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A Preliminary Report on the Biology of Harding County  
Northwestern South Dakota

By STEPHEN S. VISHER

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Report of State Geologist

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*STATE PUBLISHING CO.*  
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ELLWOOD CHAPPELL PERISHO, State Geologist

1914

## REGENTS OF EDUCATION

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## LETTER OF TRANSMITTAL

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State Geological Survey,  
University of South Dakota.

Vermillion, S. D., March 3, 1914.

Honorable A. E. Hitchcock, President of the Board of Regents of  
Education.

Dear Sir:

I herewith submit the accompanying articles for publication as Bulletin No. 6 of the State Survey. It contains a Preliminary Report on the Biology of Harding County, and the Biennial Report of the State Geologist.

Very respectfully,

ELLWOOD C. PERISHO,  
State Geologist.

# TABLE OF CONTENTS

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	Page	
Title Page .....	I	
Regents of Education .....	3	
Letter of Transmittal .....	5	
Table of Contents .....	7	
List of Illustrations .....	9	
I. A Preliminary Report on the Biology of Harding County, Northwestern S. D., by Stephen Sargent Visher .....		II-103
1. Introduction .....		II-15
2. The Ecological Formations .....		15-31
<i>The Steppe</i> , .....		15-21
Conditions of the Steppe .....		15
Conspicuous Plants and Animals .....		16
Adaptations of the Life .....		17
<i>Grassy Flats</i> or Terraces along Valleys .....		22
<i>Wooded Areas</i> .....		23
<i>Buttes</i> .....		25
<i>Badlands</i> .....		27
<i>Sandy Areas</i> .....		28
<i>Acquatic Associations</i> .....		29
3. List of Plants Collected in Harding County .....		32-68
4. The Birds of Harding County .....		68-87
5. The Mammals of Harding County .....		87-92
6. List of the Reptiles and Amphibians .....		92-93
7. A Partial List of the Insects Collected ..		93-94
8. List of the Molluska of Harding and Per- kins Counties, by W. H. Over .....		95-96
9. Notes on Animals and Plants of Economic Importance .....		96-103
Animals of Prey .....		96
Prairie Dog .....		97
Other Abundant Forms .....		97
Useful Animals .....		98

Native Plants as Indicators of Agricultural Possibilities .....	99
Poisonous Plants .....	100
Plants Used in Medicine .....	102
Food Plants .....	102
Wood Plants .....	102
Weeds .....	103
II. The Biennial Report of the State Geologist by Elwood Chappell Perisho .....	107-115
General .....	107
The State Museum .....	107
Field Work .....	109
Publications .....	111
Work to be Done .....	112
The Artesian Water Supply .....	114
Funds Needed .....	115
Index .....	116
Advertisement of Bulletins .....	(Last Page.)

## LIST OF ILLUSTRATIONS

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- Plate 1. Cottonwood Grove ..... opp. p. 23  
Plate 2. Two Abundant Plants of the Plains .....opp. p. 34  
Plate 3. Two Plants of Hills and Banks .....opp. p. 46  
Plate 4. Three Plants Conspicuous of the Plains .... opp. p. 52  
Plate 5. Western Meadowlark .....opp. p. 80  
Plate 6. Beaver Dam .....opp. p. 89

# THE BIOLOGY OF HARDING COUNTY, NORTHWEST- ERN SOUTH DAKOTA.

BY S. S. VISHER.

## INTRODUCTION

Harding County is located in the northern Great Plains. Because of the variety in topography and soil, many ecological associations are represented. It is believed that a study of the biology of this county will make easier an understanding of the biological conditions of a wide area, and therefore that the following report will have more than local interest.

Harding county is the most northwestern county in South Dakota. It is bordered on the north by Bowman county, North Dakota, on the west by Custer county, Montana, on the south by Butte county, South Dakota, and on the east by Perkins county. It is approximately 50 miles square and so extends southward nearly to the Wyoming-Montana-South Dakota corner.

Most of the area is a treeless, semi-arid, rolling plain having an average elevation of about 3,400 feet. Upon this uneven plain rise several large more or less forested buttes (Cave Hills in the north central, Slim Buttes in the east and Short Pine Hills in the southwest), and numerous smaller buttes. Below the general level have been eroded many valleys which are most conspicuous because deepest, towards the borders of the county. Badland areas are scattered widely. The finest examples are at various points in or bordering the buttes, especially at Reva gap in the Slim Buttes and about the northeastern end of the East Short Pine Hills. The "jump off" which extends for several miles eastward from the East Short Pines is notable.

The drainage is thorough—there are no lakes and no standing water except behind small artificial dams and in the shallow water holes (most of which were formed by the blowing away of the soil from small areas) which contain water for short intervals after rains.

The streams are all highly irregular in their flow, except a few spring fed brooks in forested buttes. The chief rivers are (1) the Little Missouri which crosses the northwestern corner in a deep valley along which badland areas and sandy stretches occur. This river system at present drains but a very small per cent. of the county. (2) Most of the area is drained by the south fork of the Grand river and its tributaries. (3) The southern border of the area is drained by the north fork of the Moreau river.

Numerous classes of soils are represented in this area. There are large, highly sandy belts, smaller, clay ("gumbo") areas and all gradation between these. Most of the area is overlaid with loams.

The climate is severe. The average rainfall is but little over 15 inches, but is very irregular in its distribution. Normally about four-fifths is received in the growing season. The interval between killing frosts in spring and fall averages about 120 days, but the frostless season—between the latest recorded spring and the earliest recorded fall killing frost is less than three months. A moderate wind (10 to 12 miles an hour) is normal. It increases in velocity during the day, but often dies down at night.

The vegetation is mostly that of the dry prairies or steppe—short grasses and herbs. Groves of trees, chiefly cottonwoods, are found in the Little Missouri valley. In and about the larger buttes are areas which are more or less forested with pine, ash, and cedar. The larger buttes have been incorporated into the Sioux National Forest.

For a detailed discussion of the topography, geology, soil, climate and mineral resources of this area, see a forthcoming bulletin (Number 8) of the South Dakota Geological Survey.

*The Biology of the Past.* Very early this region of course was without life. At the time represented by the oldest formations known in this definite area life was already abundant. There were woods containing trees (oak, cottonwood, pines, etc.) similar to those of the present. The flowering herbs of that time are unknown. Quite likely these were not yet extensively developed. There were various reptiles, some resembling gigantic "horned toads" with similar armor-plating. Others resembled monstrous lizards, while many were very different from anything now living. For example



the flying "dragons" and kangaroo-like dinosaurs. The birds of this time are but poorly known; some had teeth; others were very similar to those of the present; still others were flightless and very expert divers suggesting in some respects the penguins and the recently extinct great auks. Very little is known of the insect life of this the Cretaceous Period. There were beetles, grasshoppers, dragonflies, etc. Butterflies, bees and flies first became abundant at the close of the Cretaceous or somewhat later.

During the Tertiary the life was in some respects quite different than during the Cretaceous. While Mammals had been either totally absent here during the Cretaceous or exceedingly rare, they were predominant in the Tertiary. There were few reptiles, except for land tortoises and an occasional crocodile. Among the mammals were some forms which were ancestral to modern mammals and others such as the Titanotheres have left no descendants. Remains of birds have been found but rarely here. However, a fossil bird's egg was found by Wm. H. Over in the badlands at Reva Gap in the Slim Buttes. In some of the asphalt pools of California numerous large Tertiary birds have been preserved. Many are very modern. The relative absence of fossils of the smaller kinds of birds suggests that small birds have since then increased in numbers more than the large ones. Civilization at least has been less severe on the small birds than on the large ones. I know of no fossil insect having been discovered in the Tertiary of South Dakota, but at a few other localities, notably Florissant, Colorado, hundreds of species, representing almost all the modern orders and even many modern families and genera have been discovered.

The Tertiary flora of this region is shown chiefly by leaf prints in the shale was likely not greatly different from the modern flora though tree ferns, sequoias or giant redwood, tulip tree, magnolia, etc., supplemented our flora. However, it is quite probable that some families such as the grasses, legumes (peas, etc.), composites (aster, sage, etc.) were less predominant than at present. It also seems probable that there was a smaller number of species of the higher flowering plants than now.

2. At the coming of White Man into this region.

The fauna and flora was different from that of today, mainly in regard to the larger forms. In 1850 there were wild horses

(descended from those brought to Mexico and liberated by the Spaniards in the 16th century. For some unknown reason the native American horses became extinct on this continent shortly before the glacial period). There were present large herds of bison, elk, antelope and many bighorn sheep, bear and puma, and more large birds such as the cranes, grouse, ducks, etc., than there are now. Various small mammals such as some kinds of mice, etc., were doubtless more rare than now, as is also the case with numerous kinds of birds, "weeds" and household insects.

### 3. Explanatory Remarks.

In the treatment of the biology of a diversified area it is desirable to sub-divide the region into sections having many similarities. In this area there are native perhaps 50 kinds of mammals, 200 kinds of birds, 15 kinds of snakes, lizards and turtles, 6 kinds of amphibians, over a thousand species of insects and considerably over 500 kinds of plants. In addition there are the fishes, mollusks, crawfish, worms and many smaller forms. Of this vast array of life very many are inconspicuous and not observed by non-specialists, although without a doubt every species has its part to play in the biologic economy of the whole. This is made the more likely when it is noted that most of the species have a definite place to occupy. The plants and animals of the ponds are not at all of the same species as those of the hill tops, those of the shaded ravines not at all the same as those of the level prairies.

It is therefore convenient to sub-divide this area into several biological associations or ecological formations. The largest association is that of the "Grass-covered Upland," "Steppe," or "Dry Prairie." Other important formations are (b) the "grassy Flats" along the stream valleys. (c) Woods in the ravines and along the streams. (d) Pine-covered and Rocky Slopes, (e) Badlands, (f) Sandy areas, (g) Streams, Ponds and Marshes.

It is noticeable that these several formations are primarily characterized by their topography, secondarily by their vegetation and lastly by the animals which inhabit them. This is in reverse order of the motility and is to be expected. The topography is practically unchangeable except when considered in a geological sense. The individual plants are stationary, but the species is movable by means of the seeds, runners, etc. In the case of the

animals, both the species and the individual are able to move about, consequently, we would expect the animals to be but partially confined to a given association. The coyote for example may be found in each and every formation mentioned, but we all know that in some, for example, the stream, pond or marsh, its presence only indicates a visit. In the case of animals, the associations in which they breed are considered to be the associations to which they truly belong.

## II. THE ECOLOGICAL FORMATIONS.

### I. The Grass Covered Upland or Steppe.

(a) *The Climatic Conditions* of the steppe are severe. It has consequently been classed as a Xerophytic ecological formation.

*Precipitation.* The rainfall comes sporadically. Sometimes it falls with great violence and is occasionally accompanied by hail. Frequently only slight showers occur. Periods of drought of shorter (a few weeks) or longer (a couple of seasons) duration are expected. Ordinarily, about three-fourths or more of the total rainfall takes place in the five growing months. The dryness of the rest of the year is evident. The relative humidity of the steppe is low.

*Temperature.* The range of temperature is very great, almost 150 degrees Fahr. annually, and frequently 40 degrees daily. The summer months, especially July and August are hot, and the winters cold. The seasons are irregular. Freezes occasionally occur as early as mid-September and as late as May, and frosts as early as early-September and as late as June. During the winter season, especially in January and March, unseasonably warm weather occasionally starts vegetation only to have it damaged by the succeeding cold snap.

*Wind.* Steppes are windy. The velocity is seldom high, but an 8-12 mile breeze is almost constantly blowing especially during the day time. In the summer such winds may be exceedingly hot and may blast the vegetation severely. In the winter the winds are often very cold. When driving dry snow, they are indeed cutting.

*Light.* There is very little protection from the direct rays of the sun for the plants nor for the animals, except those that

burrow. Cloudiness is unusual. Consequently in regard to light, the steppe approaches the desert.

(b) *Some of the more conspicuous plants and animals* of the steppe. The predominant plants are the grasses. Perhaps chief are the grama grass (*Bouteloua\**), buffalo grass (*Buchloe*), wheat grass (*Agropyron*), wire grass (*Aristida*). Tickle grass (*Agrostis*) and blue stem (*Andropogon*), are abundant in the slight draws.

The Composites are certainly entitled to second place. In fact except in the spring they surpass the grasses. The most noteworthy genera are: Blazing Star (*Liatris*), Goldenrod (*Solidago*), Coneflower (*Ratbida*), Golden Aster (*Chrysopsis*), White Aster (*Aster*), Resin or gum-weed (*Grindelia*), Nigger-head (*Brauneria*), Wormwood and Sage (*Artemisia*), Sunflowers (*Helianthus*), Yarrow (*Achillea*), Prairie Pink (*Lycodesmia*), *Sideranthus*, *Erigeron*, *Actinella*.

The Legume family ranks third. It includes some of the most abundant plants of these plains: Leadplant (*Amorpha*), Prairie Clover (*Petalostemon*), Dakota Vetch (*Lotus*), Buffalo bean, Loco, etc. (*Astragalus*), Lupine (*Lupinus*), *Psoralea*; and in the draws the true vetch or wild sweet pea (*Vicia*), (and the *Oxalis*).

Monocots, other than the grasses, are the Wild Onion (*Allium*), Prairie Lily (*Calochortus* and *Leucocrinum*.) There are several crucifers; Shepherd's Purse (*Capsella*), Wall Flower (*Erysimum*), *Lesquerella*, *Sophia*, *Arabis*.

Various sorts of evening primroses are conspicuous because of showy flowers. Genera represented are *Anogra*, *Onagra*, *Gaura* and *Meridolix*. Members of the Chenopodaceous plants (*Chenopodium*, *Eriogonum*, etc.) are plentiful in the more clayey or more sandy portions. Two scrophs (*Orthocarpus* and *Pentstemon*) adorn the plains. Among the many other abundant genera may be mentioned: The roses (*Rosa*), Wild Flax (*Linum*), Milk wort (*Polygala*), *Malvastrum*, *Cogswellia*, Puccoon (*Lithospermum*), *Oreocarya*, Plantain (*Plantago*.)

The steppe grades, in areas of the sandy loam, into the sand-hill formation. The wire-grass association is an intermediate phase between the typical short grass ( Grama and buffalo) and the

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\*For specific names consult "The list of plants collected in this area" beyond.

bunch grass type of vegetation which occupies the rougher areas. Steppe areas covered by the Pierre clay frequently have developed on them the wheat grass association.

Among the mammals conspicuous on the plains are the northern coyote\*, the gray or buffalo wolf, the kit-fox or swift, large weasel or ermine, striped ground-squirrel or gopher, Jack rabbit or prairie hare, pocket gopher. The prairie dog, badger, the large skunk and the spotted or little skunk are found. The grasshopper mouse, the large meadow mouse, the little vole or meadow mouse all occur. A few antelope still remain especially west of Slim Buttes and in a large pasture a couple of miles north of Camp Crook.

The plains birds are especially the following: Western Meadow-lark\*, Desert Horned Lark, Lark Bunting, Chestnut-collared Longspur, Western Vesper Sparrow, Brewer's Blackbird, Marsh and Swainson Hawks, Burrowing Owl, Sennett Night-hawk, Upland Plover, and about the blowouts, the Killdeer.

The rattle snake (*Crotalus\**) and the bull snake (*Pituophis*) are the reptiles commonly found in this association, and they are far from plentiful. Land snails (*Succina\**) are rare and earth worms are lacking here. Grasshoppers of several **genera and many species\***, dung beetles, ants, and robber and bot flies, wasps, and running spiders are a few of the groups of insects which are conspicuous.

(c) *Remarks on the "Adaptations" of the life of the Steppe.*

The adaptations shown by the plants are numerous. The following seem to be the most prominent:

(1) The predominance of perennial herbs of the higher plains.

Though in favorable years annuals are conspicuous, the characteristic vegetation year in and year out is distinctly herbaceous—no larger shrubs and of course no trees. This is contrast to woodland, desert, prairie and most marshes.

(2) Compactness of growth of stalk or of flowers or of both.

This compactness of stalk is illustrated by almost all the plants. No abundant upland species reaches a height, in ordinary

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\*For scientific names of mammals see "the list of mammals found in this area" beyond.

For full scientific names see "the list of the birds," "the list of reptiles," "the list of mollusca" and "the list of insects."

seasons, of much over a foot and practically none reach two feet. The vast majority have most of their bulk within six inches from the surface. The conspicuous place held in the flora by the Compositae points to compactness of flowering parts. Even the grasses, (Grama, buffalo, wheat, etc.) have the spikelets relatively compactly arranged instead of loose as is the case of many prairie and wood land grasses.

(3) Root system specialization :

Since there are, in time of drought, frequently only slight showers which do not soak in, there are many plants, notably the short grasses which have a shallow, wide-spreading root system developed. The buffalo and grama grasses have their roots nearly confined to within a foot from the surface. In contrast to these there are such deep-rooted plants as *Psoralea* which has almost all of its roots at a depth greater than four feet, and in some cases penetrates hard sub-soil as deep as six feet. Certain species notably *Artemisia* and *Gutierrezia* have both well developed lateral roots and rather deep tap-roots. The plants showing storage are chiefly the bush morning glory, the blazing star (*Laciniaria*) and the Indian turnip (*Psoralea*). The cacti are the only ones that store considerable amounts of water above ground.

(4) Prevalence of narrow, small or resin-covered leaves :

Almost all the plants have either small or narrow leaves. The prairie pink (*Lygodesmia*) and *Gutierrezia* are almost leafless. Abundant species with resin are the cone flowers, gum-weed, *Psoralea*, etc.

(5) Wind dispersal including the tumble weed habit :

The "tumble weed habit" is developed chiefly by plants of the wind-swept plains. Several species belong to the different groups such as the Russian thistle (*Salsola pestifer*) a Chenopod; *Psoralea*, a legume; the tumble-weed (*Amaranthus*) a member of the *Amaranthaceae*, have this habit.

(6) A short growing period not closely confined as to season :

The climate of plains is irregular. In some years the vegetation is several weeks ahead of normal and the next year it may be as far behind. Delays in the coming of the rains occasionally cause surprising late flowering. We found flowers of the Pasque flower and of the prairie rose in August, following July rains.

(7) Destruction of exposed parts does not result in death of the individual:

In the case of many trees, shrubs and other plants belonging to other ecological association, the individual is killed by the destruction of the aerial parts. In the case of many steppe plants such destruction is frequent by grazing animals and perhaps in all but the season of greatest growth, by prairie fires. Certain species are killed by too frequent fires (oftener than once in three years for example) or by close pasturing, but the characteristic steppe plants have wonderful resistance in this regard.

(8) Ability to withstand inactivity (forced by drought) for an entire season or even two or three years:

This ability is very essential. After a series of wet years many new immigrants into the steppe flora are noticed. The return of the dry cycle eliminates these species which are only sojourners on the steppe. The characteristic species seem to be uninjured by even prolonged drought. In the summer of 1911 for example, there were localities which for two years had been so dry that no grass at all had started, yet when the unusual rains of September came, everything was green in a few days.

(9) Resistance to unseasonable weather:

The vegetation does not readily start in the spring. However, if after it has started a freeze comes, there is surprisingly slight destruction of the characteristic plants. Early frosts in the fall also affect the native steppe vegetation scarcely at all.

(10) Marked seasonal succession depending on accumulated temperature, water content of the soil, relative humidity, etc.:

The succession of flowers, in an ordinary year is striking. During one month the prairie is tinted by one group of flowers, and during the next month by others, and the succeeding month by still others. In this locality the early bloomers of the plains include *Cymopterus*, *Townsendia*, *Viola*, *Pulsatilla*, *Leucocrinum*. Among those blooming in June are *Pentstemon*, *Allium*, *Zygodenus*, *Astragalus*, *Linum*. In July, *Braunia*, *Ratbida*, *Psoralea*, *Malvastrum*, *Gaura*, *Euphorbia*, etc., are prominent. During August, the *Asters*, *Solidagoes*, *Senecios*, etc., are in their glory. The *Artemisias* are in full bloom early in September.

It has been determined by others that accompanying this progressive activity there is a shifting in the floristic complexion

of the region. Early in the season, the plants are mainly related to eastern or mountain plants. While as the season advances the active or dominant species are successively related to prairies, plain and finally the desert.

(11) Predominance of plain yellow flowers, with many browns.

Although several of the conspicuous flowers are white, several are orange and a few pale blues, there are few reds, deep blues or violets. Scarcely any are streaked or mottled. In the vast majority of the cases the flowers are small in size as compared with those of other plant formations.

(12) Fertilization accomplished chiefly by the aid of the wind.

The *mammals of the plains* have all adopted one or more of the following characteristics:

1. Fleet runners:

Antelope (32 miles an hour), jackrabbit (28 miles in an hour), coyote (24 miles an hour), kit-fox or swift, and gray wolf (20 miles per hour.)\*

2. Burrowers:

Pocket-gophers, striped gophers, badgers, prairie dogs, voles.

3. Acute long-range vision.

4. Gray or tawny in coloration.

5. Ability to do without drinking water.

Water for physiological activity and for cooling by perspiration is mainly secured from the food eaten. Mud about the water holes very seldom indicates that these animals have been drinking there.

6. Daily period of activity chiefly in the early morning, also to a lesser degree in the evening, and at night.

Voluntary activity of every one of the above mentioned mammals is very limited during the heat of the summer day. Most of them are in the shade then. Activity liberates heat which must be eliminated by perspiration which in turn requires precious water.

7. Many hibernate: (The fleet long-distance runners are the exception to this rule).

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\*Quoted from Seton: Life Histories of Northern Animals.



The *birds of plains* possess one or more of the following characteristics:

1. Nests necessarily built on the ground.
2. Many sing on the wing. (Lark Bunting, Longspur, Horned Lark, frequently the Meadowlark, are examples).
3. Songs and calls comparatively loud.
4. Tendency to flock not nearly as prominent as in birds of the woods or water. The winter flocking is largely accidental. They gather to feed where food is exposed by the blowing of the snow.
5. Ability to withstand strong wind. Seed-eaters feed during winter in apparent comfort on hills swept by high winds.
6. Females and nestlings are almost all protectively colored. This seems required by the exposures of the nesting sites.
7. Highly migratory.

But few individuals remain on unbroken plains during winter and these of different species than in summer, except in the case of the Desert Horned Lark. Even this bird migrates somewhat.

8. Ability to withstand the intense heat of the sun.

This is required especially by the nestlings which are often on dark ground.

9. The birds of the steppe must of necessity require but little drinking water. Heavy dews are rare on the plains.

The *reptiles*, of which the rattle snake, bull snake, and the horned lizard are the chief, possess a surprisingly effective protective coloration.

Of the *insects* of the steppe the following points may be made.

1. The period of the day when the greatest activity is evidenced is in the forenoon from 7-11 o'clock. Mating is chiefly indulged in between 11 o'clock and one. During the rest of the twenty-four hours the insects are quiescent except when disturbed.
2. Seasonal activity limited to but three or four months of the year. Almost complete inactivity during six months of the year.
3. Many forms burrow or occupy mammalian burrows.
4. Predominance of hoppers.

## 2. GRASSY FLATS OR TERRACES ALONG THE VALLEYS.

(1) This biologic association is related to the steppe; it also sometimes adjoins the wooded bottoms. Its conditions are similar to those of the steppe, but not so severe. There is no more, and perhaps there is less rainfall, but there is more ground water because of two reasons: (a) The run off from the adjacent elevations. (b) The terraces are lower and consequently nearer the water table of the district.

(2) Some of the conspicuous plants and animals of the grassy flats. Almost all of the plants of the steppe occasionally grow here. Since the wash of the rain brings down the seeds of almost all the steppe plants it is very reasonable that sporadic representatives should occur. The predominant vegetation, however, is somewhat different. There is a much larger percentage of the wheat grass (*Agropyron\**) and decidedly more prickly pears. There are many large patches of the buckbush (*Symphoricarpos*). The wild rose (*Rosa arkansana*) is often associated with these patches. Brome grass (*Bromus*) is frequently prominent and with it the grass-like *Collomia*. Other plants which are usually in evidence are burr tomato (*Solanum*), blue-joint (*Calamagrostis*) wild-rye (*Elymus*), red-top (*Agrostis*). In addition there are several species each of *Atriplex*, *Chenopodium*, *Erigeron*, *Solidago*, *Helianthus* and *Artemisia* most notable of which is the true sage brush and the lanceolate sage. As far as my observation goes there are decidedly fewer flowers than on the steppe. Locally on the the plains and rarely on the steppe are blowouts or "hardpan" spots which have a peculiar flora. The small or fragile prickly pear (*Opuntia fragilis*) here replaces the larger *Opuntia polycantha* of the loam and is sometimes exceedingly plentiful. The grass is chiefly the alkali grass (*Distichlis*). Three flowers which we found only on such spots are *Talinum*, *Suaeda*, *Monolipis*.

The conspicuous mammals making these flats their breeding places are the prairie dog (*Cynomys\**) and in these colonies animals that prey on them, especially the weasel (*Putorius*) and rattlesnakes. The western cotton-tail rabbit (*Lepus*) is often found

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\*For specific names see the technical lists of species which follow this section of "the biology."



Typical Cottonwood Grove near mouth of Rabbit Creek.

on these flats, especially where there is "buck-bush." There also nests the Sharp-tailed Grouse and Western Meadowlark. There are other birds more characteristic of the steppe. Every prairie-dog town has its brood or broods of Burrowing Owls. The smaller rodents, as far as we discovered, were those of the steppe and of the open woods. Perhaps the most striking insect is the large brown and white moth which feeds upon the sage bush. For a few days each summer these "butterflies" are very abundant and conspicuous.

### 3. THE WOODED AREAS

In Harding County there are scattered groves in the Little Missouri Valley especially near Camp Crook. The canyons in the forest reserves are more or less filled with deciduous trees and there is generally a narrow extension along the streams into the plain or steppe. In each of the forest reserves there has been at one time or other a saw mill. The timber cut was chiefly the pine, however.

(a) It seems evident that the conditions for growth of most sorts of plants are much more favorable here than on the plains. The proximity of springs and running streams indicates that the ground water is within the reach of such trees as grow here. These trees partially shade the other vegetation and protect it somewhat from the wind. In the canyons, the walls of rock have the same tendencies. The relative humidity is raised both because of the cooler temperatures, and because the ground being shaded it does not dry so quickly after a shower. The daily range of temperature is less.

