakota, by the North Dakota Department of Game and Fish (Bryant and Maser 1982). This transplant failed and future reintroductions were not attempted. In 1979, however, a small herd of elk escaped from a holding pen on an Indian reservation into river breaks near the North Unit (NU) of TRNP (Sullivan 1988). Within a few years this herd had grown in size to allow a limited hunt (25-30 animals per year) by the North Dakota Department of Game and Fish.

Plans to reintroduce elk into the SU of TRNP were initiated in 1984, in an attempt to restore one of the major ungulate species native to the area. Pronghorn (Antilocapra americana), bison, and California bighorn sheep (Ovis canadensis california) were reintroduced into the SU in 1951, 1956, and 1959, respectively. Mule deer and white-tailed deer (O. virginianus) were present in the Park since its inception. Feral horses, from a variety of sources, have established themselves in the Park, and are currently being managed according to Park goals (TRNP 1984). An elk reintroduction would complete the historic ungulate assemblage in the badlands ecosystem

(TRNP 1984). In March 1985, 47 Rocky Mountain elk were acquired from Wind Cave National Park, South Dakota and released in the SU of TRNP on Buck Hill (Fig. 1).

This study represents the second phase of a 4-year investigation of the dynamics and ecology of a reintroduced elk population. M. Sullivan conducted research during phase 1 of this project from 1985-1986. Specific objectives of phase 2 (1987-1988) were:

1. Description of daily and seasonal movements of elk.
2. Description of the population dynamics of elk and determination of elk population levels that are consistent with Park management objectives.
3. Identification of seasonally important Habitat Types/ Mapping Units/Complexes and Physiographic Types used for feeding, cover, mating, and calving.
4. Description of interactions between elk and other ungulates and identification of interactions that could detrimentally affect individual ungulate species.
5. Determination of human impacts on elk behavior and distribution in the Park.

STUDY AREA

The study was conducted in the SU of TRNP in southwestern North Dakota (Fig. 1). The Park was originally created as Theodore Roosevelt Memorial Park on 25 April 1947, but the name was changed to Theodore Roosevelt National Park in 1978. The Park is divided into two units, the SU near the town of Medora, and the NU, 80 km to the north. The SU of TRNP is bordered by U. S. Interstate Highway 94 to the south, private landholdings to the north and east, and USFS Little Missouri National Grasslands to the west. The SU covers 18,756 ha, and is bisected north to south by the Little Missouri River.

Geology

The SU of TRNP is part of the Missouri River Plateau of the Great Plains Province (Fenneman 1931). Soil substrates are from the Paleocene, Fort Union Group of the Tongue River Formation (Leonard 1930). Although TRNP was unglaciated during the last ice age, glacial diversion caused an eastern shift in the route of the Little Missouri River, which caused extensive downcutting in areas along the river channel creating an unique topography known as the badlands. The badlands are characterized by considerable erosion leaving resistant layers of sandstone, shale, and lignite.

Often when partially exposed lignite beds became heated, they would bake overlying clay beds, forming a red, slaglike clinker