(b) *Some characteristic plants and animals:* The chief trees are the Cottonwood (*Populus*), boxelder (*Acer*), Ash (*Fraxinus*) and hackberry (*Celtis*). The Elm (*Ulmus*) is most abundant and largest about the Cave Hills. The Western Yellow Pine (*Pinus*) and Aspen (*Populus*) are locally abundant on the sides of the canyons in the forest reserves, and found to some extent among the deciduous trees in the ravines. Among the larger shrubs are the plum (*Prunus*), chokecherry (*Prunus*), buffalo berry (*Lepargyrea*), dogwood (*Cornus*), Currants and gooseberries (*Ribes*), buck bush (*Symphoricarpos*), Roses (*Rosa*). In the ravines additional shrubs are the hawthorne (*Crataegus*) Service-berry (*Amelanchier*) and blackhaw (*Viburnum*). The western poison

ivy (*Rhus*) is widely represented. Of the twining plants the chief are smilax (*Nemexia*) clemantine (*Clematis*) and in the ravines, hop (*Humulus*), bittersweet (*Celastris*) and Virginia Creeper (*Parthenocissus*).

The most characteristic grasses of the open woods are the wild rye (*Elymus*) and brome (*Bromus*) with squirrel-tail (*Hordeum*) and red-top (*Poa*) locally conspicuous. Among the herbs chief are the horse mint (*Monarda*), thistle (*Carduus*), false-solomon-seal (*Smilacina*), Disporum, golden-rods (*Solidago*). In the ravines the following are in evidence: Geum, snake-root (*Sanicula*), loose-strife (*Stieronema*), nettle (*Urtica*), and on the shaded north facing banks the wintergreen (*Pyrola*), twinflower (*Linnea*), brittle fern (*Filix*), strawberries (*Fragaria*), and three-flowered-bedstraw (*Galium*).

The most numerous birds of the groves are: Western Mourning Dove, Downy and Redheaded Woodpeckers, the Flickers, Kingbird, Alder Flycatcher, Magpie, Sparrow Hawk, Cross bill, Goldfinch, Western Lark Sparrow, Arctic Towhee, Black headed Grosbeak, White-rumped Shrike, Yellow Warbler, Long-tailed Chat and Brown thrasher.

Among the mammals the more conspicuous are the cottontail (*Lepus*) the chipmunk (*Eutamias*), the porcupine (*Erethizon*), the skunks (*Mephitis* and *Spilogale*), big brown bat (*Eptesicus*), red bat (*Lasiurus*), the pack rat (*Neotoma*), the raccoon (*Procyon*), Kangaroo or jumping Mouse or rat (*Zapus*) etc. The Canada Lynx (*Lynx*) has been occasionally trapped in the forest reserves, and puma (*Felis*) are reported to have strayed into this country within the past decade. The Whitetailed Deer (*Odocoileus*) is not yet quite exterminated.

(c) The vegetation of the woods averages infinitely more bulky than does that of the grass lands. The trees of the open groves of this area all have a well developed tap root system. The dispersal of the seeds of the trees is left to the wind to accomplish. Almost all the shrubs bear fruits which are edible to the birds which therefore distribute them.

The birds, instead of being runners or walkers as those of the plains are mainly hoppers or creepers. Most of the nests are placed in the trees or shrubs. Several indeed, nest in holes in the

trees. There are numerous other characteristics of woodland birds.

#### 4. THE BUTTES—PARTLY PINE COVERED.

The buttes of the forest reserve are all "flat" topped. The west member of the Cave Hills is called Table Mountain, because it is so level. The margins at least of the tables are rocky.

(a) *Conditions*: The buttes are more exposed to the winds. Because of the increased elevation and wind they are cooler than the steppe. In fact, excessively warm temperatures are nearly lacking. Occasionally, when the clouds hang low, the buttes receive more precipitation, in the form of mist than do the lower elevations.

(b) The most conspicuous plant is the western red or yellow pine (*Pinus*). The distribution of the pine is rather peculiar. It grows most generally on the slopes, especially the north facing ones, near the tops of the buttes. Locally it extends well down to the base, or even beyond onto the plain (in the case of a valley which heads in the southwestern part of the East Short Pines). Consequently it is not elevation alone that limits their growth. Neither is it slope alone for pines are found on the level top of the West Short Pines and elsewhere, but near slopes. The more probable explanation of the distribution is that pine seedlings can with great difficulty resist the climatic conditions except where protected by the slope or shaded by other pines which when they were young were so protected. The occasional pine on the level and not shaded by a pine which is on a slope is perhaps due to unusually favorable conditions such as being buried in a gopher hole. If slopes are here favorable to the growth of pine trees the question may naturally be asked why pines are not found on hillsides throughout the area. Four factors doubtless combine to bring about this result. (1) The absence of seeds from which pine might grow. The cones of seeds washed down from the buttes are carried along the channels of the ravines and not deposited on the favorable slopes. The occasional cone favorably dropt as to slope may be prevented from starting a tree by (2) the thick cover of grass or by (3) prairie fires or by (4) the slope being so rapidly eroded as to undermine the seedling. One or more of the reasons is the cause for the lack of pines about the numerous small rocky buttes of this region. The forest service

holds that if pines were carefully set out and protected from fire, each moderately steep north-facing slope could be forested. The absence of pine on Table Mountain is probably due to the lack of proper lodgment for the seed here.

The Western Red Cedar (*Juniperus*) forms thickets on some of the slopes in this general area though to no great extent in Harding County. There are cedar thickets in the forest reserve of the East Short Pines; also in "brakes" or badlands along the Little Missouri river, near the southern edge of North Dakota. The most extensive thickets are in some of the gulches on the divide south of the Moreau river in southern Perkins County. Short sighted indeed was the policy that permitted the destruction of these valuable groves while the land was still owned by the government. However, quarter sections for miles about are well fenced.

A third tree found about buttes is the quaking aspen (*Populus*.) Thickets are numerous on the talus slopes at the foot of cliffs especially north or east facing cliffs.

Among the shrubs the more abundant are the dwarf and creeping junipers (*Juniperus*), skunk bush (*Rhus*) and sandcherry (*Prunus*). The chief grass is the bunch grass (*Andropogon*). The Spanish bayonet (*Yucca*) is common, as are also various "locos" (*Aragallus* and *Astragalus*). Other plants are *Sieversia*, *Gilia*, *Phacelia* *Phlox*, *Cerastium*, Northern bedstraw (*Galium*), small sage (*Artemesia*), blue-bell or hare-bell (*Campanula*), *Ereogonium*, *Antenaria*, *Potentilla*, Yarrow (*Achillea*) and the fern *Woodsia*.

The grassy portions of the tables are covered with the plants of the plain, but the growth is more dense; in fact the tables are quite extensively mowed for hay.

The birds most often seen about the buttes in the pine woods are Hairy Woodpecker, Sharp-tailed Grouse, Pinyon Jay, White-winged Junco, Arctic Towhee, Western Tanager, Cedar Waxwing, Audubon's Warbler, Western House Wren, Long-tailed Chickadee, Western Robin and Mountain Bluebird. Several others nest about the cliffs, including Prairie Falcon, Western Redtailed Hawk, Golden Eagle, Western Horned Owl, Say's Phoebe, Rock Wren and White-Throated Swift, Turkey Buzzards roost in the pines. I have seen as many as twenty in one tree in the Slim Buttes.

The mammal most frequently seen is the chipmunk (*Eutamias*). Mounds of the pocket gopher (*Thomomys*), are plentiful; signs of the gnawing of porcupines are seen on many young pine trees. In the various small caves of Cave Hills many pack rats (*Neotoma*) and bats (*Corynorhinus*) make their homes.

### 5. BADLANDS

The badland areas include a large percentage of those marked as "rough land" on the general and soil maps of this area. The finest badland areas are near Reva Gap in the Slim Buttes and on the northeast side of the East Short Pines, and along the "jump off" but many small areas occur (see general map). The common custom is to call any area having slopes nearly bare of soil and vegetation "badlands."

(a) Conditions: In regard to precipitation these areas doubtless fare approximately as does the adjacent plain. Their average temperature is probably somewhat greater, as is also the intensity of light, at least in badlands in the light colored formations. The relative absence of vegetation is seemingly due to two factors (1) because of the steep slopes with its consequent rapid run off, as well as the somewhat peculiar nature of the clay of most of the badlands, water is not absorbed to any great extent. Hence any vegetation which starts has an insufficient supply. The other factor is that the rapid erosion undercuts and soon destroys a considerable proportion of the seedlings which obtain a start. Consequently most of the vegetation of badland areas is at the foot of the steeper slopes, in the valleys.

(b) *Some conspicuous plants and animals* of the badland areas are: The rabbit bush (*Chrysothamnus\**), *Gutierrezia*, Golden Aster (*Chrysopsis*), False boneset (*Kuhnia*), *Mentzelia*, *Senecio*, *Machaeranthera*, *Thermopsis*, *Chenopodium Watsoni*, Saltbush (*Atriplex*), the gumbo lily (*Pachlophus*), and several sages (*Artemesia*). Occasionally forming thickets: the buffalo berry (*Shepherdia*) and the cedar (*Juniperus*).

Birds that may be expected to be found nesting in Harding County badlands are the Rock Wren, Say's Phoebe, Prairie Falcon, and Cliff Swallows. Western Horned Owls and White

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For full scientific names see technical lists which follow the Ecological Section.



Throated Swifts were noted as nesting in the badlands in the White River formation (Slim Buttes and E. Short Pines). The only common mammal is the pale chipmunk (*Eutamias*). Bobcats are fairly plentiful. Formerly blacktailed mule deer and bighorn sheep could be found in the larger badland areas.

(c) The badland life displays several peculiarities: The plants are mainly long-lived, perennial, chiefly compositiaceous, shrubs possessing powerful tap and anchor roots and narrow and pubescent leaves. All shrubs offer great resistance to erosion, under-cutting and slumping. They are also conservative, late flowering, and present to cattle very little edible stuff. Practically every species has yellow flowers. In addition to these perennials there are various annuals which thrive during moist seasons on the moister alluvial flats.

The animals are uniformly grayish in coloration with the exception of the bat and swifts. The crevices and cavelets furnish homes for the chipmunk, bat, bob cat, Say's Phoebe, Prairie Falcon, Rock Wren, etc. The Cliff Swallow and White-throated Swift find the cliffs suitable for nesting sites. Several of the mammals are notable jumpers (Bighorn sheep and mule or black-tailed deer).

## 6. SANDY AREAS

In this region most of the sand is found in areas covered by Morton Sandy Loam which covers a considerable portion of central and southeastern Harding County and northwestern Perkins County. (See soil map). Sandhills or dunes are most extensively developed locally southeast of Buffalo in central Harding county. Here and there along the river valleys sandy stretches occur and then in small areas sand is heaped into dunes.

(a) *Conditions*: Though there is no more rainfall in the sand-hills than in the surrounding associations there usually is, except for small bare batches, much more vegetation. This is due to the fact that the sand at once absorbs any rainfall. For a short time after showers the evaporation is very rapid and if this were to continue long this absorbed moisture would soon disappear. However, evaporation from the surface layers of the wet sand soon becomes more rapid than water can be supplied from below by capillary action. Consequently the capillary tubes become broken and evaporation stops long before any considerable amount

of the recent precipitation has disappeared. *Relative humidity*—As low as that of the steppe. *Temperature*—Above the average for this area. *Light*—intensity considerable, but many small areas shaded. *Wind*—Except in the protected depressions, average velocity and hot.

(b) *Abundant plants in sand areas*: The chief grass is the sand grass (*Calamovilfa*), the needle grass (*Stipa*) is very plentiful especially on the more loamy sandy soil, the bunch grass (*Andropogon*) occurs in the rougher areas. The sand wormweed (*Ambrosia*), the bee plant (*Cleome*), Clammy weed (*Polanisia*), annual erogonum (*Eriogonum*), and wormwood sage (*Artemesia*) and lupine (*Lupinus*) are perhaps generally the most conspicuous plants. Other abundant plants are *Abronia*, *Allionia*, *Franseria*, the brome rape (*Orobanche*), the groundcherry (*Physalis*) spiderwort (*Tradescantia*) and spurge (*Euphorbia*). The most common shrub is the wild rose (*Rosa*).

We found no birds or mammals characteristic of the sand areas here. Because of the small extent of the sandhills such would hardly be expected to be found.

(c) *Characteristics of sandhill vegetation*. With few exceptions the plants which grow on sandy soil have long tap roots—much longer than even very closely related plants which grow on firmer soils. Plants with long tap roots would probably be less likely to be killed by exposure caused by the drifting of the sand than would those with short roots. The vegetation is decidedly coarser than that of the steppe. Coarse plants would be less apt to be covered by drifting sand. Blowing sand undoubtedly prevents plants unable to resist it from becoming abundant. Possibly the secretion of oil from the leaves of various plants such as the clammy weed, *Abronia*, *Orobanche*, may be a method of resisting abrasion.

## 7. STREAMS, PONDS AND MARSHES

The chief permanent streams are the Little Missouri river, the north and south forks of the Grand river and the north fork of the Moreau river. Most of the creeks are but a string of waterholes connected except during rains only by seepage flows. The ponds are of two sorts (a) waterholes along the creeks and (b) "blow outs" most of which contain water only during wet spells. Marshes are very restricted. We found small ones at a

few points along brooks in the forest reserves. The largest are in the North Cave Hills. Boggy spots occur about springs in a few other places.

*A few characteristic aquatic plants and animals:* The rivers flow swiftly and are subject to frequent floods. Submerged plants, other than algae are practically lacking. For a list of the plants found on moist shores see the next two heads. The chief animals are "clam" (Anodonta) and a snail (Sphaerium), several fish of which the following were collected: bullhead (Ameiurus), catfish (Ictalurus), buffalo-fish (Ictiobus), sucker (Catostomus), Dace (Phoxinus), Shiner or minnows (Notropis)—and various insect larva. The houses of Caddice flies are abundant on the submerged rocks. Some of the birds frequently seen along the rivers are the spotted and solitary sandpipers, killdeer, the kingfisher, the herons and various ducks. Among the mammals muskrats and beaver are the most plentiful—mink and otter occur.

The ponds differ chiefly in their permanency as in this limited area "alkali" ponds are nearly lacking. The more permanent waterholes have an abundance of snails of several species and three genera (Lymnea, Planorbis and Physa), numerous insects (water beetles, water boatman, water striders, back swimmers, dragonfly and other immature stages of insects, etc.); crustacea are locally very plentiful. In the larger waterholes along streams suckers and minnows at least, among the fish, are found. Turtles and garter snakes represent the reptiles, and frogs the amphibians. Muskrats are the most abundant mammal. Killdeer and ducks are the chief birds. About the blowouts and other shallow ponds waders (sandpipers, etc.) are usually seen in migration. Killdeer nest near them. Submerged in waterholes we found the water butter cup (Batrachium), False Water Cress (Roripa), Pond weed (Potomagetan) and Chara. On the moist soil bordering waterholes are various marsh plants such as Arrowgrass (Trigloclim), Water Plantain (Alisma) Arrowhead (Sagittaria) Cord Grass (Spartina), Sedge (Carex), Rushes (Scirpus, Juncus), Spike rush (Eleocharis), buttercup (Ranunculus) and Halerpestes, Mint (Mentha), Hyssop (Gratiola) Beggar's tick (Bidens), Water hoar hound (Lycopus), waterhemlock (Cicuta) Willowherb (Epilobum), and the smartweed (Polygonum), and dock (Rumex).

The *marshes* even though small have an abundant flora including many most of the above mentioned genera of marsh plants and in addition the cattail (*Typha*) the mat grass (*Catabrosa*), canary grass (*Phalaris*), and many less common species. The most characteristic birds noted were the redwing blackbird and the two rails. The aquatic life is in the main similar to that of the ponds; along the brooks in the forest reserve, however, the darter (*Boleosoma*) and brook trout (*Salvelinus*) were seen, the latter especially in Slick Creek. The fresh water shrimp (*Gammarus*) is exceedingly abundant about some springs and brooks. Orchids (*Limmochis*) is one of the semi-aquatic plants noted only along brooks.

(c) *Characteristics of Aquatic Life.*

Plants and Animals found in marshes and other aquatic associations have characteristics which if they were less frequently exhibited would be quite striking.

The plants are chiefly aquatic or semi-aquatic herbs, many of which are biennials or short-lived perennials. Ordinarily there is an abundance of available water and transpiration can be freely indulged in; occasionally, however, the swamps go partially dry. The plants which are most successful in a region where they frequently occur, are those which can resist such dryings. The fertilization is largely by the agency of insects and the seed distribution by water and animals as well as by wind. The tick marigold (*Bidens*) is obviously adapted for animal distribution. Many, if not most, marsh plants also propagate by root runners.

The *mammals* are all semi-aquatic and rear their young either in burrows above the water table or in houses. The muskrat and beaver are examples.

The *birds* nest in reed hung or floating nests. The females and nestlings are, in almost every case, grass-colored for protection. Most species are swimmers or waders. Their bills are chiefly sharp and adapted to impaling, or are adapted to probing, or are supplied with strainers.

Almost all the *insects* characteristic of marshes spend a portion of their life as aquatic forms. Examples are mosquitos, dragon-flies, damsel-flies, may-flies, water beetles, water boatmen, etc.

### III. LIST OF PLANTS OF HARDING COUNTY, NORTH-WESTERN SOUTH DAKOTA.\*

Collected by S. S. Visher, determined by Aven Nelson.

#### 1. OPHIOGLOSSACEAE (Adder's-tongue Family)

1. *Botrychium virginianum* (L.) Sw.

Rare in the forested buttes.

#### 2. POLYPODIACEAE (Fern Family)

2. *Dryopteris Filix-mas* (L.) Schott. Shield Fern.

Rare in deep narrow gorge, Cave Hills.

3. *Filix fragilis* (L.) Underw. Brittle Fern.

Fairly abundant in deep shady ravines.

4. *Pellaea atropurpurea* (L.) Link.? Cliff Brake.

Rare in crevices in rocks, Lodge Pole Butte.

5. *Woodsia scopulina* (DC) Eat.

Abundant, growing in tufts on exposed rocks about the buttes.

#### 3. MARSILEACEAE

- \*6. *Marsilia mucronata* R. Br. "Four-leaved-clover."

Very abundant in waterholes, especially conspicuous after these holes go dry.

7. *Marsilia vestita*. Hook & Grev.

Abundant on muddy bottoms if intermittent creeks.

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\*The plants were collected, chiefly during July, August and the first week of September, 1910 and 1912. During June, 1911, most of the country was visited and some 90 numbers obtained. W. H. Over, formerly of Date, collected 16 additional species June 1-15, and a small collection by B. B. Rowley of the 1909 survey party adds 18 species. In addition 29 species are inserted, bracketted, in the list. F. D. Fromme collected about 200 species during the summer of 1910 and identified them, chiefly by manuals, the following winter. Of these 200 some 29 are additions to my list of plants as identified by Nelson. Over one hundred and fifty of the following 467 species are not seemingly mentioned in any way in Saunder's Catalog; and about one hundred and twenty, marked with an asterisk, are added to the total known flora of South Dakota by these collections.

A bibliography of the Flora of South Dakota flora.

- (1) Rydberg P. H. Flora of the Black Hills, Contrib. U. S. Nat. Herb. 3:463-536.
- (2) Flora of South Dakota, Bull 64, U. S. Experiment Station, Brookings, S. D. 1899.
- (3) S. S. Visher additions to the Flora of the Black Hills, I. Torreyia IX, pp. 186-188 1909, 9 additions.  
II. Muhlenbergia VIII 12, pp. 135-7 1912, 13 additions.  
III. Muhlenbergia IX 1, pp. 33-39 1913, 31 additions.
- (4) S. S. Visher Plants of the Pine Ridge Reservation Bull 5 S. D. Geol. and Biol. Survey, pp 84-108, 1912, 96 Additions.
- (5) S. S. Visher "Additions to the Flora of S. D." I. Muhlenbergia p. 45-52, 1913. A revised list of the additions to the state based on the Pine Ridge collections. Also includes two species of Carex, not in Bull. 5.

## 4. EQUISETACEAE (Horsetail Family)

8. *Equisetum arvense* L.  
Locally abundant in moist wooded gulches, Cave Hills.  
Common along Little Missouri River near Willett.
9. *Equisetum laevigatum* A. Br. ff  
Tolerably common on flood plains, and valley of buttes.
10. *Equisetum robustum* A. Br.  
Rare on springy ground, East Short Pine Hills.

## 5. SELAGINELLACEAE

- \*11. *Selaginella densa* Rydb. Resurrection Plant.  
Very abundant locally on the dry soil of the plains.

## 6. PINACEAE (Pine Family)

12. *Juniperus communis Siberica* (Burgsd) Rydb. Creeping Juniper.  
Abundant, especially in the shady woods. Frequent on the exposed surfaces of the tables.
- \*13. *Juniperus sabina* L.  
Very abundant on high grassy slopes especially on the sides of the buttes.
14. *Juniperus scopulorum* Sarg. Red Cedar.  
Forms extensive "Cedar brakes" along the Little Missouri River near the N. D. line, and occurs sparingly in the Slim buttes and somewhat abundantly in the E. Short Pines. Cedar apples (*gymnosporangium Nelsonii*. Arth.) is common.
15. *Pinus scopulorum* Sarg. Western Yellow or Bull Pine.  
Abundant on the higher slopes of the forested buttes. Attain the diameter of three feet. Saw mills have been located in each of the buttes.

## ANGIOSPERMS

## 7. Typhaceae (Cattail Family)

16. *Typha latifolia* L.  
Abundant about artificial ponds, and marshes caused by slumping in the forest reserves.

## 8. NAIADACEAE (Pondweed Family)

17. *Potamogeton* Sp. Pondweed.  
Abundant, submerged, in some of the ponds of the creeks.

## 9. JUNCAGINACEAE (Arrow-grass Family)

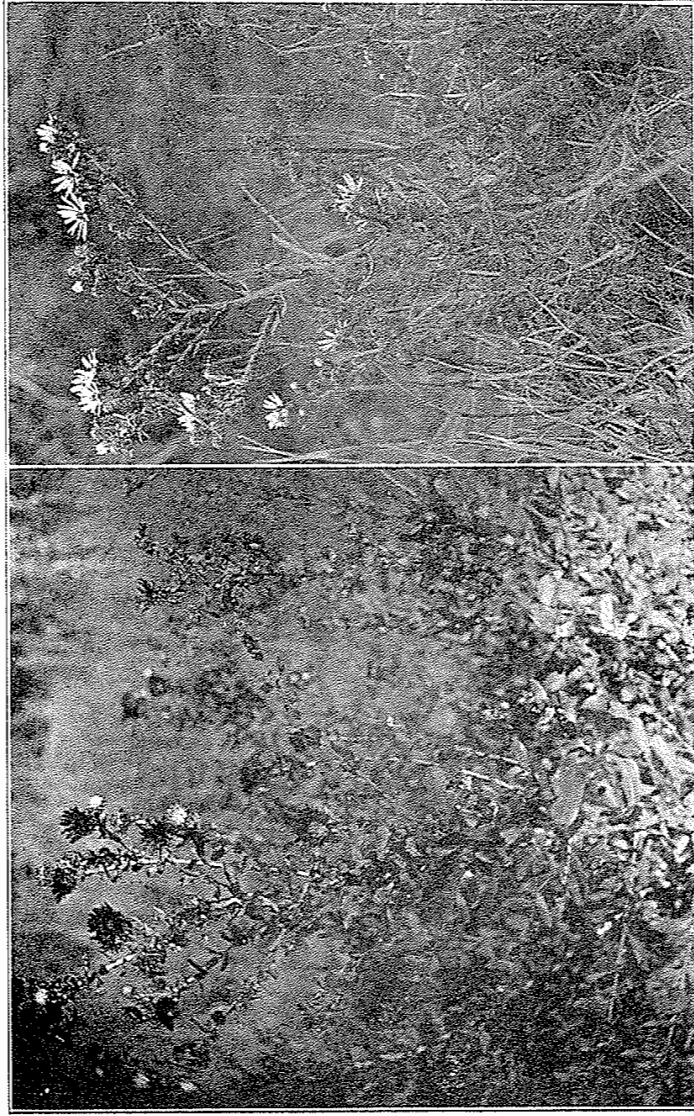
17. *Triglochin maritima* L. Arrow-grass.  
Abundant along some of the permanent streams.

## 10. ALISMACEAE (Water Plantain Family)

19. *Alisma Plantago-aquatica* L. Water Plantain.  
Very abundant on mud along all streams.
20. *Sagittaria arifolia* (Nutt) J. G. Smith. Arrowhead.  
Abundant along streams throughout.
- \*21. *Sagittaria cuneata* Sheld.  
Fairly common on the smaller water courses.

## 11. GRAMINEAE (Grass Family)

22. *Agropyron caninum* (L) Beauv. Awned Wheat Grass.  
Rare, floodplain of north Moreau River; abundant in ravines of Slim Buttes.
- \*23. *Agropyron dasystachyum* (Hook) Scribn.  
Common in draws on the steppe.  
[*Agropyron pseudorepens* Scrib. & Smith.  
Determined by Fromme. "Practically equals *A. tenerum*," Gray's Manual.]  
[*Agropyron Smithii* Rydb.  
Reported by Fromme.]
24. *Agropyron tenerum* Vasey. Slender Wheat Grass.  
Very common along valleys and draws throughout.
25. *Agrostis hiemalis* (Wats.) B. S. P. Tickle Grass.  
A very abundant grass; mixed with other grasses on the plains and floodplains, especially prominent in the bluestem-filled draws. Has "the tumble-weed habit."
26. *Alopecurus fulous* Smith.  
Shaded brooksides, West Short Pines.
- \*27. *Alopecurus pratensis* L.  
Locally common on the steppe.
28. *Andropogon furcatus* Muhl. Bluestem.  
Common on grassy hillsides and in draws of the steppe.  
(Indicates moister conditions.)
30. *Andropogon Hallii*. Hack.  
Common on sandy part of floodplains and about Cave Hills.
31. *Andropogon scoparius* Michx. Little Bluestem.  
Fairly plentiful on the plains.



Abundant composites of the grassy plains.

Resin-weed (*Grindelia squarrosa*).

*Aster hebecladus*.



- 32 *Aristida longisteda* Steud. Bunch Grass.  
Frequent on gravelly foothills of the buttes; occasional on the hill-sides of the rougher parts of the plains.
- 33 *Atheropogon curtispindula* (Michx.) Fourn. Tall Grama Grass.  
Rare, on gravelly foothills of all the higher buttes.
- 34 *Beckmannia erucaeformis* (L.) Hast.  
Locally common in open woods of Little Missouri Valley.
- 35 *Bouteloua oligostachya* (Nutt.) Torr. Grama Grass.  
Very abundant on the steppe throughout. Grows in vague patches usually with buffalo grass.  
[*Bromus altissimus* Bursh.  
Reported by Fromme.]
- 36 *Bromus cinatus* L. Fringed Brome.  
Abundant in ravines in woods of Slim Buttes.
- \*37 *Bromus inermis* Lyss.  
Locally common in open woods of the Little Missouri Valley.  
[*Bromus purgans* L. Brome Grass.  
Collected by Fromme.]
- 38 *Buchloe dactyloides* (Nutt.) Englm. Buffalo Grass.  
With the grama grass but more restricted to mesas and the higher steppe.
- \*39 *Calamagrostis hyperborca* Lange. Reed Grass.  
Frequent along streams.
- 40 *Calamovilfa longifolia* (Hook.) Hock. Sand Grass.  
Abundant on sandy soil. On the steppe it occurs in patches usually a rod or two across. Such clumps apparently start about a large burrow where the soil is more porous and spread by means of root propagation.
- 41 *Catabrosa aquatica* (L.) Beauv.  
Forming great mats in sluggish portions of the brooks in the buttes.
- \*42. *Chaetochloa viridis* (L.) Scrib. Green Foxtail.  
Infrequent. Found in grassy depressions.
43. *Distichlis spicata* (L.) Greene. Alkali Grass.  
Very plentiful in alkali spots along valleys.
- 44 *Echinochloa crus-galli* (L.) Beauv.  
Frequent along water courses.
- 45 *Elymus canadensis* L.  
Common along streams.

[*Elymus glaucus* Buckley. Smooth Wild Rye.  
Reported by Fromme.]

46 *Elymus Macounii* Vasey.

Locally abundant on Antelope Creek and in open woods in Little Missouri Valley. (Extends range from little Minnesota Valley)

[*Elymus striatus* Willd.  
Taken by Fromme.]

[*Elymus virginicus* L. Virginia Wild Rye.  
Recorded by Fromme.]

47 *Ericoma cuspidata* Nutt.

Common along floodplains and other valleys throughout.

[*Festuca ovina* L. Sheep's Fescue Grass.  
Collected by Fromme.]

\*48 *Festuca rubra* L.

Rare on the steppe.

49 *Glyceria nervata* (Willd.) Trin.

Common on springy soil in the forest reserves.

50 *Hordeum jubatum* L. Squirrel tail.

Frequent in open woods of Little Missouri and occasionally in wet spots on the plains.

\*51 *Hordeum nodosum* L.

On open clay banks.

52 *Koeleria cristata* (L.) Pers. June Grass.

Abundant in the bunch grass association about buttes.

53 *Muhlenbergia racemosa* (Michx.) B. S. P.

Common along brooks in the Slim Buttes.

54 *Panicum capillare* L.

Frequent in moist soil of Little Missouri and other valleys

55 *Panicum virgatum* L.

Locally common on floodplains.

56 *Phalaris arundinacea* L.

Very abundant on open springy ground in the buttes.

57 *Phleum pratense* L.

Common along brooks well up in Slim Buttes.

\*58 *Poa epilis* Scribn.

Rare in the West Short Pines.

- \*59 *Poa interior* Rybd. Meadow Grass.  
Rare, shady valley elevation 3,600 ft. in Slim Buttes Forest Reserve.
- \*60 *Poa laevigata* Scribn.  
In shady valleys in Slim Buttes, abundant.
- 61 *Poa nervosa* (Hook.) Vasey.  
Rare in shaded valleys in the Slim Buttes.  
[*Poa triflora* Gilib. Fowl Meadow Grass.  
Reported by Fromme.]
- \*62 *Poa Sheldonii* Vasey. Western Blue Grass.  
With *P. interior*; also collected by Fromme.
- 63 *Puccinellia airoides* (Nutt) Wats & Coult.  
Frequent about the ravines of buttes and on wet soil.
- 64 *Schedonnardus paniculatus* (Nutt.) Trel.  
Occasional in grasslands.
- 65 *Spartina gracilis* Trin. Cord, Slough or Marsh grass.  
Abundant on well-drained soils near water throughout the county. Flowers grade from red to white in color.
- 68 *Sporobolus asperifolius* Thurber. Dropseed Grass.  
Rare on the steppe. Collected by Fromme also.
- 67 *Sporobolus brevifolius* (Nutt.) Scribn.  
Infrequently widely scattered. Grows in clumps along cut banks.
- 68 *Stipa comata* Trin. & Rupr. Needle, Spear or Devil's Grass.  
Predominant in certain areas especially those where the soil is somewhat sandy; also those sections which have been over pastured by sheep.

## 12. CYPERACEAE (Sedge Family)

- \*69 *Carex abbreviata* Prescott.  
Rare in West Short Pines.
- 70 *Carex aurea* Nutt.  
Rare on springy ground at low altitudes about the buttes.
- \*71 *Carex deflexa* Farwellii Brit.?  
Common in mesophytic gullies in the Cave Hills.
- 72 *Carex festucacea* Willd.  
Infrequent along the Little Missouri and streams in the Short Pines.
- 73 *Carex gravida* Bailey.  
Rare in Moreau Valley.

- \*74 *Carex Hookeriana* Dewey?  
Rare, floodplains of Boxelder Creek.
- 75 *Carex lanuginosa* Michx.  
Abundant along some of the forest reserve brooks.
- 76 *Carex longirostris* Torr.  
Rare, in the West Short Pines.
- \*77 *Carex monile* Tuckerm.  
Tolerably common along brooks in Slim Buttes.
- 78 *Carex Sartwellii* Dew.  
Frequent in moist soil along Little Missouri River and on spring soil in the Short Pines.
- 79 *Carex siccata* Drew.  
Common in tall grass of bluestem swales.
- \*80 *Carex vesicaria* L.  
Very frequent on the margins of the permanent streams of the higher buttes, and along the rivers.
- 81 *Cyperus inflexus* Muhl.  
Locally abundant in blowouts between Zeona and Govert.
- 82 *Eleocharis acicularis* (L.) R. & S.  
Common on moist ground bordering rather permanent bodies of water.
- 83 *Eleocharis palustris* (L.) R. & S.  
Tolerably common on springy soil along the Little Missouri River.
- 84 *Scirpus americanus* Pers.  
Along streams and ponds. Probably the most abundant rush of the area.
- 85 *Scirpus atrovirens* Muhl.  
Fairly common along streams of foothills and steppe.
- 86 *Scirpus lacustus* L.  
Common on marshy ground.
- 87 *Scirpus campestris* Brit?  
Tolerably common about water.
13. LEMNACEAE (Duckweed Family)
- 88 *Lemna minor* L. Duckweed.  
Covering small stagnant ponds in the East and West Short Pine Hills.

## 14. COMMELINACEAE (Spiderwort Family)

- 89 *Tradescantia occidentalis* Brit. Spiderwort  
Occasional on the moister parts of the plains and along the floodplains.

## 15. JUNCACEAE (Rush Family)

- 90 *Juncus balticus* Willd.  
Found about an artificial pond near Ashcroft.
- 91 *Juncus longistylis* Torr.  
Common along the larger streams.
- 92 *Juncus nodosus* L.  
Frequent along shady brooks in the West Short Pines.
93. *Juncus tenuis* Willd.  
With *J. longistylis*, less frequent.
- 94 *Juncus Torreyi* Coville.  
Very plentiful along streams and also about slight undrained depressions of the steppe.

## 16. LILIACEA (Lily Family)

- 95 *Allium reticulatum* Fraser. Onion.  
Very abundant and widespread.
- \*96 *Allium rubrum* Osth? Wild Onion.  
Abundant on the steppe.
- 97 *Asparagus officinalis* L.  
Escaped from cultivation and locally fairly frequent in moist draws near Ashcroft.
- 98 *Calochortus Nuttallii* T. & G.  
Very abundant in the bunch grass of rough land. Valley side of foothills are showy with their flowers early in June.
- 99 *Fritillaria atropurpurea* Nutt.  
Quite general on the foothills of the buttes.
- 100 *Leucocrinum montanum* Nutt.  
Plentiful on the prairie.
- 101 *Yucca glauca* Nutt.  
Abundant on the dry rocky slopes of the buttes, especially near the top.

## 17. MELANTHACEAE (Bunch-Flower Family)

- \*102 *Zygadenus intermedius* Rydb. "Death Camass."  
Especially plentiful in bunch grass association of rough land.

## 18. CONVALLARIACEAE (Lily-of-the-Valley Family)

- 103 *Disporum traychycarpum* (Wats.) B. & H.  
Fairly numerous on shady slopes of Cave Hills and other forested buttes.
- 104 *Smilacina stellata* (L.) Desf.  
Common in and about open woods.

## 19. SMILACEAE (Smilax Family)

- 105 *Nemexia herbacea* (L.) Small.  
Abundant in open deciduous woods of buttes and valleys.

## 20. IRIDACEAE (Iris Family)

- 106 *Sisyrinchium angustifolium* Miller. Blue-eyed Grass.  
Not common in draws on the plains.

## 21. ORCHIDACEAE (Orchid Family)

- \*107 *Linnorchis sparsiflora* (Wats) Rydb.  
Common along the brooks of the Short Pines.
- 108 *Linnorchis viridiflora* (Cham.) Rydb.  
Not uncommon in marshy spots in the shady wooded gulches of the West Short Pine Hills.

## 22. SALICACEAE (Willow Family)

- 109 *Populus angustifolia* James. Narrow-leaved Poplar.  
Rare, along Soft Water Creek, near Redig.
- 110 *Populus occidentalis* (Rydb.) Brit. Cottonwood.  
The cottonwood is the most widely distributed tree of this section of the state. It occurs either singly or in groves along all the larger streams, a diameter of over three feet is occasionally attained.
- 111 *Populus tremuloides* Michx. Quaking Aspen.  
Aspen thickets occur on talus slopes at the foot of cliffs and locally in the box canyons of the forested buttes.
- 112 *Salix amygdaloides* Anders. Large Willow.  
Frequent along the streams throughout.
- 113 *Salix Bebbiana* Sarg.  
Found at widely scattered localities.
- \*114 *Salix Fendleriana* Anders. Bunch Willow.  
Common on boggy soil in the Forest Reserves and also the Little Missouri River.

- 115 *Salix fluviatilis* Nutt.  
Locally abundant on the Little Missouri floodplain; also in the Short Pines.
- 116 *Salix Scouleriana* Barr. Red Willow.  
In gulches in the several forested buttes.

## 23. BETULACEAE (Birch Family)

- 117 *Betula papyrifera* Marsh.  
Frequent in the valleys of the West Short Pine Hills.
- \*118 *Betula fontinalis* Sarg.  
Found only once, about bog in the North Cave Hills.

## 24. ULMACEAE (Elm Family)

- 119 *Ulmus fulva* Michx. Red or Slippery Elm.  
Rare, found sparingly in canyons of the Forest Reserves.  
Trees of a fair size seen only in South Cave Hills.

## 25. MORACEAE (Mulberry Family)

- 120 *Humulus lupulus* L. Hop.  
Frequently met with in the ash thickets in gulches of forested buttes.

## 26. URTICACEAE (Nettle Family)

- 121 *Urtica gracilis* Art. Nettle.  
Fairly common on moist ground in the Slim Buttes and elsewhere in high open valleys.

## 27. SANTALACEAE (Sandalwood Family)

- 122 *Comandra pallida* A. DC. Bastard Toadflax.  
Tolerably frequent on foothills of buttes, especially on sandy slopes.

## 28. POLYGONACEAE (Buckwheat Family)

- 123 *Eriogonum annuum* Nutt.  
Abundant on the steppe. In flower as late as Aug. 25.
- \*124 *Eriogonum cernuum* Nutt.  
Abundant in caverns in the Cave Hills.
- 125 *Eriogonum crassifolium* Benth.  
Common on sand.
- 126 *Eriogonum flavum* Nutt.  
Common on hilltops in rocks.

- 127 *Eriogonum multiceps* Nees.  
Frequent on the steppe, abundant on sand where also the largest individuals are obtained.
- \*128 *Eriogonum Visheri* A. Nels? Dakota Eriogonum.  
Abundant on the steppe near Rabbit Butte, Perkins County.  
"As far as I can see now a good strong species; will describe it soon."—Professor Nelson.
- 129 *Polygonum aviculare* L. Door-yard Weed, Knot-grass, Goose-Grass.  
Not rare along streams in all parts of the area.
- 130 *Polygonum convolvulus* L.  
Uncommon on moist ground in the forested hills.
- 131 *Polygonum Douglasii* Greene.  
Locally common on plains.
- 132 *Polygonum emersum* (Michx.) Brit.  
*P. muhlenbergia*  
Tolerably common in water holes. (Perkins County).  
[*Polygonum erectum* L. Erect Knot weed.  
Reported by Fromme.]
- \*133 *Polygonum exsertum* Small.  
Open woods in the Little Missouri Valley near routes of travel.  
[*Polygonum lapathifolium* L.  
Reported by Fromme.]
- 134 *Polygonum pennsylvanicum* L.  
Tolerably frequent in water holes and along streams.
- 135 *Polygonum persicaria* L.  
Fairly frequent on springy soil in Little Missouri Valley.  
[*Polygonum ramorissimum* Michx.  
Recorded by Fromme.]
- 136 *Polygonum scandens* L. Climbing False Buckwheat.  
Sparingly introduced.  
[*Polygonum tenue* Michx.  
Taken by Fromme.]
- 137 *Rumex mexicanus* Meisn.  
Local on waste moist ground—abundant on Soft Water Creek near Redig.



- 138 *Rumex occidentalis* Wats.  
Conspicuous in small marshes in the moister valleys in West Short Pine Hills.
- 139 *Rumex venosus* Pursh.  
Fairly frequent on the steppe.
29. CHENOPODEACEAE (Goosefoot Family)
- 140 *Atriplex argentea* Nutt.  
Uncommon on the steppe.
- 141 *Atriplex canescens* (Pursh) James.  
Abundant on gumbo.
- 142 *Atriplex hastata* L.  
Common on clay banks.
- 143 *Atriplex Nuttallii* Wats. Salt Bush.  
Common in the badlands areas and on the drier steppe.
- \*144 *Atriplex philonitra* A. Nels.  
Abundant on clay banks, etc.
- 145 *Atriplex Suchleyana* (Torr.) Rydb.  
Common to abundant in badlands and on the rougher parts of the steppe.
- 146 *Chenopodium album* L. Lambs Quarters.  
Commonly introduced.
- \*147 *Chenopodium ambrosioides* L.  
Fairly frequent along South Grand River.
- 148 *Chenopodium Fremontii* Wats.  
Wide spread but not abundant.
- 149 *Chenopodium glaucum* L.  
On bare clay in cuts, along roads, creeks, etc. Fairly common.
- 150 *Chenopodium hybridum* L.  
Common about caves; occasionally on the steppe.
- 151 *Chenopodium leptophyllum* (Mog.) Nutt.  
On the grassy table of Cave Hills.  
[*Chenopodium rubrum* L. Goats Blite.  
Reported by Fromme.]
- \*152 *Chenopodium Watsonii* A. Nels.  
On plains and badlands locally this is a predominant plant.
- \*153 *Corispermum nitidum* Kit. Bugseed.  
Locally common on steppe.
- 154 *Eurotia lanata* (Pursh) Moq. Winter Fat or White Sage.  
Rare on the steppe.

- 155 *Monolepis Nuttalliana* (R. & S.) Engelm.  
Occasional in blowouts, on "hard pan."
- 156 *Salsola pestifer* A. Nels. Russian Thistle.  
A very serious weed in small grain and flax fields. Occasion  
on the sod.
- \*157 *Suaeda erecta* (Wats.) A. Nels.  
Abundant on bare clay of blowouts on flats along streams.  
Also in fields. (Perkins Co.)  
[*Suaeda depressa* (Pursh) Wats.  
Reported by Fromme.]

- \*158 *Suaeda Moquinii* (Torr.) A. Nels.  
Locally common on foothills and tables.

30. AMARANTHACEAE (Amaranth Family)

- 159 *Amaranthus retroflexus* L. Redroot.  
Rarely introduced, near Buffalo.
- 160 *Amaranthus graecizans* L. Tumble weed.  
More commonly introduced.

31. NYCTAGINACEAE (Four-o'clock Family)

- \*161 *Abronia micrantha* (Torr.) Chois.  
Infrequent in sandy areas of floodplains.
- 162 *Allionia linearis* Pursh.  
Abundant in fields, frequent along roads and occasionally  
on the steppe.
- 163 *Allionia hystaginea* Michx.  
Rare on the floodplain of the Little Missouri near Ashcroft.
- \*164 *Allionia pilosa* (Nutt.) Rydb.  
Occasional on sand.

32. PORTULACACEAE (Purslane Family)

- 165 *Talinum perfolium* Nutt.  
Locally abundant on gumbo spots.

33. CAROPHYLLACEAE (Pink Family)

- 166 *Agrostemma gigatho* L. Corn Cockle.  
Rare, in fields, Perkins Co.
- 167 *Cerastium arvense* L. Chickweed.  
Abundant in the thin soil of the edge of the tables and in  
cracks in the cap rock of the butte.

- 168 *Lychnis Drummondii* Wats. Cockle.  
Occasional along Antelope Creek near Rabbit Butte, Perkins  
County.)
- \*169 *Paronychia sesselifolia* Nutt.?  
Abundant in gravelly soil in the drier parts of the steppe.  
Grows in compact clumps from a strong root.
- 170 *Saponaria vaccaria* L. Cockle.  
Occasionally introduced into fields.
- 171 *Silene* sp.  
Occasional on gravelly foothills of the buttes.

## 34. RANUNCULACEAE (Buttercup Family)

- 172 *Anemone cylindrica* Gray.  
Not rare, on the steppe and the swales of the foothills.
- 173 *Batrachium trichophyllum* (Chaix.) Bossch. Floating Butter-  
cup.  
Locally abundant, submerged, in water holes of streams on  
steppe.
- \*174 *Clematis occidentalis* Homem.  
Widespread especially in boxelder groves.
- 175 *Halerpestes cymbalaria* (Pursh) Greene.  
Abundant on the wet flats of the floodplains of streams on  
the plains.
- 176 *Pulsatilla hirsutissima* (Pursh) Brit? Pasque Flower.  
Fairly abundant, but inconspicuous in summer. The unusual  
event of finding pasque flowers in full bloom on August 26,  
1910, was probably associated with the drought of the early  
part of the year. Specimens sent Professor Nelson were re-  
ported not to be typical.
- 177 *Ranunculus abortivus* L.  
Tolerably common on springy ground in the buttes.  
[*Ranunculus ovalis* Raf.  
Reported by Fromme.]
- \*178 *Ranunculus cremogenes* Greene.  
Uncommon along brooks in the forest reserves.
- 179 *Ranunculus pennsylvanicus* L.  
Not uncommon in the shaded valleys of the Slim Buttes.
- 180 *Ranunculus Macounii* Brit.  
Rare along brooks in the Short Pines.

- 181 *Thalictrum dasycarpum* F. & L. Meadow Rue.  
Occasional in the small openings along streams at high altitudes in the buttes, sometimes abundant.

35. BERBERIDACEAE (Barberry Family)

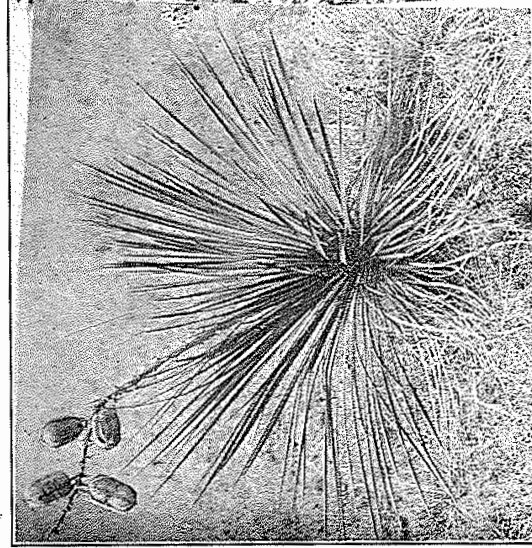
- 182 *Berberis aquifolium* Pursh.  
Common in the forest reserves. Surprising abundant on the eastern foothills of Slim Buttes in Reva Gap.

36. PAPAVERACEAE (Poppy Family)

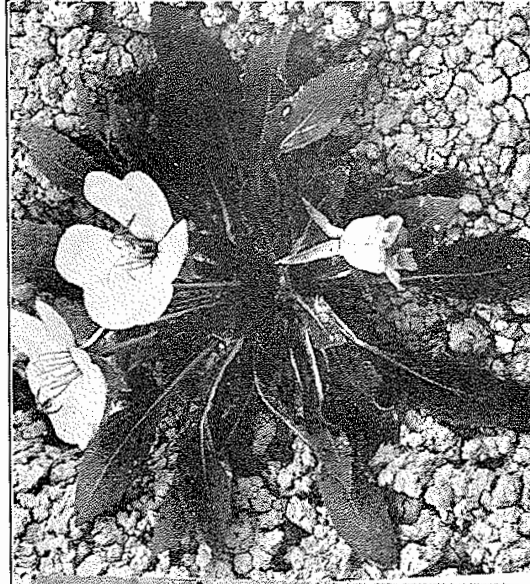
- 183 *Argemone intermedia* Sweet? Prickly Poppy.  
Occasional on the steppe.
- 184 *Corydalis aurea* Willd. False Dutchman's-breeches.  
Several clumps were found in the higher ravines of the Short Pines.

37 CRUCIFERAE (Mustard Family)

- \*185 *Arabis caduca* A. Nels.  
Rare, Short Pine Hills.
- 186 *Arabis hirsuta* Scop.  
Wide spread and fairly plentiful.
- 187 *Brassica arvensis* (L.) B. S. P. Yellow Mustard.  
Sparingly introduced into fields.
- 188 *Camelina sativa* Crantz. False Flax.  
Local in badlands near East Short Pines.
- 189 *Capsella bursa-pastoris* Medik. Shepherd's Purse.  
Naturalized from Europe but now very abundant everywhere.
- 190 *Draba nemorosa* L.  
In fields and on plains.
- 191 *Erysimum asperum* DC.  
Tolerably common on the steppe throughout but especially on the foothills.
- 192 *Erysimum asperrimum* (Greene) Rydb.  
On bare clay in the steppe, not at all common.
- 193 *Erysimum cheiranthoides* L. Western Wallflower.  
Wide spread but not abundant, open woods, brooks and steppe.
- 194 *Erysimum inconspicuum* (Wats.) Mac M.  
Rare on the steppe, Rabbit Butte, Perkins Co.
- 195 *Lepidum apetalum* Willd. Pepper grass.  
Sparingly introduced on the steppe.



Bayonet or Bear Grass (*Yucca glauca*)  
in fruit. Abundant on hills  
and buttes.



"Gumbo Lily" (*Pachylophus caespitosus*)  
Abundant on clay banks.

- [*Lepidium medium* Greene.  
Reported by Fromme.]
- \*196 *Lesquerella alpina* (Nutt.) Wats.  
Common on the bare soils of tables, etc.
- \*197 *Lesquerella argentia* (Pursh) Mac M. Globular-podded  
Crucifer.  
Common on the steppe.
- \*198 *Lesquerella Lunellii* A. Nels.  
Abundant on the steppe.
- 199 *Physaria didymocarpa* Gray.  
Rare, Slim Buttes, June.
- \*200 *Roripa lyrata* (Nutt.) Rýdb.  
Abundant on muddy margins of streams throughout.
- 201 *Roripa palustris* (L.) Bess.  
Fairly abundant in mud along streams throughout the area.
- 202 *Roripa sinuate* (Nutt.) A. S. Hitch. Nastursian.  
Uncommon in open woods along the Little Missouri Valley  
and elsewhere along streams.
- 203 *Roripa* "close to *R. sinuata* but likely distinct." A. Nels.  
Fields, roadsides, etc., near Rabbit Butte, Perkins Co.
- 204 *Sophia incisa* (Engelm.) Greene. Tansy Mustard.  
Plentiful about the Short Pine Hills.
- \*205 *Sophia pinnata* (Walt.) Brit.  
Common on tables of buttes.

## 38 CAPPARIDACEAE (Capper Family)

- 205 *Cleome serrulata* Pursh. Bee-plant.  
Infrequent on sandy floodplains.
- \*206 *Polanisia graveolens* Raf.  
Common in sand.
- 207 *Polanisia trachysperma* T. & G. Clammy-weed.  
Abundant on sand along valleys.

## 39. SAXIFRAGACEAE (Saxifrage Family)

- 208 *Heuchera hispida* Pursh.? Alumroot.  
Rare in the shade at high altitudes in the buttes.
- \*209 *Heuchera valifolia* Nutt.  
Fairly numerous in cracks in the rocks in gulches in the  
forest reserves.

## 40. GROSSULARIACEAE (Gooseberry Family)

- \*210 *Ribes americanum* Nutt.  
Common.
- 211 *Ribes cereum* Dougl. Red Currant.  
Quite abundant about the buttes.
- \*212 *Ribes hudsonianum* Rich. Currant.  
Abundant along the sides of the larger valleys and in the coulees.
- \*212 *Ribes longiflorum* Nutt. Golden or Missouri Currant.  
Common in open woods.
- \*214 *Ribes saxosum* Hook. Common wild gooseberry.  
Fairly abundant in thickets throughout the county.
- 214 *Ribes setosum* Lindl?  
Not uncommon in the woods.

## 41. ROSACEAE (Rose Family)

- \*215 *Agrinomia Brittoniana* Bickn.  
Rare on springy ground in the buttes.
- 216 *Dasiophora fruticosa* (L.) Rydb. Shrubby Cinquefoil.  
Locally abundant on rocky slopes in the South Cave Hills.
- 217 *Drymocallis arguta* (Pursh) Rydb?  
Rare on the margins of Table Mountain.
- 218 *Fragaria americana* (Porter) Brit. Wild Strawberry.  
Not uncommon on the shady north facing banks of ravines in the forest reserves.
- 219 *Geum canadense* Jacq.?  
Rare along wooded valleys.
- 220 *Geum strictum* Ait.  
Along streams throughout especially in the reserves. Common.
- \*221 *Potentilla biennis* Greene.  
Frequent in open woods of the valleys and on the steppe.
- 222 *Potentilla concinna* Rich?  
"Probably a form of this species" Nelson. Common about buttes.
- 223 *Potentilla Hippiana* Lehm.  
On the grassy table of the Cave Hills, infrequent.
- 224 *Potentilla monspliensis* L.  
On springy ground in the West Short Pines.

- \*225 *Potentilla pennsylvanica* arachnoidea Lehm.  
Tolerably common on the plains.
- \*226 *Potentilla pennsylvanica* strigosa Pursh.  
In grasslands, frequent.  
[*Rosa Arkansana* Porter.  
Abundant on the steppe, determination by Fromme.]
- \*227 *Rosa Fendleri* Crepin. Wild Rose.  
Common on the steppe. In flower as late as July 23 in 1910. Abundant in woodlands of buttes.
- \*228 *Rosa Sayi* Schwein. Longfruited Rose.  
Locally common in woods of Slim Buttes.
- 229 *Rosa Woodsii* Lindl.  
Plentiful in open woods, and also on the steppe.
- 230 *Rosa* sp.  
Abundant on the plains. Reported by Professor Nelson as probably a new species. No. 582.
- 231 *Rosa* sp.  
"These tiny roses I do not know." Professor Nelson. Common in the East Short Pines.
- 232 *Rubus strigosus* Michx. Red Raspberry.  
In thickets especially in talus at the foot of the escarpments of the buttes.
- 233 *Sieversia ciliata* G. Don.  
Abundant on tables and foothills.

## 42. POMACEAE (Apple Family)

- 234 *Amelanchier alnifolia* Nutt. Juneberry, Service-berry.  
Scattered specimens wherever copses occur. Very abundant in the buttes.
- 235 *Crataegus Sheridanana* A. Nels. Thorn-apple, Hawthorne.  
Forming small thickets in coulees, in the gulches in the buttes and occasionally along the valleys in the low-lands.

## 43. DRUPACEAE (Plum Family)

- 236 *Prunus americana* Marsh. Wild Plum.  
In close thickets in open gulches, at base of cliffs about buttes, and along streams of the plains.
- 237 *Prunus Besseyi* Bailey. Western Sandcherry.  
Frequent on the dry hillsides especially on the foothills of the buttes.

Sig.—4.



- 238 *Prunus melanocarpa* (A. Nels.) Rydb. Western Chokecherry.  
In thickets in wooded parts of the valleys. Less abundant  
than the Wild Plum.

44. LEGUMINOSAE (Pea Family)

- 239 *Amorpha canescens* Nutt. Lead Plant, Shoe String.  
Abundant on the steppe, even locally giving the color to the  
landscape early in August.
- 240 *Aragallus Lambertii* (Pursh) Greene. Loco.  
*Oxytropis lambertii* Pursh.  
Very plentiful in the bunch grass association on the foothills.
- \*241 *Aragallus dispar* A. Nels.?  
Common on the plains especially in the rougher areas.
- 242 *Astragalus bisulcatus* (Hook) Gray.  
Along streams, frequent throughout.
- 243 *Astragalus caespitosus* (Nutt.) Gray?  
Abundant on gravelly soil in the drier parts of the steppe.  
Grows in compact clumps from a strong tap root.
- 244 *Astragalus carolinianus* L.  
Locally abundant along the Little Missouri River.
- \*245 *Astragalus diversifolius* Gray?  
Rare on table of Short Pine Hills.
- \*246 *Astragalus elatiocarpus* Sheld.  
Rare along roads on the plains of southern Perkins Co., etc.
- 247 *Astragalus lotiflorus* Hook.  
Abundant on rougher land.
- \*248 *Astragalus nitidus* Dougl.  
Tolerably frequent about buttes.
- \*249 *Astragalus pauciflorus* Hook?  
Prof. Nelson thinks more material might indicate that this  
represents a new species. Fairly frequent in the bunch grass  
association on the foothills of the forested buttes.
- \*250 *Astragalus Purshii* Dougl.  
Rare on the steppe of the extreme northwestern corner.
- \*251 *Astragalus succulentus* Rich.  
Common on the plains. We found no fresh fruit during the  
dry summers of 1910 or 1911. Quite plentiful in 1912.
- 251 *Glycyrrhiza lepidota* Pursh. Buffalo Bur.  
A common shrub along stream banks.

- 252 *Lotus americanus* (Nutt.) Bisch. "Wild Alfalfa," "Dakota Vetch."  
Wide spread and abundant on the plains and in fields.  
Still more plentiful on sandy floodplains.
- \*253 *Lupinus argenteus* Pursh. Lupine.  
Abundant on the steppe, especially at high elevations.
- 254 *Lupinus pusillus* Pursh.  
Very abundant in sand along valleys and in sandy soil of the plains.
- 255 *Melilotus alba* Desv. White Sweet-clover.  
Found along the banks of several streams even fifty miles from a railroad.  
[*Petalostemon candidus* Michx. White Prairie Clover.  
Reported by Fromme.]
- 256 *Petalostemon oligophyllus* (Torr.) Rydb. White Prairie Clover.  
Fairly abundant on the steppe.
- 257 *Petalostemon purpureus* (Vent.) Rydb.  
Abundant on the high prairies throughout.
- 258 *Petalostemon villosus* Nutt.  
Rare, found only on the grassy table of North Cave Hills.
- 259 *Psoralea argophylla* Pursh.  
Abundant on the plains in loam.
- 260 *Psoralea lanceolata* Pursh.  
Fairly abundant in open woods, etc.
- 261 *Psoralea tenuiflora* Pursh.  
Common along the Grand River.
- 262 *Strophostyles paniciflora* (Benth.) Wats. Small Wild Bean.  
Locally common along some of the creeks.
- 263 *Thermopsis rhombifolia* (Nutt.) Rich.  
Abundant on the steppe, dominant on brakes. Only a few individuals fruit in dry years.
- 264 *Vicia linearis* (Nutt.) Green. Narrow-leaved Vetch.  
Plentiful in draws on the plains.

## 45. OXALIDACEAE

265. *Oxalis stricta* L. Wood Sorrel.  
Abundant in blue stem draws on the steppe.

## 46. LINACEAE (Flax Family)

- 266 *Linum Lewisii* Pursh. Blue Wild Flax.  
Quite abundant on the plains.
- 267 *Linum rigidum* Pursh. Yellow Wild Flax.  
Plentiful on the steppe in all parts of this area.

## 47. POLYGALACEAE (Milkwort Family)

- 268 *Polygala alba* Nutt. Milkwort.  
Common on the plains.
- 269 *Polygala verticillata* L.  
Rare on the steppe near Rabbit Butte, Perkins Co.

## 48. EUPHORBIACEAE (Snow-on-the-mountain Family)

- \*270 *Euphorbia arkansana* Engelm & Gray.  
Tolerably common on the steppe.
- 271 *Euphorbia glyptosperma* Engelm.  
Occasionally on the plains throughout.
- 272 *Euphorbia petaloidea* Engelm.  
Common on the sand along the Moreau River, Boxelder Creek and other streams.

## 49. CALLITRICHACEAE

- 273 *Callitriche bifida* (L) Morong. Water Starwort.  
Growing submerged in water; local in the smaller streams.
- 274 *Callitriche palustris* L. Water Fennel.  
Partly submerged in shady brooks, West Short Pines.

## 50. ANACARDIACEAE (Sumac Family)

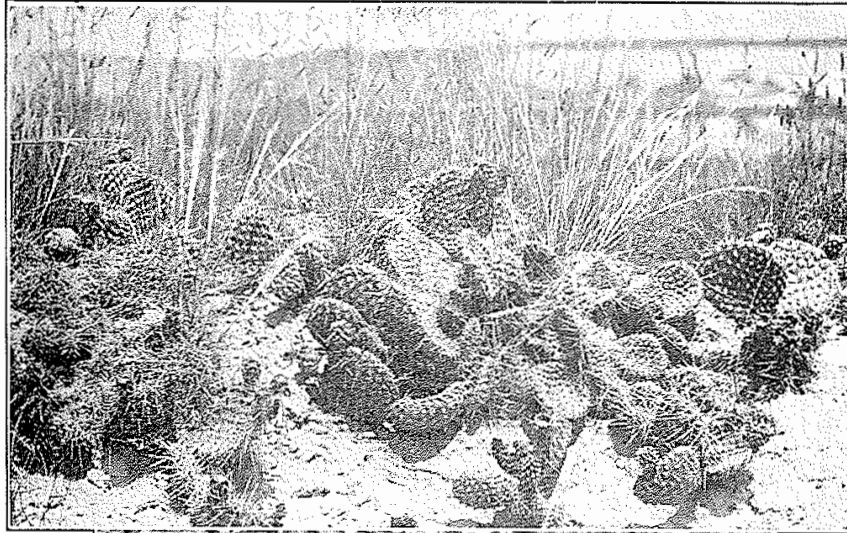
- 275 *Rhus Rydbergii* Small? Western Poison Ivy.  
Abundant in groves, on rocky slopes, on grassy hillsides in "broken" areas.
- 276 *Rhus trilobata* Nutt. Skunk-Bush.  
Common on hillsides of rougher regions. Not poisonous.

## 51. CELASTRACEAE (Staff Tree Family)

- 277 *Celastris scandens* L. Climbing Bittersweet.  
Abundant in the wooded gulches of the buttes.

## 52. ACERACEAE (Maple Family)

- 278 *Acer negundo* L. Boxelder.  
Single trees and small clumps are scattered along the streams in the valleys especially about the buttes.



The Prickly Pear (*Opuntia polyacantha*) especially abundant on the flats or benches along the valleys. Grama grass in background.

Snow-on-the-Mountain (*Euphorbia marginata*) abundant on steppe.

*Chrysothamnus graveolens*. A conspicuous plains composite.

## 53. VITACEAE (Vine Family)

- 279 *Parthenocissus vitacea* A. S. Hitch. Virginia Creeper.  
Rather plentiful in groves, especially in ravines of buttes.
- 280 *Vitis vulpina* L. River-bank Grape.  
Rare; most common in East Short Pines.

## 54. MALVACEAE (Mallow Family)

- 281 *Malvastrum coccineum* (Pursh) Gray. False Mallow.  
Very abundant on steppe, especially along roadsides.

## 55. VIOLACEAE (Violet Family)

- 282 *Viola canadensis* L.  
Common on moist banks about the buttes and occasionally on other streams.
- \*283 *Viola retusa* Greene?  
Rare Little Missouri and Shaw Creek.
- \*284 *Viola vallicola* A. Nels.  
Abundant along valley banks.

## 56. LOASACEAE (Loasa Family)

- 285 *Mentzelia decapetala* (Pursh) Urban & Gilg.  
This large and showy herb grows on steep clay banks, less common than the following.
- 286 *Mentzelia nuda* (Pursh) T. & G.  
Fairly numerous on clay bluffs of cut banks and on rocky slopes of buttes.

## 57. CACTACEAE (Cactus Family)

- 287 *Mamillaria vivipara* (Nutt) Haw. Pin-cushion Cactus.  
Fairly frequent on the steppe especially on the moister portions.
- 288 *Opuntia fragilis* (Nutt.) Haw. Smaller Prickly Pear.  
Abundant in blowout spots on hard pan, especially on flats along valleys.
- 289 *Opuntia polyacantha* Haw. Larger Prickly Pear.  
Abundant on the steppe in general, but seldom in blowouts.

## 58. ELAEAGNACEAE (Oleaster Family)

- 290 *Shepherdia argentia* Nutt. Buffalo Berry.  
Abundant in dense thickets along streams, in washouts, and on hillsides. The yellow fruited variety is widespread but rare.

## 59. ONAGRACEAE (Evening Primrose Family)

- 291 *Anogra albicaulis* (Pursh.) Brit.  
Numerous in fields, along roads, on bare clay of banks, and frequent elsewhere on the steppe.
- 292 *Anogra Nuttallii* (Sweet) A. Nels.  
Not uncommon on the steppe, fields, open woods of Little Missouri, etc.  
[*Anogra coronifolia* (T. & G.) Brit.  
Reported by Fromme.]
- 293 *Chamaenerion angustifolium* (L.) Scop. Forest Fire-weed.  
Locally abundant in open valleys in the buttes.
- 294 *Epilobium adenocaulon* Hausskn. Common Willow Herb.  
Common along brooks.
- 295 *Epilobium lineare* Muhl.  
Plentiful in marshy spots along streams.  
[*Gayophytum ramosissimum* T. & G.  
Reported by Fromme.]
- 296 *Gaura coccinea* Bursh.  
One of the most abundant of the "weeds" on the steppe.
- \*297 *Lavauria flava* A. Nels.  
Common on the sandy floodplain of the Grand River, near Buffalo. Rare in badlands.
- 298 *Meriolix serrulata* (Nutt.) Walp. Tooth-leaved Primrose.  
Abundant on the steppe, particularly along roads.
- 299 *Oenothera laciniata* Hill.  
Tolerably common on steppe near Govert, etc.
- 300 *Onagra biennis* (L.) Scop. Eastern Evening Primrose.  
In valleys of Slim Buttes and on Little Missouri floodplain.
- 301 *Onagra striogosa* Rydb. Common Evening Primrose.  
Fairly frequent in all open situations.
- 302 *Pachylophus caespitosa* (Nutt.) Raimann. Gumbo Lily.  
"Typical! Good specimen and a great find." Prof. Nelson.  
Fairly abundant on bare heavy clay of badlands.
- 303 *Pachylophus macroglottis* Rydb.  
In badlands and on clay.
- \*304 *Pachylophus montanus* (Nutt.) A. Nels.  
Bare clay, Short Pine Hills. June.

## 60. UMBELLIFERAE (Parsnip Family)

- 305 *Carum carui* L.?  
In wolfberry patches on the eastern foothills of the Long Pine Hills.
- \*306 *Cicuta occidentalis* Greene. Water Hemlock.  
Fairly numerous along brooks; occasional along creeks.
- \*307 *Cogswellia macrocarpa* (L.) Kuntze.  
Abundant on the steppe.
- \*308 *Cogswellia montana* Jones.  
Numerous on the plains.
- 309 *Cymopterus acaulis* (Pursh) Rydb.  
Rare on the steppe throughout.
- 310 *Heracleum lanatum* Michx. Cow Parsnip.  
Along streams, tolerably frequent.
- 311 *Sanicula Marylandica* L. Snake-root.  
Plentiful in forest reserves.
- 312 *Washingtonia* sp. Sweet Cicely.  
Common in deep shade in the forested buttes.

## 61. CORNACEAE (Dogwood Family)

- 313 *Cornus canadensis* L. Bunch-berry, Carnel.  
Common in the most shaded ravines of the forest reserves.
- \*314 *Cornus instolonensis* A. Nels. ined. Dogwood, "kinnikinic."  
Not uncommon in thickets along streams throughout.

## 62. PYROLACEAE (Wintergreen Family)

- 314 *Pyrola elliptica* Nutt. Winter green.  
Abundant in moist ravines in the West Short Pine Hills.
- \*315 *Pyrola uliginosa* Torr.  
Common in shady gulches of the forest reserves.

## 63. MONOTROPACEAE (Indian Pipe Family)

- 316 *Pterospora andromeda* Nutt. Pinedrops.  
Frequent in shady gulches.

## 64. ERICACEAE (Heath Family)

- 317 *Arctostaphylos uva-ursi* (L.) Greene. Bear berry or Kinnikinnick.  
Quite frequent on partly open hillsides at high elevations in the Slim Buttes and Pine Hills; rare in Cave Hills.

## 65. PRIMULACEAE (Primrose Family)

- 318 *Androsace occidentalis* Greene.  
Common on Rabbit Butte, etc. (Perkins Co.)
- 319 *Steironema ciliatum* (L.) Raf. Fringed Loosestrife.  
Fairly abundant in shady valleys well up in the buttes.

## 66. OLEACEAE (Olive Family)

- 320 *Fraxinus lanceolata* Borck. Green Ash.  
Abundant in small groves along all streams except in the drier parts of the steppe. Predominant in coulees.

## 67. GENTIANACEAE (Gentian Family)

- \*321 *Gentiana affinis* Griseb.  
Abundant along brooks.
- \*322 *Gentiana plebeja* Cham.  
Uncommon in the Little Missouri floodplain and on the foot hills of the buttes.
- 323 *Gentiana puberula* Michx? Blue Prairie Gentian.  
Locally abundant with blue stem grass in mesophytic north-eastern draws near Lodge Pole Butte. In full bloom August 10.
- \*324 *Gentiana strictiflora* (Rydb.) A. Nels. Yellow Gentian.  
Fairly abundant on wooded hill sides in Cave Hills.

## 68. APOCYNACEAE (Dogbane Family)

- 325 *Apocynum androsaemifolium* L. Indian Hemp.  
Pretty general on the foothills of the buttes.

## 69. ASCLEPIADACEAE (Milkweed Family)

- 326 *Acerates viridiflora* Ivesia. Brit. Green Milkweed.  
Locally abundant along the creeks and rivers.
- 327 *Asclepias pumila* (Gray) Vail. Small Milkweed.  
Frequent on plains, especially their rougher portions.
- 328 *Asclepias speciosa* Torr.  
Frequent along the larger valleys.
- 329 *Asclepias verticillata* L.  
Rare in the valleys on the steppe.

## 70. CONVULVULACEAE (Morning-glory Family)

- 330 *Convolvulus sepium* L. Hedge Bindweed, Wild Morning-glory.  
Occasional in thickets and about dwellings.



- 331 *Ipomoea leptophylla* Torr. Bush Morning-glory.  
Rare on dry hillsides.

71. POLEMONIACEAE (Phlox Family)

- 332 *Collomia linearis* Nutt.  
Abundant in grassy parts of the flood plain of the Little Missouri and its tributaries.
- \*333 *Gilia cephalodidea* Rydb. Round-headed Gilia.  
Common in bunch grass association.
- \*334 *Navarretia minima* Nutt.  
Rare along Antelope Creek near Rabbit Butte, Perkins Co.
- \*335 *Phlox alyssifolia* Greene.  
Abundant on rocky cliffs of Slim Buttes.
- \*336 *Phlox canescens* T. & G.  
Plains, and especially buttes.
- \*337 *Phlox Hoodii* Rich.  
Fairly plentiful on exposed rocky points.
- 338 *Phlox Kelseyi* Brit.  
Common on rocky exposures.
- 339 *Phlox sp.*  
Rare on steppe and rough land near Camp Crook.

72. HYDROPHYLLACEAE (Waterleaf Family)

- 340 *Macrocalyx nyctelea* (L.) Kuntze.  
Frequently abundant at the foot of clay banks along creeks.
- \*341 *Phacelia leucophylla* Torr.  
Abundant on rough land and rocks.

73. BORAGINACEAE (Borage Family)

- 342 *Crypanthe crassisepala* (T. & G.) Greene.  
Reported by Fromme.
- 343 *Lappula floribunda* (Lehm.) Greene. Stick-seed.  
Locally abundant in woods along the Little Missouri River
- 344 *Lappula occidentalis* Greene. Stick tight.  
A pest in old fields; abundant on steppe.
- 345 *Lithospermum angustifolium* Michx.  
Numerous on the steppe.
- \*346 *Lithospermum linearifolium* Goldii. Puccoon, Gronwell.  
Very common on the dry prairies.

- \*347 *Mertensia foliosa* A. Nels.  
Abundant along streams.
- 348 *Mertensia paniculata* Don. ?  
Rare, West Short Pines. "A full series might show this to be new." Nelson.
- \*349 *Oreocarya affinis* Greene.  
Common on Rabbit Butte (Perkins Co.)
- 350 *Oreocarya glomerata* (Nutt.) Greene.  
Abundant on the steppe.

## 74. VERBENACEAE (Verbain Family)

- 351 *Verbena stricta* Vent?  
Fairly common especially in close-cropped pastures.

## 75. LABIATAE (Mint Family)

- 352 *Agastache anethoidora* (Nutt.) Brit. Fragrant Giant Hysop.  
Abundant on rocky areas especially slopes within the buttes.
- 353 *Hedeoma Drummondii* Benth. Pennyroyal.  
Locally common in gulches in buttes.  
[*Hedeoma hispida* Pursh.  
Reported by Fromme.]
- 354 *Lycopus americanus* Muhl. Water Hoarhound.  
Along streams throughout.
- \*355 *Lycops asper* Greene.  
Along all streams.
- 356 *Mentha canadensis* L. Mint, catnip.  
Abundant along brooks.
- 357 *Monarda menthaefolia* Graham. Horse Mint, Balm.  
Abundant in coulees and groves.

## 76. SOLANACEAE (Potato Family)

- 358 *Physalis heterophylla* Nees. Ground Cherry.  
A rare ruderal, berry yellow.
- 359 *Physalis lanceolata* Michx. Ground-cherry.  
Abundant on the sandy flood plain of the Grand River near Buffalo. Berry greenish yellow.
- 360 *Solanum nigrum* L. Night shade.  
Occasionally frequent in fields during wet seasons.
- 361 *Solanum rostratum* Dunal. Buffalo-bur, Wild-tomato.  
Quite abundant along roads, etc.

362 *Solanum triflorum* Nutt.

Abundant along floodplains of streams and in fields.

77. SCROPHULARIACEAE (Figwort Family)

\*363 *Castilleja flava* Wats?

Abundant on the grassy plains of the northeastern part of Harding and adjacent Perkins Co.

364 *Gratiola virginiana* L. Hedge Hyssop

Abundant on wet soil on the plains especially along streams.

365 *Orthocarpus luteus* Nutt.

Very abundant on the plains, spreading into ravines of buttes.

366 *Pentstemon acuminatus* Dougl? Beard Tongue.

Common on the steppe on sandy soil.

367 *Pentstemon albidus* Nutt.

Plentiful on uplands and grassy valleys.

368 *Pentstemon angustifolius* Pursh.

Abundant in draws on the plains.

369 *Pentstemon erianthera* Pursh.

Common on foothills of the Short Pines.

370 *Pentstemon* sp.

"Probably new." Nelson. Common on hillsides in buttes

371 *Veronica americana* Schwein.

Growing in the water of brooks in forest reserves, locally abundant.

78. OROBANCHACEAE (Broom Rape Family)

372 *Orobanche ludoviciana* Nutt. Broom Rape.

Very abundant especially in sandy soil Parasitic on Composites.

79. PLANTAGINACEAE (Plantain Family)

[*Plantago aristata* Michx.

Reported by Fromme.]

373 *Plantago elongata* Pursh. Slender Plantain.

Tolerably common on steppe throughout.

374 *Plantago lanceolata* L. Ribwort

One patch on a creek just east of Reva; introduced.

375 *Plantago major* L. Common Plantain.

Uncommonly introduced about towns.

- 376 *Plantago Purshii*, Roem & Schult.

Abundant everywhere on the dry plains.

- 377 *Plantago Rugelli* Dene.

Locally plentiful on margin of Little Missouri River and along streams in the buttes.

#### 80. RUBIACEAE (Madder Family)

- 378 *Galium boreale* L. Bedstraw, Cleavers.

Common on hillsides of buttes, in coulees and other partially sheltered places.

- 379 *Galium triflorum* L. Fragrant Bedstraw.

Abundant in shaded ravines of the forest reserves.

#### 81. CAPRIFOLIACEAE (Honeysuckle Family)

- 380 *Linnaca americana* Forbs. Twin Flower.

Abundant in the more moist ravines at considerable elevations in the buttes.

- 381 *Symphoricarpos occidentalis* Hook. Buckbush, Wolfberry.

Very abundant forming low thicket-patches along much of the bottomland, and in open groves. Also occasional in shaded gulches.

- 382 *Symphoricarpos racemosus* Michx.

Rare in Slim Butte Ravines.

- 383 *Fiburnum Lentago* L. Black Haw.

Locally abundant forming large thickets in several of the valleys of the West Short Pines. "Somewhat different from eastern specimens." Nelson.

#### 82. CUCURBITACEAE (Gourd Family)

- 384 *Echinocystis lobata* (Michx) T. & G. Wild Cucumber, Wild Balsam Apple.

A few patches in thickets in the West Short Pines.

#### 83. CAMPANULACEAE (Bluebell Family)

- 385 *Campanula rotundifolia* L. Harebell, Bluebell.

Common at high elevation, along cracks in rocks and also in grass.

#### 84. COMPOSITAE, tribe Eupatorieae

- 386 *Liatris punctata* Hook. (Lacinaria). Blazing-star.

Abundant everywhere on the plains.

- 387 *Kuhnia glutinosa* Ell. False Boneset.  
Abundant in badlands and on buttes.
- \*385 *Kuhnia reticulata* A. Nels.  
Rare on the edge of mesa of Table Mountain.

## COMPOSITAE, tribe Astereae

- \*387 *Aster commutatus* Gray:  
Rare on buttes, occasional on the steppe.
- \*340 *Aster Geyeri* (Gray) Howell.  
Frequent along ravines and in thickets along rivers.
- \*391 *Aster hebecladus* DC.  
Common on the steppe throughout.
- 392 *Aster laevis* L.  
Reported by Fromme.
- \*393 *Aster laetevirens* Greene.  
Frequent in ravines in Slim Buttes, and Cave Hills.
- \*394 *Aster multiflorus* Ait.  
Uncommon on the foothills.
- 395 *Aster oblongifolius* Nutt.  
"Great find. Not supposed to be so far west." Prof. Nelson.  
Frequent on the steppe in both Harding and Perkins County.
- \*396 *Aster pauciflorus* Nutt.  
Fairly frequent on floodplains of Boxelder, etc.
- 397 *Aster ptarmicoides* T. & G.  
Not uncommon on mesas.
- \*398 *Chrysopsis hirsutissima* Greene. Golden Aster.  
"This greatly extends the range of this species" (from Colorado, its type locality.) Numerous on the steppe and abundant in the badland areas.
- \*399 *Chrysopsis mollis* Nutt.  
Frequent on the plains.  
[*Chrysopsis villosa* Nutt.  
Reported by Fromme.]
- 400 *Chrysothamnus graveolens* (Nutt.) Greene. Rabbit Brush.  
Rayless Goldenrod.  
A perennial shrub with large woody roots which is abundant in all South Dakota badlands.
- \*401 *Chrysothamnus nauseosus* (Pall.) Brit.  
Abundant in badlands.

- 402 *Erigeron annuus* L. Daisy Fleabane.  
On almost bare clay of Little Missouri floodplain, not un-  
common.
- 403 *Erigeron asper* Nutt.  
Abundant on steppe and table.
- 404 *Erigeron divergens* T. & G.  
Infrequent along brooks in the Cave Hills.
- 405 *Erigeron pumilus* Nutt.  
Common on the plains and foothills throughout.
- 406 *Erigeron new?*  
Frequent on the plains.
- \*407 *Grindelia perennis* A. Nels. Gumplant.  
Only locally frequent, on the plains.
- 408 *Grindelia squarrosa* (Pursh.) Dunal. Resinweed.  
Especially abundant on the steppe; not lacking in the shaded  
valleys.
- 409 *Gutierrezia Sarathrae* (Pursh) B. & R.  
A prominent plant in the bad lands.
- 410 *Leptilon canadense* (L.) Brit. Prairie Fire-weed.  
Abundant on old fields and along roads.
- \*411 *Machaeranthera canescens* (Nutt.) Gray.  
Abundant in badland areas. In full bloom at the end of  
August.
- 412 *Sideranthus grindeliodes* (Nutt.) Brit.  
Frequent on rocky cliffs of buttes.
- 413 *Sideranthus spinulosus* (Pursh.) Sweet.  
*Aplopappus spinulosa*  
Common on the steppe throughout.
- \*414 *Solidago concinna* A. Nels. Goldenrod.  
Rare on the steppe.
- 415 *Solidago elongata* Nutt.  
Fairly numerous in the valley of the Little Missouri River.
- 416 *Solidago missouriensis* Nutt. Common Goldenrod.  
Very numerous on the plains especially in slight draws.
- 417 *Solidago mollis* Barth. Goldenrod.  
Abundant on the steppe, on the tables and on the slopes about  
the buttes. The most abundant goldenrod of the area.
- 418 *Solidago nemoralis* Ait.  
Reported by Fromme.

- 419 *Solidago rigida* L. Hard-leaved Goldenrod.  
Common on the plains throughout, especially on tables of buttes.
- 400 *Solidago serotina* Ait. Late Goldenrod.  
Common on the plains especially in draws.

## COMPOSITAE, tribe Inuleae

- [*Antennaria arida* E. Nels.  
Reported by Fromme.]
- 421 *Antennaria aprica* Greene. Pearly Everlasting, Indian Tobacco.  
Frequent on the buttes and plain.

## COMPOSITAE, tribe Heliantheae

- 422 *Ambrosia artemisiaefolia* L.  
Little Missouri Valley, infrequent.
- 423 *Ambrosia psilostachya* DC.  
Along rivers especially on sandy soil where it is one of the most prominent plants.
- 424 *Ambrosia trifida integrifolia* T. & G.  
Along shaded brooks, West Short Pines.
- 425 *Ambrosia trifida* L.  
Common along roads, on floodplains and along brooks.  
[*Bidens frondosa* L.  
Reported by Fromme.]
- 425 *Bidens glaucescens* Greene. Beggar's Ticks, Bur Marigold.  
Plentiful along streams throughout.
- \*426 *Bidens vulgata* Greene.  
Along brooks, not uncommon.
- 427 *Brauneria angustifolia* (DC.) Heller. Niggerhead "Black-eyed Susan."  
On the steppe, very abundant in the areas underlain with loam.
- 428 *Coreopsis tinctoria* Nutt. Tickseed, "Marsh Flax."  
Rare in waterholes and undrained spots in fields near Lemmon, Perkins County.
- \*429 *Franseria acanthiarpa* (Hook.) Coville.  
Abundant on sandy soil along streams, locally common on sandy portions of the plains.

- 430 *Helianthus annuus* L. Large Sunflower.  
About dwellings and fields, especially in the valleys.  
[*Helianthus hirsutus* Raf.  
Reported by Fromme.]
- 431 *Helianthus Maximilianus* Schrad. Prairie Sunflower.  
Scattered all over the plains; most frequent on hillsides.
- 432 *Helianthus petiolaris* Nutt. Prairie Sunflower.  
On sandy floodplains, locally very numerous.
- 433 *Helianthus scaberrimus* Ell. Stiff Sunflower.  
On grassy tables of forest reserves, not common
- 434 *Iva xanthifolia* Nutt.  
Widely distributed about buildings, animal burrows, also in shaded valleys.
- \*435 *Madia glomerata* Hook. Tarweed.  
Abundant on the foothills of East Short Pines.
- 436 *Ratibida columnaris* (Sims.) D. Don. Cone-flower.  
Found to be numerous on all grassy areas.
- 437 *Xanthium echinatum* Murr. Cocklebur.  
Quite abundant on mud flats along rivers.

## COMPOSITAE, tribe Helenieae

- 438 *Actinella simplex* A. Nels.  
Abundant everywhere in the open; plains, buttes and badlands.
- 439 *Bahia oppositifolia* Nutt.  
Common in grassy tables of buttes, frequent on steppe especially along roads.
- \*440 *Chaenactis Douglasii* H. & G.  
Rare, Short Pine Hills.  
[*Gaillardia pinnatifida* Torr.  
Reported by Fromme.]
- 441 *Hymenopappus filifolius* Hook.  
Not rare on rocks.

## COMPOSITAE, tribe Anthemideae

- 442 *Achillea millefolium* L. Yarrow, Milfoil.  
Abundant in grassy areas especially on hillsides.
- \*443 *Artemisia aromatica* A. Nels. Fragrant Wormwood.  
Abundant everywhere on the plains, much parasitized by *Orobanchia*.



- 444 *Artemisia biennis* Willd.  
Fairly frequent in a few localities for instance along the north fork of the Moreau River and in the Short Pines.
- 445 *Artemisia cana* Pursh. Small Prairie Sage.  
Abundant on the drier floodplains and especially on the terraces of streams. Frequent on the steppe.
- 446 *Artemisia canadensis* Michx.  
Abundant on rocky slopes and gravelly floodplains.  
[*Artemisia caudata* Michx.  
Reported by Fromme.]
- 447 *Artemisia frigida* Willd. Silver Sage.  
Abundant on drier plains, badlands, terraces, etc.
- 448 *Artemisia gnaphalodes* Nutt. Coarse Sage, Mugwort.  
Predominant in rougher areas and found also along Little Missouri floodplain.
- \*449 *Artemisia ludoviciana* (Nutt.) Riddeli.  
Rare on rocky talus slopes of buttes.
- \*450 *Artemisia natronensis* A. Nels.  
Plentiful on sandy floodplains and on rough land about buttes, not lacking on the steppe.
- \*451 *Artemisia pabularis* (A. Nels.) Rydb. Eastern Sage.  
Now considered by Prof. Nelson to be indistinguishable from *A. gnaphalodes*. Rare on the plains especially eastward.
- 452 *Artemisia tridentata* Nutt. Desert Sagebrush.  
Abundant especially on the lower terraces of the valleys and badlands. Lacking on the uplands and rare or absent east of the Slim Buttes.

## COMPOSITAE, tribe Senecioneae

- 453 *Senecio canus* Hook. Silver Groundsel.  
Badlands and buttes, frequent.
- \*454 *Senecio canus Purshianus* (Nutt.) A. Nels.  
Common on the foothills of buttes.

## COMPOSITAE, tribe Cynareae

- \*455 *Carduus dakoticus* A. Nels. sp. ined. Dakota Thistle.  
Not uncommon in open woods along Little Missouri Valley.
- \*456 *Carduus filipendulus* (Engelm.) Rydb.  
Common in forest reserves, occasional on steppe.

- \*457 *Carduus nebraskensis* Brit.  
Not uncommon in open woods of Little Missouri Valley.
- 458 *Carduus unulatus* Nutt. Plains Thistle.  
Common on prairies especially in sand grass patches, along valleys even in thickets.  
[*Cirsium iowense* (Pammel) Fernald. Plumed Thistle.  
Reported by Fromme.]

## COMPOSITAE, tribe Cichorieae

- \*459 *Crepis glauca* T. & G.  
Brooksides in Cave Hills and other forest reserves.
- 460 *Hieraceum canadensis* Michx.  
Tolerably common in woods.
- 461 *Hieracium umbellatum* L. Hawkweed.  
Not uncommon in moist valleys of the timbered buttes.
- 462 *Lactuca pulchella* (Pursh) DC.  
Fairly frequent along all streams.
- 463 *Lygodesmia juncea* Don.  
Frequent on the plains, common in fields.
- \*464 *Lygodesmia rostrata* Gray.  
Common on sandy stretches along the Grand River.
- 465 *Nothocalais cuspidata* (Pursh) Greene.  
A common ruderal.
- 466 *Sonchus asper* (L.) Hill.  
Tolerably common along streams in the Slim Buttes.
- 467 *Troximon glaucum* Nutt.  
Common in the grassy portions of the forest reserves.
- \*468 *Troximon glaucum pumilum* (Nutt.) A. Nels.  
Fairly frequent on the foothills of the Short Pines.

## LICHENS\*

- Cladonia pyxidata* (L.) Fr.  
Abundant on dry soil in the Badlands.
- Parmelia mollinscula* Ach.  
Very abundant on bare dry soil growing between sage, cactus and other clumps of vegetation. (Harding, Washington, Washabaugh Counties).

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\*Determinations of Lichens and Mosses are by R. S. Williams of N. York Botanical Garden.

*Parmelia conspersa* (Ehrh.) Ach.

Very common on exposed surfaces of large talus blocks about Table Nut, Harding Co., and elsewhere.

*Parmelia saxatilis* (L.) Fr.

Frequent on talus blocks, with the preceding.

*Peltigera aphthosa* (L.) Hoffm.

Rare in the badlands (Washington Co.)

*Peltigera canina* (L.) Hoffm.

Rare in the badlands (Washington Co.)

*Ramalina pollinaria* (Ach.) Tuck.

Fairly abundant on talus blocks, Cave Hills.

*Usnea barbata hirta* Fr. Beard Lichen.

Occasional on trees, especially dead limbs, in canyons at high elevations on the buttes of Harding County; rare on Sheep Mt. in the Badlands. Locally abundant in the Black Hills.

## MOSSES

*Amblystegium compactum* (C. M.) Aust.

Abundant on moist rocks of canyons, Cave Hills and Badlands.

*Amblystegium riparium* (L.) Bry Eur.

Forming bogs in sluggish portion of brooks in Cave Hills and near Little Missouri River.

*Brachythecium salebrosum* (Hoffm.) Bry. Eur.

Common on shady banks of narrow gullies in the Forest Reserves, etc.

*Bryum arcticum* (R. Br.) Bry. Eur.

Common on steppe slopes, but growing in more exposed situations than the preceding.

*Bryum cernuum* (Sw.) Lindb. (*B. uliginosum*.)

With the preceding.

*Bnium affine* Bland?*Minium cuspidatum* (L. in part Schreb.) Leyss.

Common in moist ravines, Cave Hills.

*Orthotrichum rupestra* Schleich.

Rare, growing on talus blocks especially in spots where water collects.

*Philonotis fontana* Brid.

Common in bogs and frequent in deep shade along the Little White River, La Creek and other streams.

*Polytrichum piliferum* Schreb.

Abundant on thin dry soil on steep slopes, quite general.

*Pseudoleskeella tectorum* (A Braun) Kindb.

Rare with the following.

*Stereodon cupressiformis* (L.) Brid.

Rare in Harney Springs, Washington Co.

*Thuidium abietinum* (L.) Bry Eur.

• Rare with preceding.

*Tortula ruralis* (L.) Ehrh.

Rare in pools in White River Valley.

#### IV. LIST OF THE BIRDS OF HARDING COUNTY

By S. S. VISHER.

The following list is based upon the following sources of information: (1) Mr. G. B. Grinnell passed through the area from northeast to southwest during July 9-16, 1874, and through the western part August 17-29 with the Custer Expedition to the Black Hills. His report as naturalist, published in Ludlow's "Report of Reconnaissance of the Black Hills," contains some statements which certainly apply to our district. (2) Mr. Sal Catron of Camp Crook has lived there on the Little Missouri River since 1883. Continual hunting has made him familiar with the larger birds. (3) A. A. Saunders of the U. S. Forest Service spent portions of November and December, 1909, and in a letter has reported several interesting winter records. (4) As naturalist to the South Dakota Geological and Natural History Survey, it was my privilege to visit the area several times, (July 7-Sept. 4, 1910, June 6-20, 1911, Aug. 1-9, Aug. 30-Sept. 11, 1912), during which practically every township was visited, and the most interesting areas revisited.

#### LIST OF SPECIES\*

Eared Grebe (*Colymbus nigricollis californicus*). An occasional migrant along the Little Missouri River.

\*A revised combination of articles by S. S. Visher, which appeared in "The Auk" Jan. 1911, Jan. 1912, April 1913.

- Pied-Billed Grebe (*Podilymbus podiceps*). Reported by Catron and others to be fairly abundant migrant along the larger streams.
- Loon (*Gavia immer*.) Mr. Catron has shot a loon on two occasions, flying along the Little Missouri.
- Ring-billed Gull (*Larus delawarensis*). Taken by Grinnell on the Little Missouri River in July.
- [Forster's Tern (*Sterna forsteri*). A flock of terns, probably of this species, was seen hovering over the Little Missouri River August 30, 1910.]
- Black Tern (*Hydrochelidon nigra surinamensis*). A fairly common migrant through the county.
- American Merganser (*Mergus americanus*). Taken, infrequently, by Catron and on August 10, 1910, near Harding by a forester.
- Red-breasted Merganser (*Merganser serrator*). Mr. Catron reports having several times shot them on the Little Missouri River near Camp Crook during migrations. Taken by Grinnell near our area.
- Hooded Merganser (*Lophodytes cucullatus*) Occasional migrant. (Catron). Grinnell found them nesting near our area.
- Mallard (*Anas platyrhynchos*). Abundant migrant, arriving August 22. Reported by Grinnell, Catron, and others to nest during wet summers.
- Bald-pate (*Marca americana*). A common migrant (Catron). Grinnell reports that in 1874 they bred near our area.
- Green-winged Teal (*Nettion carolinensis*). Breeds wherever possible. Six broods seen; one on an artificial pond not larger than two rods square.
- Blue-winged Teal (*Querquedula discors*). As abundant as the preceding.
- Shoveller (*Spatula clypeata*). Common migrant. One brood of young seen on an artificial pond.
- Pintail (*Dafila acuta*). Abundant breeder on artificial ponds and along Grand River.
- Red-head (*Marila americana*). Usually fairly abundant during migrations (Catron).
- Canvas-back (*Marila callisineria*). Uncommon, during migrations (Catron).

- Greater Scaup Duck (*Marila marila*). Abundant migrant along the rivers (Catron).
- Lesser Caup Duck (*Marila affinis*). Very common migrant (Catron).
- Buffle-head (*Charitonetta albeola*). Abundant migrant.
- Snow Goose (*Chen hyperboreus hyperboreus*). Not commonly seen, most frequently in spring (Catron and others).
- White-fronted Goose (*Anser albifrons gambeli*). Catron reports this to be the most abundant goose; a common migrant.
- Canada Goose (*Branta canadensis canadensis*). Grinnell found this species breeding abundantly along the Little Missouri and other streams in 1874. Catron reports they were fairly common till 1890. Now infrequent and seen only as a migrant.
- Hutchins's Goose (*Branta canadensis hutchinsi*). Not common during migrations (Catron and others).
- Bittern (*Botaurus lentiginosus*). A few here in wet seasons.
- Great Blue Heron (*Ardea herodias herodias*). Both Grinnell and Catron reports that this species occasionally breeds along the Little Missouri River. We saw several in 1912 though none before.
- Green Heron (*Butorides virescens*). One seen July 13 on Little Missouri River. This is a large extension of range and the bird seen was probably a wanderer.
- Black-crowned Night Heron (*Nycticorax nycticorax naevius*). Several young of this year were seen on the Moreau River during the third week of August. They were probably wanderers.
- Whopping Crane (*Grus americana*). Reported to be not infrequently seen during the spring migration.
- Sandhill Crane (*Grus mexicanus*). Grinnell states that this species was occasionally seen on the plains, and that its nests were numerous in the pines of the Black Hills. The present status of Sandhill and little Brown Crane may be described as "occasionally an abundant migrant."
- Virginia Rail (*Rallus virginianus*). One pair bred in a small reedy patch in the Cave Hills in 1910 and one pair in West Short Pines 1912.
- Sora Rail (*Porzana carolina*). One was seen in the slump marsh on the east side of the East Short Pines Sept. 7, 1912.

- Coot (*Fulica americana*). Rare, because of almost total absence of suitable resorts.
- Avocet (*Recurvirostra americana*). Fairly abundant in migrations (Catron). Ten were seen flying low on August 23, 1910.
- Stilt Sandpiper (*Micropalama himantopus*). Seen on the South Fork of the Grand River August 17. Apparently only a migrant.
- Wilson's Snipe (*Gallinago delicata*). Common along the river early in September.
- Pectoral Sandpiper (*Pisobia maculata*). A common migrant.
- Baird's Sandpiper (*Pisobia bairdi*). Several were seen on artificial ponds.
- Least Sandpiper (*Pisobia minutilla*). Tolerably common in August.
- Greater Yellow-legs (*Totanus melanoleucus*). A pair was seen July 19 on Little Missouri River. Catron reports that they are regular and not rare migrants.
- Yellow-legs (*Totanus flavipes*). One seen with the preceding. Apparently only a migrant, in dry seasons at least.
- Solitary Sandpiper (*Helodromas solitarius solitarius*). Rare in summer; abundant migrant. Found wherever there is water, in the buttes as well as on the plains.
- Upland Plover (*Bartramia longicauda*). Breeds sparingly in the drier western half, mainly in draws of foothills, but fairly abundant in the eastern half.
- Buff-breasted Sandpiper (*Tryngites subruficollis*). Seen several times on the shallow pools in blow-outs after the heavy rain of August 15.
- Spotted Sandpiper (*Actitis macularia*). Breeds sparingly. A common migrant. Seen after July 15 about almost every body of water.
- Long-billed Curlew (*Numenius longirostris*). Breeds. Frequently seen in the sparsely settled western part of the county. No longer found elsewhere except very rarely.
- Killdeer (*Oxyechus vociferus*). Very abundant breeder on the plains wherever moist ground occurs. Fledgelings observed as late as August 5. The Killdeer is certainly our most

common water bird. Almost every pond, or even permanent puddle has its brood and each lake is the home of several pairs. Though in our state killdeers prefer to nest near water, I have found broods who could claim only a small patch of moist earth as their own. But you may be sure this wet ground was claimed as vociferously as though it had been an artesian well pond.

The Killdeer is one of our noisiest of birds. Its loud killdee, killdee, killdee, repeated incessantly is heard so frequently as to be familiar to all. In fact its harshness is such that it often is an unwelcome call. However, I never met a "man with soul so dead" as not to be thrilled by the cheerful calls of the first killdeer to return in March.

This bird has an exasperating habit of signalling the approach of an intruder. Often it will fly a quarter of a mile with loud outcries to meet and scold the sportsman who is trying to get within shot of a flock of ducks, and it will often follow a man or dog a long way, advertising his presence. If the nest of downy young be approached the parents redouble their complaints and may become almost frantic in their endeavors to lead us away. They run ahead, limp, fall over, flutter seemingly helplessly and otherwise pretend to be wounded. I suspect that every boy at least once in his career was so well deceived that he chased after the wounded bird only to find that a sudden cure has taken place. Again and again have I seen a daring mother so tempt a dog by fluttering almost within his reach as to lead him far from her helpless young. Such is the mother instinct!

"The Killdeer is particularly valuable to the farmer on account of its fondness for grasshoppers and for insects of cultivated land. As many as 49 locusts have been taken from a single Killdeer's stomach and the average of six stomachs was 44."

Piping Plover (*Aegialitis meloda*). One seen and heard on Boxelder Creek, July 17-18.

Prairie Chicken (*Tympanuchus americanus*). Fairly abundant resident in the valleys near the Short Pine Hills. Feeds almost solely on "buffalo-berries" during their season, August and September.



Gray Ruffed Grouse (*Bonasa umbellus umbelloides*). One seen in the Short Pine Hills. Fairly abundant in the Long Pine Hills.

Prairie Sharp-tailed Grouse (*Pediocetes phasianellus campestris*). Very abundant resident along the permanent streams and in the park-like area at the top of the buttes and near their base. Broods this year contain about twelve. One nest was found in a clump of "buck-bush" (*Symphoricarpos*). It was only a slight hollow. The stomach of a bird of the year, shot August 14 on the mesa of the South Cave Hills, contained 200 flying ants, 4 small (shorthorned) grasshoppers, 1 small beetle (Chrysomelidae), 1 small caterpillar, 25 black currants, 50 pods of wild flax.

Sage Hen (*Centrocercus urophasianus*). Abundant resident in the areas covered with scrub sage-bush (*Artemisia tridentata*), where water is far distant; therefore mainly found on the terraces in the stream valleys. Eight live tapeworms, the largest a foot long, were taken from the body cavity of an adult female which, though in good health, was solitary..

The Sage Grouse is in many respects one of the most interesting of the birds of many portions of the west. The cock is almost as large as a hen turkey, so he is big enough to attract anyone's attention. All grouse are wonderfully effectively colored from the standpoint of protection. Some, of which the sage hen is one, have so much confidence in their invisibility that they have been dubbed "Fool Hens" because they allow such close approach. It is astonishing how completely hidden a sage chick can be even on bare ground. Many a time I have come upon a mother walking conspicuously along with her brood. When she flew they would squat on the short grass and disappear from sight. It is a mighty good test of acuteness of observation to then try to find all the young. Perhaps some may be located quite easily but others "in plain sight" will not be seen until they fly almost from under one's feet.

Formerly they were found in many sections of western South Dakota and westward. The last ones recorded from this state, except in the northwestern corner, were found in Sage Creek in the Badlands in 1907. By 1910 all were gone except those in

Harding and Butte Counties. Now (1913) after three more years of homesteading Sage Grouse are restricted in this state to the Little Missouri Valley in Harding County and to the headwaters of Indian Creek in Butte. In a very few years they will occur in South Dakota only as a rare winter straggler from Montana.

This wide spread extermination of the Sage Grouse is in spite of the fact that the flesh of all but the youngest Sage Hens tastes so strongly of sage that they are not usually considered edible. Sage hens are somewhat destructive to gardens and are sometimes killed as pests. The young, which are easily shot with a 22 rifle, are used extensively as food.

Polygamy among wild birds is very rare and the Sage Grouse is one of our few examples. The mating dance takes place in April and May and lasts from dawn till well along in the forenoon. Upon an open grassy slope as many as fifty of these stately birds will gather. The cocks walk about with tail wide spread and the neck much distended by the enflatement of the air sacs. Upon approaching a female the male drags one wing on the ground. From time to time the cock utters a dull ringing note which can be heard but a very few rods. The females seem to pay but little attention to the dance nor do they select mates in any obvious manner since several are looked upon with favor during a single morning.

The nest is made in slight depression and contains from seven to nine spotted eggs. The young remain with the mother until winter. They spend the night, not on the lower flats along streams where most of the day is spent, but on the edge of upland frequently near the border of a patch of sand grass. The flock sleep within a few feet of each other. The mother clucks to her very young chicks after the same manner as does the domestic hen.

During the summer the cocks congregate together while unfortunate females are solitary. Sage Hens require drinking water and are hence found near waterholes. Since a few small trees are usually found near our permanent pools, the most frequent place to find Sage Hens in the heat of the day is sprawled out in the shade of the single tree, or under a nearby "cut bank."

Western Mourning Dove (*Zenaidura macroura marginella*).

Though a common breeder in the groves along the streams it is but rarely seen in driving about the country. The Mourning Dove, also known as Turtle Dove, Wild Pigeon, etc., is very plentiful especially in the autumn. It arrives from the south early in April and departs in October or November, depending upon the season. The cooing is one of the most soothing of the notes of our groves. The free, swift flight of the Mourning Dove and the skill with which he manages his airship proclaim him a traveller. As he shoots by over head he cuts the air with the hiss of a bullet. Mourning Doves ordinarily build a slight nest of twigs in low trees but frequently they nest on the ground.

This is one of our most useful birds feeding chiefly upon weed seeds but destroying many grasshoppers in season. Though doves eat considerable grain it is almost entirely the stray kernels which have been spilled along the roads.

Turkey Vulture (*Carthartes aura septentrionalis*). Tolerably abundant summer resident about the higher buttes. Especially abundant about Slim Buttes, where thirty or forty were found roosting together in a large pine tree during the last week of August.

Marsh Hawk (*Circus hudsonius*). A common summer resident on the plains. The Marsh Hawk is certainly our most easily recognized hawk and even it is often misidentified because of the different color phases. The young have a general reddish aspect while the aged birds, especially the males, become quite hoary. However, they always can be known by their white patch on their lower back or rump in connection with their habit of flying close to the ground. They never soar, never fly high, never perch in trees, and very seldom on fences.

The Marsh Hawk is of very great value to the farmer. They are constantly passing to and fro over his meadows on the outlook for mice and gophers. Once in a long while an immature Marsh Hawk, before he has learned to catch mice very well, may pick up chickens now and then. The old birds apparently never bother poultry and deserve the farmer's protection.

- Goshawk (*Astur articapillus*). One seen in the Cave Hills, August 12. One reported by Saunders from near Harding Nov. 7.
- Sharp-shinned Hawk (*Accipiter velox*). Common during the autumn migration, which commenced August 22.
- Cooper's Hawk (*Accipiter cooperi*). Several seen early in September along the Little Missouri Valley.
- Western Red-tail (*Buteo borealis calurus*). A common summer resident throughout the area.
- Krider's Hawk (*Buteo borealis krideri*). Two were observed, apparently near their nest, at the cliff of the Cave Hills.
- Swainson's Hawk (*Buteo swainsoni*). Abundant summer resident.
- Rough-legged Hawk (*Archibuteo lagopus sancti-johannis*). Seen July 14, and three or four times during the last of August and the first of September.
- Ferruginous Rough-leg (*Archibuteo ferrugineus*). Quite abundant on the plains. Nests in the buttes. Especially numerous after August 20.
- Golden Eagle (*Aquila chrysaetos*). A common resident about the high buttes. Aeries were seen in the Cave Hills and in the Short Pines.
- Bald Eagle (*Haliaeetus leucocephalus*). One seen July 20 on the Little Missouri.
- Prairie Falcon (*Falco mexicanus*). Abundant summer resident in the badlands and elsewhere where clay cliffs occur.
- Duck Hawk (*Falco peregrinus anatum*). Rare. Seen twice.
- Pigeon Hawk (*Falco columbarius*). Rare autumn migrant along the Little Missouri Valley.
- Sparrow Hawk (*Falco sparverius*). Abundant summer resident on the plains.
- Osprey (*Pandion haliaetus carolinensis*). One seen September 2 along the Little Missouri River.
- Western Horned Owl (*Bubo virginianus pallascens*). Abundant resident in the badlands and about the stepper buttes.
- Short-eared Owl (*Asio flammeus*). Grinnell reported several from the Little Missouri Valley. I have seen this species chiefly east of the Slim Buttes and in Ferkins County. Under the name of Fanning Owl it is fairly well known there.

- Snowy Owl (*Nyctea nyctea*). A frequent winter visitor. Saunders reports several seen north of Camp Crook December 14.
- Burrowing Owl (*Speotyto cunicularia hypogaea*). Abundant in some of the prairie-dog towns.
- Black-billed Cuckoo (*Coccyzus erythrophthalmus*). One observed July 11 in the Little Missouri Valley within six miles of the Montana line, and a short distance north of Harding County, in North Dakota.
- Kingfisher (*Ceryle alcyon alcyon*). A few pairs nested along the Little Missouri River, and one on the largest stream of Cave Hills.
- Rocky Mountain Hairy Woodpecker (*Dryobates villosus monticola*). Rare summer resident in the forested buttes and along the Little Missouri near Camp Crook.
- Bachelder's Downy Woodpecker (*Dryobates pubescens homorus*). Much more frequently seen than the preceding. A specimen collected near Willet identified by Biological Survey.
- Red-headed Woodpecker (*Melanerpes erythrocephalus*). An abundant summer resident in the groves of the Little Missouri Valley, and sparingly in the buttes.
- Northern Flicker (*Colaptes auratus luteus*). Breeds wherever trees occur; much more frequent east of the Little Missouri than west of it.
- Red-shafted Flicker (*Colaptes cafer collaris*). A common summer resident in and west of the Little Missouri Valley. More rare to the eastward.
- Nuttall's Poorwill (*Phalaenoptilus nuttalli nuttalli*). A frequent breeder in the high buttes. One was seen on the mesa of Cave Hills, one in badlands in Slim Buttes, and a third was flushed in an arroya at the base of Slim Buttes. They were heard each night during the two weeks spent about the Cave Hills in 1910.
- Sennett's Nighthawk (*Chordeiles virginianus sennetti*). Common breeder in the plains. The Nighthawk, often called Bull Bat, is a very picturesque bird. During the day time it sits on fence posts, or stones nearly asleep. Yet when disturbed it may fly about peenting shrilly even in the middle of the hottest and brightest days. In fact the jerky zig-zag flight and loud call of the nighthawk is constantly associated in my

mind with our most sultry days. The loud boom which sounds as the long swoop earth-ward is ended is more frequently heard in the early evening.

The Nighthawk nests on flat stones or on the ground and the eggs and young are so well protected by their coloration as to be very difficult to find.

The food of the nighthawks consists of insects of which myriads are destroyed. As many as nearly 2,000 flying ants have been taken at one time from the mouth and stomach of a single bird. Since such food is digested very rapidly the total number eaten must be enormous.

White-throated Swift (*Aeronautes melanoleucus*). Several pairs nested on the high castellated buttes of Slim Buttes and a few at the north end of the East Short Pine Hills.

Kingbird (*Tyrannus tyrannus*). Nests sparingly, usually in box-elder trees, wherever trees occur. The Kingbird is so well known that it needs but scanty mention. In some parts of the country it is called the bee-bird; but the Biological Survey after the examination of many stomachs has found that though it sometimes catches honey bees, they are usually the large, slow flying drones and not the valuable workers. Since ninety per cent. of his food consists of insects, mostly of grasshoppers, crickets, butterflies, weevils, wild bees, wasps and gadflies it is seen that the Kingbird is another of the farmers' friends.

The Kingbird is pugnacious and does not hesitate to attack and drive away hawks and owls. It scarcely ever molests birds smaller than itself.

Arkansas Kingbird (*Tyrannus verticalis*). Rare in the area under discussion. One pair nested in the foothills of the Cave Hills and two more in the extreme eastern and southeastern portions of the county. Their favorite nesting site, a small tree near a farm house on the plains, is almost lacking as yet.

Say's Phoebe (*Sayornis saya*). Abundant summer resident wherever cliffs occur. Therefore most numerous in the badlands.

Western Wood Pewee (*Myiochanes richardsoni richardsoni*). Nests rarely in the forested parts of the high buttes.

Olive-sided Flycatcher (*Nuttallornis borealis*). One was seen in Slim Buttes August 20.

Alder Flycatcher (*Empidonax trailli alorum*). Nests, not frequently, along the Little Missouri and in canyons of the forested buttes.

Least Flycatcher (*Empidonax minimus*). A pair nested in a grove in a valley in Cave Hills.

Desert Horned Lark (*Otocoris alpestris leucolaema*). One of the four most numerous residents of the plains. A nest with four eggs was found July 15. We estimated that there were perhaps twenty-five adults to each section (640 acres) of land.

The Horned Lark is with us the year round. It is a demure, companionable little bird of roadsides, along which it runs a fearlessly vanguard for travelers; or from which it may be seen perching on wayside fence posts with its little horns raised in curiosity as we pass. Its quaint ditty is usually rendered from the ground, a stone or a post but in the nesting season, which commences as early as March, the males frequently circle around high in the air for several minutes poising repeatedly for an out pouring of song. Since the Horned Lark is a very close relative of the Famous English Sky Lark which always sings on the wing, this trait of our bird might be expected.

So far there is no evidence that Horned Larks are injurious; on the contrary examination of stomachs show that from the large number of weed seeds, and the considerable number of harmful insects eaten, that they are decidedly beneficial.

Magpie (*Pica pica hudsonia*). Common resident in groves in the Little Missouri Valley and in canyons of the buttes which are filled with deciduous trees.

Raven (*Corvus corax principalis*). Reported by Catron to be abundant at Camp Crook during the very coldest weather only. "Ravens were seen almost every day on the way to the Black Hills. They had bred on many of the lofty buttes that we passed." (Grinnell.)

Crow (*Corvus brachyrhynchos*). A common migrant. A few nest near Camp Crook in the Little Missouri Valley.

Clarke's Nutcracker (*Nucifraga columbiana*). A frequent summer resident in the forested Short Pine Hills—no nests found.

Pinion Jay (*Cyanocephalus cyanocephalus*). In 1910 we saw Pinion Jays only in the North Cave Hills; residents inform me that they spread to the Slim Buttes that fall. I found them in the Short Pine Hills in 1911.

Bobolink (*Dolichonyx oryzivorus*). Rare summer residents along the Moreau River.

Cowbird (*Molothrus ater ater*). Grimmell found this species numerous. We found it very rare in 1910 but frequent in 1911 and 1912.

Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*). An occasional migrant only, because of absence of reedy marshes.

Thick-billed Red-wing (*Agelaius phoeniceus fortis*). A common migrant. A few pairs nested in a tiny marsh in the North Cave Hills.

Western Meadowlark (*Sturnella neglecta*). Abundant nester on the plains and on the mesas of the buttes. We estimated that there were about ten pairs to each section of land.

From the standpoint of the agriculturist the meadowlark has few rivals; in fact we know of not a single bad habit. Seventy-five per cent of its food for the entire year is made up of insects. Grass seeds and weed seeds make up the rest. It rarely eats grain of any kind and probably never takes sprouting grain or grain from head or shock. It lives on grasshoppers, crickets, spiders, cut worms, caterpillars and a variety of other insects especially those to be found in meadows. Professor Beal of the Biological Survey calculates that by killing grasshoppers and other insects meadowlarks save for man's use, at the lowest estimate, twenty-five dollars worth of hay per township per year, on the average the whole country over.

Bullock's Oriole (*Icterus Bullocki*). One pair was found nesting in a grove in the Little Missouri Valley July 20.

Brewer's Blackbird (*Euphagus cyanocephalus*). Abundant breeder. Fifty or so fly around together after the breeding season. Ecologically they replace the Cowbird, the Redwing, the Crackle, and the Yellowhead. That is to say, they inhabit groves, etc., much as do the Crackles; they follow the plow,



South Dakota Geological Survey. Plate 5



Western Meadow Lark

- etc., as do the Yellow-heads; they hang about streams as do the Redwings; they follow the cattle as do the Cowbirds; and in addition, they wade in the water as do Snipe.
- Bronzed Grackle (*Quiscalus quiscula aeneus*). Several nested near Reva in Slim in 1911.
- Crossbill (*Loxia curvirostra minor*). A frequent summer resident wherever trees are plentiful. After the breeding season they fly about in flocks of twenty or thirty.
- Redpoll (*Acanthis linaria linaria*). Saunders reports having seen a small flock of Redpolls in the West Short Pines, November 6.
- Goldfinch (*Astragalinus tristis*). Not uncommon during the summer.
- Pine Siskin (*Spinus pinus*). A small flock was seen early in September.
- English Sparrow (*Passer domesticus*). Abundant in the only large town, Camp Crook, even when there was no railroad nearer than 80 miles.
- Snow Bunting (*Plectrophenax nivalis nivalis*). Flocks of Snow Bunting were seen by Saunders during the last half of November, and first half of December, the time he was in that region.
- Lapland Longspur (*Calcarius lapponicus lapponicus*). Reported by Saunders to have been abundant during his stays.
- Chestnut-collared Longspur (*Calcarius ornatus*). Abundant breeder on the plains of the eastern part of the county; less numerous westward.
- McCown's Longspur (*Rhynchophanes maccoeni*). Abundant on the plains. This and the preceding probably outnumber the Horned Larks. A nest containing young just hatched was found July 16.
- Western Vesper Sparrow (*Pooecetes gramineus confinis*). A common summer resident on the plains. Very frequently seen during the first half of September.
- Western Savannah Sparrow (*Passerculus sandwichensis alaudinus*). Seen September 1-6. It may be expected to nest here.

Baird's Sparrow (*Ammodramus bairdi*). Breeds rarely in the moister draws of the steppe. Common as a migrant toward the close of August and early in September.

Western Grasshopper Sparrow (*Ammodramus savannarum bimaculatus*). Nests in the moister blue-stem swales of the eastern part of the area.

Western Lark Sparrow (*Chondestes grammacus strigatus*). A common breeder in the groves along the streams. They left the region about August.

White-crowned Sparrow (*Zonotrichia leucophrys leucophrys*). A few were seen several times early in September.

Western Tree Sparrow (*Spizella monticola ochracea*). Common in the Short Pines in December (Saunders).

Western Chipping Sparrow (*Spizella passerina arizonae*). Rare summer resident along the Little Missouri. Quite numerous in the Slim Buttes during the last half of August.

Clay-colored Sparrow (*Spizella pallida*). Seen once in July on the plains.

Western Field Sparrow (*Spizella pusilla arenacea*). Not uncommon on the foothills of the higher buttes, where suitable situations occur—copses and grass. Occasional elsewhere.

White-winged Junco (*Junco aikenii*). Common nester in the Short and Long Pine Hills. Fledgelings observed July 20 in the Long Pines.

Dakota Song Sparrow (*Melospiza melodia Juddi*). Nests in each of the suitable localities about the buttes. Quite common as a migrant after August 21.

Lincoln's Sparrow (*Melospiza lincolni lincolni*). One collected September 7, 1912, in the East Short Pines.

Swamp Sparrow (*Melospiza georgiana*). One seen August 22 on the Moreau River.

Arctic Towhee (*Pipilo maculatus*). Abundant breeder wherever woods occur.

Black-headed Grosbeak (*Zamelodia melanocephala*). Abundant nester in those parts of the Little Missouri Valley which are well filled with cottonwood groves. One was observed to sing while flying, a song much resembling that of the Western Mockingbird.

Indigo Bunting (*Passerina cyanea*). One seen in the Slim Buttes early in June—probably a wanderer.

Lazuli Bunting (*Passerina amoena*). A rare breeder in the forested buttes.

Lark Bunting (*Calamospiza melanocorys*). One of the most numerous summer residents of the plain. Most of the males have moulted by August first, when migration is under way. However, a mother was observed to feed a fledgeling as late as August 31.

The Lark Bunting is commonly known as the "White-winged Blackbird" which name is chiefly objectional because this bird belongs to the finch, sparrow, or bunting family, and is therefore not a blackbird. In fact only the male can ever be called black and he wears his sable robes during but three or four months. During the rest of the year he resembles the greyish brown female.

He is a delightful songster. He flies to a height of a few rods and then flutters slowly down to earth singing a stimulating lay throughout.

During the nesting season I have observed no tendency to flock, but afterwards when the immature are able to fly they gather sometimes in immense flocks and sit around on the fences and weeds "as if they had nothing to do."

Western Tanager (*Piranga ludoviciana*). An abundant breeder in the Short Pines in June, 1911.

Cliff Swallow (*Petrochelidon lunifrons lunifrons*). Abundant nester on the cliffs of badlands and along streams wherever such cliffs occur. The only swallow seen frequently.

Barn Swallow (*Hirundo erythrogastra*). A pair or two nest about the sheds of each of the old ranches, and in Camp Crook. They do not wander far from their nests.

The Barn Swallow is perhaps our best known swallow, though we have several others which are very abundant in many localities. Our other kinds are all colony builders, but the Barn Swallow generally nests a pair or two to a barn. It builds an open mud nest. The Eve or Cliff Swallow makes a covered mud nest; the Bank and Rough-winged burrow into banks, while the Tree Swallow nests in trees and the Violet green in crevices in cliffs and the Martin in bird boxes.

Though we wonder about the strange and varied nesting instincts of the swallows, their most wonderful trait is their remarkable powers of flight. They circle about with such rapidity as to almost defy efforts to continually follow with the eye their movements.

"No bird is better loved by the average country dweller. With absolutely no bad habits, believed to subsist entirely upon winged insects (mosquitoes, flies, etc.) and always graceful, beautiful and musical, this bird has few rivals in the affections of the real nature lover."

Bank Swallow (*Riparia riparia*). One small colony is established on the North Fork of the Grand River.

Bohemian Waxwing (*Bombycilla garrula*). A large flock is reported to have spent several days in the Short Pine Hills during February, 1910, and to have been conspicuous throughout the winter of 1910-11.

Cedar Waxwing (*Bombycilla cedrorum*). A common summer resident in the pine-forested parts of the buttes.

White-rumped Shrike (*Lanius ludovicianus excubitorides*). Abundant summer resident of the plains. Nests in the scattered trees which occur along the intermittent creeks.

The Shrike is a peculiar bird. Though it is far less abundant in numbers than many other of our birds it is noticed very frequently because of certain of its traits. It spends much of the day sitting on telephone and fence wires where the big head and tail are held in odd positions. When persons pass along the road the shrike flies slowly by rapid beating of small wings, off on a level until near the next landing place when it swoops almost to the ground and as it alights it sails nearly vertically. This position is very favorable for the display of its distinctive color pattern—suggesting a crazy quilt of black and white.

This shrike, often called summer butcher-bird, is considered decidedly beneficial. The greater part of its food consists of large insects of which it sometimes kills more than it eats, leaving the rest empaled on the barbs of fences. Mice are frequently eaten. Our shrikes nest about tree claims and other clumps of trees. The nest is a bulky affair of small twigs.

Red-eyed Vireo (*Vireo olivaceus*). Not a rare nester in the wooded canyons of Slim Buttes.

Western Warbling Vireo (*Vireosylva gilva swainsoni*). Common during the summer in the woody areas.

Yellow Warbler (*Dendroica aestiva*). Nests commonly in the canyons along the brooks of the buttes, and along the Little Missouri.

The Yellow Warbler or yellowbird is often called "The Wild Canary" because it resembles the canary. The black and yellow goldfinch, however, might more correctly be so named since it belongs to the canary or sparrow family. The yellow bird is our most common warbler and because it nests abundantly in willow thickets, small groves and orchards it is quite frequently seen. As it flits about it distinctly suggests a flash of golden sunlight. Its simple song has a pleasing happy ring and a surprising penetration. The food of warblers consists very largely of insects.

The Yellow Warbler arrives from the tropics during the first week in May and departs early in August. The nest is built very soon and is commonly placed in some low bush or shrub, often a rose bush. It usually is made largely of light-colored flaxen materials gathered from various weed stalks and is often lined with the cotton from the seeds of willow and cottonwood.

The Yellow Warbler is constantly victimized by the Cowbird, which you know is too lazy to rear its own young. Where this parasite is abundant many deserted nests are found containing from two to four eggs of the Cowbird with or without some of the warblers' own. This clever warbler sometimes covers a cowbird's eggs with a new layer of material, and I have found two nests where a second "false bottom" had been added to cover additional eggs of the intruder, resulting in a three storied nest.

Audubon's Warbler (*Dendroica auduboni*). Nests in the pine forests of the higher buttes; fairly common.

Ovenbird (*Seiurus aurocapillus*). Nests in the Short Pine Hills. Fledglings seen in the Long Pines.

Grinnell's Water-Thrush (*Seiurus noveboracensis notabilis*). Three seen along the river early in September.

Western Yellow-throat (*Geothlypis trichas occidentalis*). Breeds commonly along the permanent streams.

Long-tailed Chat (*Icteria virens longicauda*). Nested abundantly in the most wooded portions of the Little Missouri floodplain.

Wilson's Warbler (*Wilsonia pusilla*). An abundant migrant, arriving August 19.

Redstart (*Setophaga ruticilla*). Several pairs nested in the Slim Buttes in 1911. Common along the Little Missouri River in September, 1912.

Sprague's Pipit (*Anthus spraguei*). Common breeder on the grassy plains of the northeastern part of the country. Abundant migrant. The call, che,che, is then frequently heard.

Western Mockingbird (*Mimus polyglottos leucopterus*). An individual was closely observed by W. H. Over of Date near Rabbit Butte, Perkins County, on August 12, 1912. Mr. Over is familiar with this species and I do not doubt the accuracy of the record which extends its range from the southern Black Hills.

Catbird (*Dumetella carolinensis*). Not common during the summer, in the groves along the streams.

Brown Thrasher (*Toxostoma rufum*). More numerous than the preceding, in similar situations.

Rock Wren (*Salpinctes obsoletus*). Breeds abundantly wherever steppe slopes with crevices occur. Hence especially noticeable in badlands and on the cliffs of the steep-sided buttes.

Western House Wren (*Troglodytes aedon parkmani*). Nests abundantly in the more wooded portions of the Little Missouri Valley and in the pine forests of the high buttes.

The House wren is as energetic a little bird as you could want. They are all the time on the go. They sing with all their might. Their notes fairly tumble over each other, they are poured out so fast. At times the little musicians become so ecstatic that they raise their quivering wings high over their backs.

The food of the wren is almost entirely insects. "Half of the food consists of grasshoppers and beetles and the other half is made up of almost equal quantities of caterpillars, bugs, and spiders."

- Rocky Mountain Nuthatch (*Sitta carolinensis nelsoni*). Seen November 8 in the East Short Pines, by Saunders.
- Red-bellied Nuthatch (*Sitta canadensis*). A common resident in the pines of the buttes.
- Long-tailed Chickadee (*Penthestes articapillus septentrionalis*). Breeds abundantly in the forests of the buttes. Common later in the woods elsewhere.
- Olive-backed Thrush (*Hylocichla ustulata swainsoni*). Frequent migrant. Taken in September, 1912, near Camp Crook.
- Willow Thrush (*Hylocichla fuscescens salicicola*). Not uncommon along the Little Missouri, August 27-September 3.
- Robin (*Planesticus migratorius migratorius*). Seen several times in August, 1910.
- Western Robin (*Planesticus migratorius propinquis*). Nested quite plentifully in the Short Pines in 1911. The two varieties of robins differ most noticeably in regard to white on the tail. The eastern robin has some, and the western has none.
- Bluebird (*Sialia sialis*). Common breeder in the pines of the higher buttes.
- Mountain Bluebird (*Sialia currucoides*). A brood was seen in the Short Pine Hills. Grinnell also reports seeing a brood of young there in 1874.

## V. A PRELIMINARY LIST OF MAMMALS OF HARDING COUNTY.

Compiled by S. S. Visher.

[Elk (*Cervus canadensis*). Formerly were doubtless abundant. The last were killed in 1879 when a large crew cut trees for the N. P. R. R. in the Long Pines. We found two skulls in the Cave Hills, one of which was well preserved. Some of the older settlers have fine antlers.]

Western Whitetailed Deer (*Odocoileus virginianus macrourus*). Until quite recently this deer was fairly plentiful in the forest reserves. In 1910 we saw deer or certain evidences in each. During the winter of 1910 over thirty were killed in Slim Buttes. It is believed that they are now nearly exterminated.



[Blacktailed Mule Deer (*Odocoileus hemionus hemionus*). Blacktails were formerly found in the brakes along the Little Missouri and near the "Jump Off" north of the East Short Pines. They were exterminated by 1900.]

[Big horn Sheep (*Ovis montanus*). "Sheep Mountain," a large butte at the end of Slim Butte is reported to have been until the 90's the home of the mountain sheep. The older settlers state that in the 80's they were found on each of the buttes.

Pronghorned Antelope (*Antilocapra americana*). Antelope were until about 1900 very plentiful in this region. In 1910 we saw four or five bunches. A cowboy who rode about a good deal estimated that there were over 500 in the county that summer. In spite of a fine and a year's imprisonment for killing this beautiful animal they are rapidly disappearing. Although I visited the most likely portions of the county in 1912 I saw none, though I learned that there is still a small bunch in a large pasture a short distance north of Camp Crook.

[Buffalo (*Bison bison*). In 1874 the Custer expedition in crossing this area saw no buffalo. An old settler reports seeing a small bunch in 1886. Judging from the large number of skulls with bullet holes through them, the "market shooters" who killed the buffalo solely for the hide must have slaughtered many here. Northeast of the north Cave Hills and west of the South Cave Hills we came across groups of numerous skeletons. In one place more than 13 must have been killed within a few rods of each other.]

Dakota Red Squirrel (*Sciurus hudsonicus dakotensis*). I collected a red squirrel in the Long Pines in July, 1910. They are reported to have been seen in the West Short Pines also.

Western Chipmunk (*Eutamias quadricitatus borealis*).\* Quite abundant in badlands and about streams near scattered trees.

Striped Gopher (*Citellus tridecemlineatus pallidus*). With the coming of the homesteader gophers are increasing in numbers though they are far from plentiful. They are smaller as well as paler than the common eastern form.

Richardson Ground-squirrel (*Citellus richardsoni*). This northern gray gopher or "flicker-tail" was seen only in the ex-

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\*A specimen of chipmunk from near the mouth of the Moreau river has been identified by the Biological Survey as *Eutamias pallidus*.



Beaver Dam on Rabbit Creek.

treme northwestern corner of the county. It supplements the striped gopher in much of North Dakota.

[Gray Gopher (*Citellus Franklini*). One was seen in extreme eastern Perkins County. With the settlement of the region it will probably extend its range westward into Harding County.]

Prairie-dog (*Cynomys ludovicianus*). Very large towns occur. One covering several sections was driven across west of the Little Missouri river. Most of the towns are along the "flats" of the streams. There is a small one, however, on the table of the West Short Pine Hills.

Pack Rat (*Neotoma cinerea*). Quite plentiful and general, several killed. (One from the mouth of the Moreau River was determined by the Biological Survey).

Beaver (*Castor canadensis canadensis*). Beaver occur in various sections of this area. Freshly gnawed trees were seen along the Little Missouri and its chief tributary, Boxelder Creek, and along the forks of the Grand River. Numerous recent dams were found in 1910 along Bull Creek between the north and south Cave Hills and in "The Devil's Gulch" in the North Cave Hills.

Common House Mouse (*Mus musculus*). Not yet common. Most of the mice about the houses come in from the prairies.

[Large Grasshopper Mouse (*Oryzomys leucogaster leucogaster*). Doubtless common on the grasslands.]

Whitefooted or Deer Mouse (*Peromyscus maniculatus nebrascensis*). Plentiful in the open groves along the Little Missouri and elsewhere. We trapped three in one trap in one night. This mouse is one which enters the homesteader's cabins. (A specimen from Pierre has been determined by the Biological Survey).

Large Meadow Mouse (*Microtus pennsylvanicus modestus*). The common short-tailed mouse.

[Small Meadow Mouse or Little Vole (*Microtus haydeni*). Also doubtless abundant.]

Muskrat (*Fiber zibethicus cinnamominus*). Fairly plentiful along the streams having deep permanent "holes." (A specimen of this variety taken at the mouth of the Moreau River has been identified by the Biological Survey).

Pocket-gopher (*Thomomys talpoides talpoides*). Pocket-gopher mounds are quite frequent especially on some butte sides.

Prairie Jumping-mouse (*Zapus hudsonius campestris*). Kangaroo mice or "rats" have been taken by Mr. Over in Perkins County.

Porcupine (*Erethizon epixanthum epixanthum*). We ran on to several porcupines and signs of their work as barkers of young pine trees were plentiful in the forest reserves.

Jack-rabbit or Prairie Hare (*Lepus campestris*). Fairly common in this area.

Western Cottontail (*Lepus nuttalli*). Quite plentiful in the groves.

[Canada Lynx (*Lynx canadensis canadensis*). George Craig and others claim that specimens of this lynx have been taken recently in the Cave Hills.]

Bobcat (*Lynx rufus*). Plentiful in the badlands and entering the buttes where our party saw one in 1910.

Kit Fox or Swift (*Vulpes velox velox*). While the Swift is so rare here that a rancher has hunted with hounds for years without ever seeing one, it nevertheless undoubtedly occurs. We saw one along the Little Missouri Valley in North Dakota. Catron reports having trapped a few.

Prairie Red Fox (*Vulpes regalis*). Catron reports having trapped two or three red foxes in this county. Another reports them not rare about the Long Pines.

Gray or Buffalo Wolf (*Canis occidentalis occidentalis*). Quite plentiful. As an indication of its abundance I may quote figures given me in 1910 by Assistant Forest Supervisor Haines: A government trapper caught 5 adult and 25 pups in two months about the Short Pines and 2 adults and 11 pups about the Cave Hills in two months.

Coyote (*Canis latrans nebracensis*). Generally considered as abundant. However, in 1912, I traveled very widely throughout this area and saw but one though in 1910 and 1911 I saw several. Haines gave me the following data concerning the number taken by government trapper in the Short Pines in two months: 34, in the Cave Hills, 2 months, 22. These were the same periods during which the gray wolves were trapped and scarcely indicate the relative abundance of the two because of the greater bounty on the Gray. The same trapper took 102 coyotes and but 4 wolves in a whole winter (1909-10) in the Ekalaha Forest.

Otter (*Lutra canadensis canadensis*). This wide roving animal has been recently trapped along the Little Missouri River.

Long-tailed Weasel (*Putorius longicauda longicauda*). The weasel, which during winter when it is white is called the ermine, is quite common here. During the summer of 1910 we saw 4 or 5 dead ones along the roads.

Mink (*Putorius vison vison*). The mink is not common. Some trappers report never having caught one, but they occur. My friend, Alvin Mentzer, trapped one on Bull Creek in Feb., 1911.

Skunk (*Mephitis (Chincha) hudsonica*). This large skunk is uncommon in this area.

Little Skunk (*Spilogale interrupta*). The "spotted skunk" or "civet cat" is much more common than the large skunk.

Badger (*Taxidea taxus taxus*). Quite common.

Raccoon (*Procyon lotor lotor*). I know of the killing of two raccoons in Perkins County.

Puma (*Felis concolor*). A puma or mountain lion visited the East Short Pines in the winter of 1910-11. It was doubtless a roamer from the larger Long Pines or Ekalaka Forests.

[Grizzly (*Ursus horribilis horribilis*). In the early 90's a grizzly was killed a short distance southwest of Camp Crook. Years before they were doubtless fairly plentiful in this area.]

[Black bear (*Ursus americanus americanus*). It is reported that a black bear was seen near the Cave Hills in July, 1910. Bears have been recently killed in the Long Pine and Ekalaka forests, but their day of extermination is here near at hand.]

[Shrew (*Sorex personatus personatus*). Though we have no specimen of the shrews from this county the species certainly is present.]

Little Brown Bat (*Myotis lucifugus lucifugus*). Abundant about the groves along the Little Missouri and in the forest reserves. (Determined by the Biological Survey).

[Say Bat (*Myotis subulatus*). Some of the little brown bats we saw may have been of this species.]

[Silver haired Bat (*Lasionycteris noctivagans*). This small black bat was probably seen in the canyons of the Cave Hills.]

Large-eared Bat (*Corynorhinus macrotis pallescens* Miller). Several made Ludlow Cave their home in early September, 1912. One was sent to the biological survey for determination.

Hoary Bat (*Myotis (Lasiurus) cinereus*). This very large bat is doubtless a migrant to this area. I saw an individual, I believe, of this species late in August, in a plum thicket (a specimen taken in July at the mouth of the Moreau River has been determined by the Biological Survey.)

## VI. A PRELIMINARY LIST OF THE REPTILES AND AMPHIBIANS OF HARDING COUNTY.

By S. S. Visher.

Prairie Rattle Snake (*Crotalus confluentus*). After questioning many persons we concluded that where several rattles are killed in a year on a quarter section rattlers are considered to be "very abundant." One may drive or ride a couple hundred miles without seeing one. Mr. Over reports an interesting case of abundance. In the summer of 1912 he saw not a one until early in August; nor another until October first. During the first two weeks of October he killed 27 in a very limited locality.

Bull Snake (*Pityophis catenifer sayi*)\*. The "yellow gopher" snake is the most abundant of the snakes, except along some of the streams where the garter snake is more plentiful.

Blue Racer (*Bascanion constrictor flaviventris*). Occasional on the plains.

Western Hog-nosed Adder (*Heterodon nasicus*). Fairly frequent on the sandy portions of the floodplains.

Garter Snake. (*Thamnophis sirtalis*). The most abundant snake; along all streams.

Horned Lizard (*Phrynosoma douglassii hermandesi*). Horned "Toads" are according to my experience quite common in this general area, though large sections seem to be without them. I have found them chiefly in the rougher portions of the steppe—about such buttes as Wage Pole butte and on the borders of badlands.

Mud Turtle or Terrapin (*Malococlemmys geographica*). Plentiful in streams.

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\*Specimens of these varieties were determined by Dr. Alx. Ruthven of the U. of Michigan Museum.

Snapping Turtle (*Chelydra serpentina*). Fairly frequent in water holes.

Common Toad (*Bufo americanus*). Quite plentiful especially around buildings.

Great Plains Toad (*Bufo cognatus*). This "leopard" toad was met with twice, once just west of the North Cave Hills and the other time near the Slim Buttes. This apparently establishes a new northern limit to its range.

Tree Frog (*Acris gryllus*). I captured an individual of this species near the dump-pond in the East Short Pine Hills.

[Spade-foot Toad (*Scaphiopus hammondi bombifrons*). This toad ought to be found in this county, though we did not succeed in finding it. It comes out only after heavy rains and such were very rare in 1910, 1911, which may account for not seeing any.]

Common Leopard Frog (*Rana pipiens*). Green frogs are most plentiful along the springs in the buttes, but are locally abundant elsewhere. We had several meals on them.

Mud Puppy (*Nocturus maculosua*). Mud Puppies believed to be of this species were seen several times. They are quite common about cellars, etc.

## VII. A PARTIAL LIST OF THE INSECTS COLLECTED IN HARDING COUNTY.

### *Orthoptera* (Grasshoppers)

(Named by Prof. L. P. Morse, Ph. D., Wellesley College.)

Sparogemon. Barren Ground Locust.

Melanophus. Two striped Locust.

Asphia.

Opeia

Dactylotum pictum. Brilliant Locust.

Brachystola magna. Giant Grasshopper.

### *Coleoptera* (Beetles)

(Named by Wm. M. Mann, Bussey Institution, Harvard University.)

Agonoderus pallipes.

Amara sp. (New?)  
 Caligrapha lunata.  
 Cincindela longilabrus var montana. Tiger Beetle.  
 Cincindela punctulata. Tiger Beetle.  
 Dicerca elongata.  
 Disonycha triangularis  
 Galerucella notulata.  
 Histera abbreviatus.  
 Lebia furcata.  
 Pachybrachus bivittatus.  
 Saprinus lugens.  
 Trirhabda canadensis.

*Hymenoptera*

(Named by Wm. Mann.)

Agatheis.  
 Philanthus.

*Lepidoptera* (Butterflies)

(Collected and named by B. B. Rowley.\*)

Argynnis adwardsi.	Dnoisa pluxippus.
Agynia electa.	Erynnis uncas.
Argynnis idalea.	Euptoieta claudias.
Argynnis meadi.	Hispiris montivaga.
Argynnis nevadensi.	Lycaena comyntus.
Apatela quadrata.	Lycaena lycia.
Autographa sp.	Lycaena melissa.
Basilarchia weidemeyeri.	Lyneda divergens.
Chrysophanus rubidus.	Phycoides phaon.
Coelnonympha inornata.	Primba sp.
Colias scudderi.	Pyramus atalanta.
Colias philodin.	Satyrus baroni.
Cymatophora ribcaria.	Scoliopteryx lilatrix.
Drasteria crassiuscula.	Thanaos martialis.

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\*Rowley's collection together with additional specimens collected by Visher were submitted to specialists in 1912, but no returns have been received. However, it is believed that the determinations are fairly correct and hence this provisional list is published.



## VIII. LIST OF MOLLUSCA OF HARDING AND PERKINS COUNTIES.\*

Collected by Wm. H. Over and Determined by Dr. H. A. Pilsbry  
of Academy of Natural Sciences, Philadelphia, Pa.

*Lymnaea bulimoides cockerelli* Pils & Fer. Common in water-  
holes.

*Lymnaea palustris* Mull. The most common freshwater shell in  
state.

*Lymnaea Caperata* Say. In waterholes, not abundant.

*Lymnaea bullimoides* var. *techella* Hald. Near Camp Crook.

*Lymnaea humilis* var. *modicella* Say. Springholes in East Short  
Pine Hills.

*Lampsilis luteolus* Lamk. Rare, only one specimen collected in  
Little Missouri river at Camp Crook.

*Anodonta grandis* Say. Several seen in North Grand river, near  
Grand River, P. O.

*Physa sayi* Tapp. Springholes in West Short Pine Hills.

*Physa gyrina* Say. Near Antelope Creek.

*Physa integra* Hald. Little Missouri river north of Camp Crook.

*Planorbis exacuus* Say. Antelope creek, Perkins county.

*Planorbis deflectus* Say. Antelope creek, Perkins county.

*Planorbis trivolvis* Say. Waterholes 7 miles north of Camp Crook.

*Planorbis tinidus* Pfr. Antelope creek.

*Planorbis umbilicatellus* C'k'll. Waterholes near Rabbit Butte.

*Euconulus fulvus* Mull. Damp shady places in Slim Buttes.

*Succinea avara* Say. Floodplain Little Missouri River at Camp  
Crook.

*Succinea grosvenorii* Lea. Collected from under sagebrush and  
cacti. The most abundant land shell in the plains country.

*Pisidium contortum* Ptime. Springs in Slim Buttes.

*Musculium jayense* Prime. Waterholes near Sorum.

*Sphaerium striatum* var. *acuminatum* Prime. Little Missouri  
River.

*Vallonia gracilicosta* Reinh. Camp Crook and West Short Pine  
Hills.

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\*As Perkins County joins Harding on the east and the topography is  
nearly identical, it is probable that all specimens listed from Perkins  
could be found in Harding County.

*Agriolimax campestris* Binn. Slim Buttes.

*Bifidaria armifera* Say. Wooded ravines in Slim Buttes.

*Bifidaria armifera agna* P. & V. Wooded ravines near Antelope Creek.

*Bifideria armifera* var. *abbreviata* Str. Shady places in Slim Buttes.

*Zonitoides arboreus* Say. Wooded ravines in Slim Buttes.

*Pyramidula cronkhite* var. *anthonyi* Pils. Collected in moist shady places in Slim Buttes, West Short Pine Hills and at Camp Crook.

## IX. NOTES ON ANIMALS AND PLANTS OF ECONOMIC IMPORTANCE.

BY S. S. VISHER.

### I. ANIMALS OF PREY.

(a). The *gray wolf* is moderately plentiful, and because of the proximity of rough lands will probably continue to give some trouble to horse and cattle raisers for some years to come.

(b) *Coyotes* are plentiful. However, fences that are coyote proof are not difficult to make.

(c) Weasels and skunks are especially feared by poultry raisers. Since their activities are limited to the hours of darkness, precautions can easily be taken against their entrance.

(d) Hawks and owls are, with a couple of exceptions, very great allies of the farmer, because they live on gophers and rabbits. Consequently, they ought by all means be permitted to live. The only owl which is destructive to poultry is the very large Horned Owl which is occasionally seen in this area. The Sharp-shinned Hawk, a rather small, swift-flying hawk, is the only one found at all regularly here, which merits destruction. Persons who discriminately shoot every hawk or owl that they can get at are extravagant to say the least.

(e) All the snakes are useful. The only one that has any serious faults is the rattler. Even they do much good, and exceedingly rarely do any damage. However, they are rapidly approaching extinction.

## 2. GREGARIOUS OR VERY ABUNDANT ANIMALS.

(a) The *prairie dog* is locally abundant. The poisoning of these pests is comparatively such a simple task that no one need have a town near his land unless he is too lazy to get rid of it. Large towns have been entirely destroyed by one application of poisoned food done properly and at the right time.

The poisons found most satisfactory, and recommended by the Biological Survey of the Department of Agriculture are (1) Sulphate of strychnine. Care should be taken to secure *strychnine sulphate* since the strychnine usually sold by druggists is insoluble in water. One and one-half ounces of strychnine sulphate to a bushel of grain is sufficient. The strychnine should be dissolved in 2 1-2 gallons of water by heating in a covered receptacle. After thoroughly dissolved, add the grain and allow to stand over night. The grain will absorb the liquid. In distributing the grain, one-half teaspoon full should be put just outside of each hole, and had better be distributed during the evening hours.

(2) One ounce of strychnine sulphate dissolved in one gallon of water mixed with green alfalfa or green, growing grain cut in lengths of 2 to 4 inches and distributed in the evening so that it may be eaten before it is dried by the sun, is usually entirely successful.

(3) Crude bisulphide of carbon suitable for killing burrowing animals costs about 8 cents per pound in 50 pound carboys or drums. It is a volatile liquid and hence should be kept tightly corked. It is highly explosive. A tablespoonful of crude bisulphide should be poured in a piece of dried horse manure, corncob or other absorptive material and this should be thrown as far as possible down a burrow into which a prairie dog has just disappeared. The burrow should be immediately closed. Bisulphide can be used to best advantage after a heavy rain.

It should be clearly understood that the method recommended by the government consists of two steps—(1) to destroy the great bulk of the inhabitants of the colony by poisoning with strychnine in winter or early spring when food is scarce; (2) to kill the remaining animals with bisulphide of carbon. In this way it is believed that colonies of any size may be wiped out at a total cost of not to exceed 16 or 17 cents per acre, probably less.

(b) *Gophers*. The carbon bisulphide method of killing prairie dogs can be applied to gophers. Trapping and digging-out as well as shooting is very much more simple with gophers than with prairie dogs, and is usually sufficient.

(c) *Rabbits* are chiefly destructive to young fruit trees and gardens. We heartily recommend that anyone setting out an orchard or garden to first have it fenced with a rabbit-proof fence.

(d) *Wild Mice* are caught in baited traps even more easily than the house mouse. Of course, the best way to keep down the mice in the fields and meadows is to allow hawks, owls and snakes to be unmolested.

(e) *Blackbirds, crows, magpies, and jays* are all highly useful during the most of the year. Occasionally they are troublesome for short periods. At such times it is recommended that they be frightened away rather than killed.

(f) *Grasshoppers* are abundant but ordinarily not destructive. It is occasionally worth while to soak binding twine in tar.

(g) *Striped potato beetles* can usually be controlled by proper application of Paris Green. Since the few individuals which winter are the ones which multiply sufficiently to cause the trouble, it is good economy to go over the patch shortly after the potatoes are up and to kill these adults before they have laid eggs. If clumps of yellow eggs are observed on the lower side of the leaves they ought to be destroyed. During a hot day this can be most delicately done by picking off that portion of the leaf and allowing it to dry up. The bur-tomato, or buffalo-bur thistle (*Solanum rostratum*) is frequent in this area, especially on deserted ground. This plant is fed upon by the potato beetle, which by its means can exist long distances from potato fields. Since these plants are easily killed, the wide awake farmer, and the one who endeavors to save himself future work will cut down all available plants of this species. This plant, by the way, is the original food plant of the potato beetle (*Leptinotarsa decimlineata*). Until the cultivated potatoes were introduced into its range, this beetle was found only occasionally, as we found it, on the scattered *Solanum rostratum*.

### 3. PARTICULARLY USEFUL ANIMALS.

(a) *Insectivores*: All birds feed their nestlings upon insects, worms or other soft animal food. Most birds subsist almost to-

tally upon insect life during the summer months. Almost all birds in summer time, especially the so-called song birds are useful and many are so highly useful as to be almost invaluable. Every farmer can well afford to put himself out to encourage the birds. In many treeless localities a clump of trees or a plum thicket would attract them. It is an excellent plan to place water in such a position as to be accessible for drinks. Cats which are not valuable "mousers" ought by all means to be destroyed.

(b) *Carnivores*: Coyotes, hawks and other animals of prey are valuable as destroyers of rodents such as rabbits, mice and gophers. In regions where there are no sheep, and where reasonable precautions are taken with the poultry, even coyotes are useful animals.

(c) *Seed eaters*: Many of the birds subsist chiefly on seed, except during the summer months. All kinds of seed is eaten, but since the most available ones are usually seeds of weeds the birds are very effective weed destroyers. The flock of sparrows, usually of several species, flushed from the weed patches in fall and spring are doing a good work for the farmer and should be appreciated.

(d) *As sources of food*. Rabbits are always good food though without a doubt, young rabbits and those not having "grubs" are most attractive. Ducks, geese and snipe are all excellent food. It is indeed a short sighted person, that kills these birds in the spring after breeding is under way. Grouse and bobwhites or quail present first class flesh. They however are exceedingly valuable as destroyers of grasshoppers. Let anyone who maintains that these birds eat much grain before it is harvested, examine the crops of such as are available. Since these birds have practically no bad faults, and have such excellent qualities, as sources of food and as destroyers of insects, it would indeed be a pity to have them exterminated.

#### 4. NATIVE PLANTS AS INDICATORS OF AGRICULTURAL POSSIBILITIES.

"Land which bears a pure short-grass cover was found to be supplied with water in the surface foot or two of soil only, and usually even to that depth for but a brief period during spring and early summer. Land with a uniform cover of tall grasses was found to be supplied with water to a much greater depth and to offer conditions favorable for plant growth during a much longer

season. As a connecting link between these two conditions a short grass cover which supports a scattered growth of taller plants was found to indicate intermediate conditions as regards water supply.

"The area of greatest agricultural value one year with another are those marked by the presence of the wire-grass vegetation. Of almost equal value are the areas characterized by those phases of the grama-buffalo-grass vegetation which are distinguished by the presence of a considerable quantity of *Psoralea* or of wire-grass. Bunch grass land is best for crops during especially dry years, but is relatively the least productive during favorable years. Typical short-grass land (grama-buffalo-grass association) produces more than any other type during wet years, but is first to fail in time of drought." (From Bulletin No. 201 Bureau of Plant Industry U. S. Dept. Agri. 1911.)

#### 5. POISONOUS PLANTS.

(a) *Locoæcd.* This is a low, stemless plant having a few pinnate leaves and a clump of small, white flowers which resembles those of beans. The seeds are borne in capsules which rattle when dry. Stock which get the habit of eating this plant finally gets "locoed." Horses are especially susceptible, particularly young horses. The loco leaves are green after the grass has turned dry, and also early in spring. It is eaten more or less by all live stock. It is dangerous only when an animal gets the habit of making it the main article of its diet. This most frequently takes place when the supply of grass is short.

*Symptoms.* Two stages are recognized. The first, which may last several months or longer is accompanied by defective eyesight and many queer actions. After acquiring a taste for the plant it refuses every other kind of food and the second stage, characterized by sunken eyeballs, lusterless hair and feeble movements, is ushered in. The animals die from starvation in periods ranging from a few months to one or two years.

*Treatment of locoed animals.* Animals in the earlier stages can be cured by depriving them of opportunities of obtaining loco, and feeding them on nutritious food. Probably nothing is better for locoed horses and cattle than turning them, under proper conditions, into a field of alfalfa. Locoed animals are constipated.

If alfalfa or alfalfa and oil meal are not effective in overcoming this, Epsom salts may be given (mature cattle does—1 pound; calves, 2 oz.; horses, 8 oz.; sheep, 4 oz.) Animals chronically locoed in addition need a remedy to overcome nervousness. For horses arsenic in the form of Fowler's solution (4-6 drams) given in the grain or drinking water is effective after a considerable time, usually more than a month. Cattle respond best to hypodermic injections of exceedingly small daily doses (3 to 4 twentieths of a grain) of strychnine. Locoed cattle are easily killed by doses which would be considered small in ordinary veterinary practice. It is usually necessary to treat cattle for thirty days or more.\*

On the principle that an ounce of prevention is worth a pound of cure, careful stock men will keep their stock out of pastures badly infected with loco until the grass has started well in the spring, and at other times when the grass is short. It is not a difficult plant to kill the loco plants—chopping them off just below the ground is sufficient.

(b) *Poison ivy*. This low, three-leaved shrub is found in the woods and upon north-facing hill sides and about the buttes. The leaves resemble those of the boxelder. The poisoning is caused by a non-volatile oil and is not spread by the blood. It causes swellings, itchings, and finally, in bad cases, running sores. The oil is readily dissolved and can be washed off by 50-75 per cent. alcohol. If all the sugar of lead (Lead acetate) which will be readily dissolved be added to weak alcohol a cure can be secured as a result of several applications a day for a few days. Applications of castile soap are beneficial.

(c) *Snow-on-the-mountain*. (Euphorbia). Honey made from the flowers of this plant is hot and disagreeable to the taste and causes vomiting and purging. The milky juice of this plant may cause skin eruptions similiar to those produced by poison ivy. This blistering is, in fact so decided that a few stock raisers in Texas use the juice to brand cattle, it being held by them to be superior to red-hot iron for that purpose, because the scar heals more satisfactorily.\*\*

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\*These notes on the treatment of locoed stock are taken from Farmers Bulletin 280 U. S. Department of Agriculture.

\*\*According to Farmers Bulletin 86.

## 6. PLANTS USED IN MEDICINE.

Quite a variety of plants which are used in medicine and for which, under proper conditions, have a market value, occur in this county. For directions concerning collecting, as well as description, price, etc., see Farmer's Bulletin 188 U. S. Dept. of Agriculture which can be secured free of charge through your Congressman or Senator. A list of the plants treated in this bulletin which are found somewhat commonly in these counties are as follows:

- Tansy (*Tanacetum vulgare*).
- Gum plant (*Grindelia squarrosa*).
- Yarrow (*Achillea millefolium*).
- Fleabane (*Eriogonon* [*Leptilon*] *canadensis*).
- Wormseed (*Chenopodium ambrosioides*, etc.).
- Mustard (*Brassica nigra* and *Sinapis alba*).

At least two other species not mentioned in Farmer's Bulletin 188, of considerable medical importance are locally common in this area.

- Oregon grape (*Berberis aquifolium*). (Rhizons and roots).
- Slippery elm (*Ulmus fulva*). (Inner bark).

## 7. PLANTS AS SOURCES OF FOOD.

The chief wild fruits are (1) the *plum* found in thickets along all wooded valleys (2) *chokecherry* found with the plum (3) *sand-cherry*, occasional on buttes, etc. (4) *buffalo-berry* found in thickets along streams, especially in the badlands. (5) wild *goose-berry* and *currants* along the flood plains and in the woods. (6) The *June* or *service berry* occurs scattering in brush especially in the forest reserves.

Herbs used somewhat for food include the Indian Turnip (*Psoralea*), ground cherry (*Physalis*), and night shade (*Solanum*).

## 8. PLANTS AS SOURCES OF WOOD.

With about 100,000 acres of Harding County included within national and state forest reserves, the natural assumption is that there is considerable timber of economic importance. Before the establishment of the federal reserves there had been saw mills in each of the forest buttes, and many of the larger trees were



then cut. Certain treeless areas apparently favorable for tree growth are doubtless the result of former extensive fires.

At present there are encouraging young growth of pine (*Pinus Scopulorum*) upon most of the north facing slope in the forest reserves, and locally elsewhere in the reserves. Ash thickets have been of great value in furnishing fence posts. There is still a considerable supply in the Sioux Reserve. Red cedar is now quite rare in Harding County. The most extensive thickets we noted were in the Bad Lands just east of the East Short Pine Hills. Extensive cedar brakes occur in North Dakota along the Little Missouri River a few miles north of the state line. The remnant of what was formerly a very valuable supply of cedar timber is found in Cedar Canyon, etc., on the south side of the Moreau River a short distance southeast of our area.

The only extensive groves of cottonwood in Harding county are found in the Little Missouri Valley in Camp Crook.

#### 9. WEEDS.

Weeds are not troublesome in Harding County. This is due mainly to the dryness. The common weeds require more water than is available. An additional fact is that as yet but few weeds have been introduced and established because of the newness of the region agriculturally. Fields almost perfectly free from weeds are frequent.

SOUTH DAKOTA  
GEOLOGICAL SURVEY

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Biennial Report of the State Geologist  
for 1913-14

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ELLWOOD CHAPPELL PERISHO  
University of South Dakota, Vermillion  
1914

# THE GEOLOGICAL SURVEY OF SOUTH DAKOTA

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## REPORT OF THE STATE GEOLOGIST

ELLWOOD CHAPPELL PERISHO,

University of South Dakota, Vermillion, 1914.

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The work of the State Survey is of vital interest to the people of South Dakota. This interest is both educational and economic. Few fields of endeavor furnish such returns to the people for so small an expenditure of money.

The Survey has been active the last two years along the following lines of work:

I. General Information. A large number of inquiries from the citizens of the state concerning mineral specimens, clays, soils, climatic conditions, artesian and common wells, plants, birds, coal, oil, etc., are being constantly received and answered. All this is without charge and hence must be a saving of no small amount to our citizens. All the people of the state are urged to make use of the Survey by sending in specimens of minerals, clays, birds, plants, and mammals for identification or other information desired.

II. The State Museum: For years the State Geologist has been anxious to see the collections made by the Survey put into a more permanent and accessible form. The importance of having a State Museum in which the type forms of life, especially those found in our state, are properly classified, labelled, mounted, and systematically arranged, is so self-evident that it needs no argument. Such a collection of the representative forms of life would prove to be of great value as an educational factor. There is certainly no one in the state who would not only endorse this idea but be glad to aid in its accomplishment. The Survey was exceptionally fortunate in securing the services of William H. Over who has devoted much time the past year in assisting the Department of Geology of the University and the Survey in collecting, classifying and arranging specimens for the Museum. Aside from three or four months in the summer occupied in the field, his whole time was devoted to museum and laboratory work.

Early in 1913, work was started on the mounting and labelling of the large collection of the type botanical specimens of our state, mostly collected by S. S. Visser under the direction of the Survey. This was accomplished and a metallic case was purchased and placed in the Museum to contain the plant collections. This gives the state an exceptionally valuable herbarium so arranged that it may be used as a work of reference by all who are interested in botany or the plants of the state. The collection is especially rich in the flora of the Black Hills, Forest Reserves, western plains and many other localities of the state. We yet need to make extensive collections of the early spring flowers in a number of counties before the herbarium reaches its maximum of completion and usefulness.

Another valuable addition to the Museum in the spring of 1913 is a large case of old Indian stone, flint and bone articles, of 2,000 specimens, about 500 of which belong to the department and represent the implements of warfare, the chase, and ornamentation of the Arickaree Indians, who formerly lived on the Missouri River in South Dakota. The balance of the collection was loaned by William H. Over. It is valuable on account of representing the implements of prehistoric races of America, and is the largest and best collection of old flint and stone relics in South Dakota.

A large case of land and freshwater Mollusks were also loaned by William H. Over and displayed to the public. There are nearly 1,000 species of shells in the collection, properly identified and labelled, representing the Mollusca from all parts of the world. One hundred and thirty species of Unionidae or clams of our rivers and lakes are shown in this case. In the display there is also a series showing the economic products of the clam shell as manufactured at the pearl button factories along the Mississippi river.

A collection of one hundred twenty-five species of woods were received from the Philippines and properly displayed.

In addition to a number of skins, forty-five mounted birds and seven mounted mammals including a black bear and a coyote have been added to the Museum during the year 1913. The taxidermy work was done by H. E. Lee of Rapid City and William H. Over. Many valuable specimens were presented by friends to the Museum during the year. Every one was properly labelled

with the donor's name. The Survey wishes to especially thank the following for donations or loans: Dr. Franklin Gault, Tacoma, Wash., Snowy Owl; Roy C. Davis, Vermillion, bear, monkey, and fifteen mounted birds, loaned; Roy C. Davis, Lamprey and Kriender's Hawk, donated; Floyd Bond, Custer, specimen of tremolite, loaned; Professor A. L. Haines, Vermillion, fossil sponge, polished, donated; E. D. Cowles, Vermillion, petrified wood, and screech owl, donated; Carlton A. Haines, Vermillion, Bat, Garter Snake and Mole, donated; W. J. Jones, Rolling Bay, Wash., section of pile from dock showing effects of ravages of ship worm; Maurice Chaney, Vermillion, Lamprey, donated; Floyd Bond and O. R. Skola, Screech Owl, donated; Wm. H. Over, one hundred species of land and freshwater shells, donated; Peter Lund, Vermillion, Am. Long-eared owl, donated; Wm. Bauman, Gophers and moles, donated; Van Buren Perry, Aberdeen, fossils and minerals, donated; William Siders and Ronald Jordan, Vermillion, three Bats, donated; Lewis Kephart, Vermillion, Bats, donated; Lewis Ort-mayer, Vermillion, large Hornets' nest, donated; John Visher, Vermillion, Barnacles, donated; L. A. Riter, Vermillion, American Merganser duck, donated; Harold Howard, Vermillion, Indian Maul, donated.

In addition to arranging the accessions, Mr. Over has classified many of the specimens already in the Museum, and made a catalogue of all plants, birds and mammals.

III. Field Work: Stephen S. Visher, and Wm. H. Over, visited Harding County for the Survey during the fall of 1912. This trip was made to complete the herbarium collection and continue geological observations. Collections were especially made in and around Slim Buttes, South Grand River, Cave Hills, Little Missouri River, East and West Short Pine Hills, and Crow Buttes. This route covered the most interesting part of the county, from a geological and biological standpoint, and part of the material for this bulletin was obtained on this trip.

Some work was done along archeological lines in the Cave Hills, where it was discovered that the old tribes of Arickaree Indians had long ago used for living rooms, the eroded-out depressions or "Caves" in the sandstone walls. Fragments of pottery, flint and bone articles were found and in one place their

pictograph writings showed plainly and drawings were taken for future reference.

Mr. Barthold Iverson did some valuable field work for the Survey in the eastern part of the state upon the artesian well problem.

The State Geologist has spent a limited amount of time in field work in the northwest part of the state making a study of the general geology with special reference to the lignite coal beds. Also in the Southern Black Hills, principally upon the mica and lithia ore formation. A valuable mineral collection was added to the Museum by this trip. He has also made many observations and collected data concerning the Artesian water supply for eastern South Dakota.

Wm. H. Over devoted the summer to field work. The month of June was spent upon the fauna and flora of Clay County. Some four hundred plant specimens were obtained. Special attention was paid to the collecting of grasses of this locality. Many specimens of Reptiles, Amphibians and Mollusks were taken.

During July, August, September and part of October Mr. Over was camping at different localities in the southwestern part of Stanley County, Washabaugh and Lawrence Counties. In Lawrence County about four hundred plant specimens were procured, forty-five species being new to our Black Hills collection.

In Stanley County the time was occupied in the Badlands collecting fossils, however, nothing of interest in geology or biology was neglected. Perhaps the most valuable specimen collected was an almost complete fossil skull of the ancestral rhinoceros, (*Caenopus Tridactylus*) found in the Oligocene formation. This was found embedded in a sandstone layer. Later it was worked out of the sandstone matrix and is now on exhibition in the Badland fossil case.

A number of specimens of fossil Turtles were found, two of which are new to our Museum collection of turtles.

The skull of a fossil *Elotherium* was found in the Oligocene. This mammal was about the size of, and perhaps allied to the ancestral hog. A new species of *Helix*, a fossil land shell, was also found.

Many teeth and parts of a skeleton of the fossil *Mesohippus bairdi*, or ancestral three toed horse, were collected and much

time and effort was spent in hunting for enough of the little horse to warrant us in attempting the construction of a skeleton for the Museum, but without success.

Two hundred and fifteen species of plants were collected from Stanley County and seventy from Washabaugh County, about twelve hundred specimens, including duplicates. All plants collected from Clay, Stanley and Washabaugh Counties and the Black Hills were properly named and a true type from each species was labeled, mounted and placed in the Museum Herbarium. The duplicates were all labeled and may be used in exchange for specimens from other Universities.

The Mollusca of the different localities visited, was also collected and will be properly identified.

Much attention was paid to the collecting of mammal skins and especially the rodents and bats. These were identified by the United States Biological Survey and many new species were added to our Museum. One species of pocket gopher (*Thomomys Clusius*) and one of bats (*Myotis californicus ciliolabrum*) were the first records for the state. Bird Skins of about forty species were taken in Stanley County and the Mountain Plover (*Podasocys montanus*) is a new record for the state. Eighty specimens of Reptiles and Amphibians were collected and are in the Museum. A number of these were identified by Alexander G. Ruthven of the University of Michigan.

Many insects, including grasshoppers, beetles, moths and butterflies were taken in the different localities visited and are in the Museum.

IV. Publications. Bulletin IV may be secured upon request. It contains the following articles:

- 1st. Preliminary Report of the Geology of the Northwestern Central South Dakota—Professor J. E. Todd, formerly State Geologist.
- 2nd. Preliminary Report on the Geology of Gregory and Tripp Counties.—Ellwood C. Perisho.
- 3rd. List of Birds, Mammals and Plants of the old Rosebud Reservation.—A. B. Reagan and Sheridan R. Jones.
- 4th. Drainage of South Dakota.—Professor A. B. McDaniel, University of South Dakota.

Bulletin V., published last year, may be procured upon request. It contains the following articles:

1st. Report on the Geography and Geology of Mellette, Washa-  
baugh, Bennett and Todd Counties.—Ellwood C. Perisho and  
Stephen S. Visher.

2nd. A Preliminary Report on the Biology of this Area.—Stephen  
S. Visher.

Bulletin VI., published in 1914, and may be procured upon  
request. It contains:

1st. A Preliminary Report on the Biology of Harding County.  
Stephen S. Visher, under the following subjects:

List of Birds, Plants, Mammals, Reptiles and Amphibians,  
Insects and Mollusks.

Notes on Animals and Plants of Economic Importance.

2nd. Biennial Report of State Geologist.

The Survey has much material, including field notes, manu-  
scripts, etc., which should be published as soon as funds are avail-  
able.

The above will include material for two bulletins; one on the  
Geology and Mineral resources of Northwest South Dakota. The  
other, The Birds of South Dakota.

V. WORK TO BE DONE. There are a number of in-  
vestigations that the Survey should do for the people of our  
state. Among these may be mentioned:

1. The continuation of the collecting and proper mounting of  
the type fauna and flora. The longer this work is delayed the  
more difficult it will be to procure the needed specimens. A sum  
expended now, in the biological work of the Survey, will accom-  
plish much more than even a large appropriation can do in a few  
years hence.

It is the wish of the Survey, not only to locate and discuss and  
put to the service of the people the economic products of the  
state, but also to form a good working museum, where there will  
be found, in usable condition, the type fauna and flora of South  
Dakota. We are certain that everyone, especially teachers and  
students, will be interested in seeing a large and complete collec-



tion of the mammals, birds and insects, trees, wild flowers and grasses, all properly mounted and described.

It is well known that the Surveys of our neighboring states have published educational Bulletins concerning the animal and plant life of their respective areas. No one questions the value of such publications, nor doubts the propriety of extensive appropriations made for such purposes. The people of our state not only need, but are frequently requesting this information, and they should have it.

2. The services of a competent person for the entire year should be retained to do field and museum work. Specimens collected during the summer should be prepared, classified, labeled and properly mounted as quickly as possible. In addition to the collections made during the regular field trips, the Survey secures a large number of specimens during the winter months, which should demand immediate attention. Without such an assistant, individual and entire collections are stored away in boxes for months and at times for years. The work of Wm. H. Over the past year has been exceptionally helpful.

3. In a prairie country like South Dakota, the supply of building material is always a most interesting problem. Our state is rich in clay, cement and building stones. The exceptional varieties of clays found, especially in the western part of the state, should be carefully investigated with reference to the manufacturing of brick as well as to tile and pottery possibilities. If properly studied the almost natural cement character of extensive beds of clay west of the Missouri River, might become of great economic value to the settlers.

4. Few problems now before the people of South Dakota can be of more vital interest than the one of fuel supply. As yet we have no oil, and but little natural gas, used for economic purposes. Our extensive Forest Reserves, with the limited amount of timber, is inaccessible to most of our population. The people of the state spend annually for fuel, millions of dollars more than the entire yearly gross output of the Homestake and all other mines, and all of our cement plants, brick yards and stone quarries. It is not certain as yet whether we have oil in usable quantities beneath the surface, nor do we know if we have an extensive field of gas which we may draw upon for fuel. These should be  
Sig.—8.

determined. However it is known that we have beds of Lignite Coal, which may be converted into briquetts. In this form our lignite can be easily shipped and used in every way that the hard coal of the eastern states are now being utilized. When ever cheaper transportation is obtained along the Missouri River, or a fuel supply at less cost is accessible, then the inexhaustible beds of Niobrara Chalk, Ft. Benton and Ft. Pierre shales may become the sources of the greatest cement manufacturing plants the country has ever seen.

South Dakota should have cheaper fuel. The Survey must help in this problem if necessary.

5. THE ARTESIAN WATER SUPPLY. Too much emphasis cannot be placed upon the importance of our artesian wells. No fact is better known, than that the water is decreasing in many of these wells. If the decrease in pressure is due to the loss of water, this must be caused by one of the following reasons: (1) Drainage into rivers which have cut into the water-bearing stratum. (2) Loss of water at the artesian wells. It seems probably that the very sudden decline in the flow of our wells is due to the loss at the well. This loss may be either through the pipe at the surface or around the pipe below the surface into porous beds. The whole problem of our artesian wells should be carefully studied by our Survey in order that proper precautions may be taken to conserve this great resource.

If careful investigation shows that the amount of water escaping through the tube at the surface is quantitatively important, laws regulating the size of wells and the flow of water, must be passed and enforced. At present less than 5 per cent. of the water supplied by the artesian wells is used. However, if investigation proves that much more water leaks into porous beds below ground than escapes at the surface, then great efforts will have to be taken to save our artesian well supply, since leaks usually become larger and larger. That there be no hole around the pipe through which water can escape will have to be required by law. At the time of the first piping of new wells, proper precaution can easily be taken. Methods for stopping the leaks in the older wells will have to be devised. That we have been careless in the past concerning our artesian wells, the greatest

mineral product of the eastern part of the state, is evident to all. The time for action has certainly come if this great resource is to be shared by our children.

VI. FUNDS NEEDED. The survey should publish other bulletins during the coming period:

Bulletin VII, on the Geography, Geology and Coal Resources of Northwestern South Dakota, especially Harding and Perkins Counties; Bulletin VIII, a preliminary report on the birds of South Dakota; Bulletin IX. A revised "List of the Plants of South Dakota."

The Legislature appropriated \$3,000 for the past biennial period. In consideration of the work which ought to be done and the reports now awaiting publication, we feel that the appropriation for the coming period should be at least \$2,000 or \$2,500 a year. If all problems outlined above are to be advantageously undertaken a larger fund will be required.

The policy of the Survey is to do those things which will be of the most real value to the people of the State. This work should be educational as well as simply utilitarian in character. The advancement of knowledge, as well as the development of industries, must be an aim of this organization. The State Survey of South Dakota exists for all the people of the state. The Survey cordially invites the hearty co-operation of all the people of South Dakota.

To assist in making the work of the Survey as efficient as possible, Professor Christian P. Lommen of the Department of Biology, and Dr. Alfred N. Cook of the Department of Chemistry, of the State University, fill the positions of Biologist and Chemist respectively.

ELLWOOD C. PERISHO,  
State Geologist.

# INDEX

Numbers refer to pages of the Biological Section. Figures referring to pages of the scientific lists where specific names will be found are in each case the last numerals given.

<b>A</b>	<b>Page</b>		<b>Page</b>
Abronia .....	29, 44	Antelope .....	14, 17, 20, 88
Acanthus .....	81	Antennaria .....	26, 63
Accipeter .....	76	Anthemideae .....	64
Acer .....	23, 52	Antilocapra .....	88
Acerates .....	56	Anthus .....	86
Aceraceae .....	52	Ants .....	17
Achillea .....	16, 26, 102, 64	Apatela .....	94
Acris .....	93	Apocynaceae .....	56
Actinella .....	16, 64	Apocynum .....	56
Actitis .....	71	Apple, balsam .....	60
Adder .....	92	Apple family .....	49
Adder tongue Family .....	32	Aquila .....	76
Aegialitis .....	72	Arabis .....	16, 46
Aeronautes .....	78	Aragallus .....	26, 50
Agastache .....	58	Archibuteo .....	76
Agatheis .....	94	Ardea .....	70
Agelaius .....	80	Argemone .....	46
Agonoderus .....	93	Argynnis .....	94
Agrinomia .....	48	Aristida .....	16, 35
Agnolimax .....	96	Arrowhead .....	30
Agropyron .....	16, 34	Artemisia .....	16, 18, 19, 26, 27, 29, 64
Agrostemna .....	44	Asclepias .....	56
Agrostis .....	16, 34	Ash .....	23, 56
Alfalfa, wild .....	51	Asio .....	76
Alisma .....	30, 34	Asparagus .....	39
Alismaceae .....	34	Aspen .....	23, 26, 40
Allium .....	16, 19, 39	Asphia .....	93
Allonia .....	29, 44	Aster .....	16, 19, 61
Alopecurus .....	34	Golden .....	16, 27, 61
Ambrosia .....	29, 63	Astragalinus .....	81
Amara .....	94	Astragalus .....	16, 19, 26, 50
Amaranthaceae .....	44	Astur .....	76
Amaranthus .....	18, 44	Atheropogon .....	35
Amblystegium .....	67	Atriplex .....	27, 43
Amelanchier .....	23, 49	Autographa .....	94
Ameiurus .....	30	Avocet .....	71
Ammondromus .....	82		
Amorpha .....	16, 50	<b>B</b>	
Amphibian .....	14, 30, 93	Badger .....	17, 20, 91
Anacardiaceae .....	52	Badlands .....	14, 27
Anas .....	69	Conditions .....	27
Andropogon .....	16, 26, 29, 34	Life .....	27, 28
Androsace .....	56	Bahia .....	64
Angiosperms .....	33	Baldpate .....	69
Anemone .....	45	Balm .....	58
Anodonta .....	30, 95	Bartramia .....	71
Anogra .....	16, 54	Bascanion .....	92
		Batrachium .....	30, 45
		Basilaichia .....	94

	Page		Page
Bats .....	24, 27, 91, 92	Bromus .....	24, 35
Bayonet, Spanish .....	26	Bryum .....	67
Bean		Euchlo .....	16, 35
Buffalo .....	16, 50	Bubo .....	76
Wild .....	51	Buckwheat .....	41
Bear .....	14, 91	Bufo .....	93
Beaver .....	30, 31, 89	Buffalo, S. D. ....	28
Bedstraw .....	24, 26, 60	Buffalo .....	84
Beetles .....	17, 30, 98, 93	Bufflehead .....	70
Beckmannia .....	35	Bugseed .....	43
Bell, blue or hair .....	26, 60	Bunting .....	83
Berberis .....	102, 46	Lark .....	17, 21, 83
Berry		Butorides .....	70
Bear .....	55	Bush, buck .....	23, 60
Buffalo .....	23, 27, 102, 53	Rabbit .....	27, 61
Rasp .....	49	Sage .....	65
Service .....	23, 102, 49	Salt .....	27, 43
Straw .....	24, 48	Skunk .....	26, 52
Wolf .....	60	Buttercup .....	30, 45
Berberidaceae .....	46	Buttes	
Betulaceae .....	41	Birds of .....	26
Betula .....	41	Conditions of .....	25
Bidens .....	31, 63	Location of .....	11
Bifderia .....	96	Mammals of .....	27
Bighorn .....	14, 28, 88	Plants of .....	25, 26
Biology of the past .....	12	Slim .....	11, 12, 17, 27, 28
Birch .....	41	Buzzards .....	26
Birds .....	13, 14		
List of .....	68	Cactaceae .....	53
Plains .....	17, 20	Cactus .....	18, 53
Bison .....	14, 88	Calamogrostis .....	35
Bittern .....	70	Calcarius .....	81
Bitter, sweet .....	24, 52	Calcegrapha .....	94
Blackbirds .....	80, 98	Callitriche .....	52
Brewers .....	17, 80	Callitrichaceae .....	53
Blazing star .....	16, 18, 60	Calochortus .....	16, 39
Blite, goats .....	43	Calomospiza .....	83
Blowouts .....	11, 29	Calomovilfa .....	35
Bluebird .....	26, 87	Camas .....	39
Bnuim .....	67	Camelina .....	46
Bobcat .....	90	Campanula .....	26, 60
Bobolink .....	80	Canis .....	90
Bog .....	30	Canvas back .....	69
Boleosoma .....	31	Canyons .....	23
Bombycilla .....	84	Capparidaceae .....	47
Bonasa .....	73	Capper family .....	47
Boneset .....	27, 61	Caprifoliaceae .....	60
Borage .....	57	Capsella .....	15, 46
Boraginaceae .....	57	Carex .....	30, 37
Botrychium .....	32	Carduus .....	24, 65, 68
Botaurus .....	70	Carophyllaceae .....	44
Bouteloua .....	16, 35	Carum .....	55
Box elder .....	23, 52	Carthartes .....	75
Brachystola .....	93	Castelleja .....	59
Brachytecium .....	67	Castor .....	89
Branta .....	70	Catabrosa .....	31, 35
Brassica .....	102, 46	Catostonus .....	30
Brauneria .....	16, 19, 63		

	Page		Page
Catbird	86	Colias	94
Catnip	58	Collomia	57
Cattail	31, 33	Colors of flowers	20
Catron, S.	68	Colymbus	68
Cave Hills	11, 23, 25	Comandra	41
Cedar	26, 27, 103, 33	Commelinaceae	39
Celastris	24, 52	Composites	60
Celtis	23	Of steppe	16
Centrocerus	73	Coneflower	16, 64
Cerastium	26, 44	Convallariceae	40
Cervus	87	Convolvulus	56
Ceryle	77	Convolvulaceae	56
Chaenactis	64	Coot	70
Chaetochloa	35	Corispermum	43
Chamaenerion	54	Coreopsis	63
Chara	30	Corvus	79
Chat	24, 86	Cornaceae	55
Chelydra	93	Cornus	23, 55
Chenopodium	16, 27, 102, 43	Corydalis	46
Chenopods	16, 43	Corynorhinus	27, 92
Cherry		Cottontail	24, 90
Ground	29, 102, 58	Cottonwood	11, 12, 103, 23
Choke	102, 49	Cowbird	80
Sand	26, 102, 49	Coyote	15, 17, 20, 96, 99, 90
Chickadee	26, 87	Crane	14, 70
Chicken, Prairie	72	Crataegus	23, 49
Chipmunk	24, 27, 88	Crawfish	14
Chondestes	82	Creeper, Virginia	24, 53
Chordeiles	77	Crepis	66
Chrysopsis	16, 27, 61	Crook, Camp, S. D.	17
Cicely, sweet	55	Crossbill	24, 81
Cichorieae	66	Crotalus	92
Cicuta	30, 55	Crow	79, 98
Cieindela	94	Crucifers	16, 46
Cinquefoil	48	Crustacia	30
Circus	75	Crypanthe	57
Cirsium	66	Cucumber, wild	60
Citellus	88	Cucurbitacea	60
Cladonia	66	Cuckoo	77
Clam	30	Currants	23, 102, 48
Clay, Pierre	17	Cyanocephalus	80
Cleavers	60	Cymatophora	94
Clemantine	24, 45	Cymapterus	19, 55
Clematis	45	Cymareae	65
Cleome	29, 47	Cynomys	89
Climatic conditions		Cyperaceae	37
.....	12, 18, 25, 27, 28	Cyperus	38
Cloudiness	15		
Clover		<b>D</b>	
White	51	Dactylotum	93
Prairie	16, 51	Dafila	69
Cockle	44	Dasiophora	48
Cocklebur	64	Deer	24, 28, 87
Cocoyzus	77	Dendroica	85
Coelnonynpha	94	Dicerca	94
Cogswellia	16, 55	Disonycha	94
Colaptes	77	Disporum	24, 40
Coleoptera	93	Distichlis	35

	Page		Page
Dock	30	Fish	14, 30, 31
Dog, prairie	17, 20, 23, 97, 89	Buffalo	30
Dogbane	56	Bullhead	30
Dogwood	23	Cat	30
Dolichonyz	89	Dace	30
Dove	24, 75	Darter	31
Donisa	94	Minnows	30
Draba	46	Sucker	30
Drainage	11	Trout	31
Drosteria	94	Flats, grassy	14, 22, 23
Drought, results of	19	Flax, Marsh	63
Drupaceae	49	False, wild	16, 46, 52
Drymocallis	48	Fleabone	102, 62
Dryopteris	32	Flicker	24, 77
Ducks	14, 30, 69	Flicker-tail	88
Dumetella	86	Flies	17, 30
<b>E</b>			
Eagle	26	Flower	
Echinochloa	35	Bunch	39
Echmocystis	60	Cone	18, 64
Ecological formations	14	Pasque	18, 45
Elaeagnaceae	53	Sun	64
Eleocharis	30, 38	Twin	24, 60
Elgruns	35	Wall	16, 46
Elk	14, 87	Flycatcher	24, 78, 79
Elm	23, 102, 41	Four-o'clock	44
Empidonax	79	Fragaria	24, 48
Epilobium	30, 54	Franseria	29, 63
Eptesicus	24	Fraxinus	23, 56
Equisetaceae	33	Fritillaria	39
Equisetum	33	Frogs	30, 93
Erethizon	24, 90	Fox	17, 90
Ericaceae	55	Fulica	71
Ericoma	36	<b>G</b>	
Erigeron	16, 62	Galeracella	94
Eriogonum	16, 26, 29, 41	Galium	24, 60
Ermine	17	Gallinage	71
Erynnis	94	Gammarus	31
Erysimum	16, 46	Gaura	16, 19, 54
Euconulus	95	Gavia	69
Eupatorieae	60	Gayophytum	54
Euphagus	80	Geese	70
Euphorbia	19, 29, 101, 52	Gentiana	56
Euphorbiaceae	52	Gentianaee	56
Euptoieta	94	Geum	24, 26, 47
Eurotia	43	Geothlypis	86
Eutamias	24, 27, 88	Gilia	26, 57
<b>F</b>			
Falco	76	Glyceria	36
Falcon	26, 27	Glycyrrhiza	50
Felis	24, 91	Golden-rod	16, 19, 24, 62
Fern	24, 26, 32	Gold-finch	24, 81
Festuca	36	Gooseberry	23, 102, 48
Fiber	89	Goosefoot	43
Filix	24, 32	Gopher, pocket,	17, 20, 27, 98, 89
Fires, Prairie	19, 25	Stripped	17, 20, 98, 88
		Grackle	81
		Gramineae	34

	Page		Page
Grape .....	53	Heath family .....	55
Oregon .....	102	Hedeoma .....	58
Gratiola .....	30, 59	Helenieae .....	64
Grass Family .....	34	Heliantheae .....	63
Grass		Helianthus .....	16, 69
Alkali .....	35	Helodromas .....	71
Arrow .....	30, 33	Hemlock, water .....	30, 55
Blue .....	37	Hen, sage .....	73
Blue stem .....	16, 34	Herb, willow .....	30, 54
Brome .....	24, 35	Hérons .....	30, 70
Buffalo .....	16, 18, 35	Heterodon .....	92
Bunch .....	26, 29, 35	Heuchera .....	47
Canary .....	31	Hieraceum .....	66
Cord .....	20, 31	Hills	
Dropseed .....	37	Cave .....	11, 23, 25, 30
Foxtail .....	35	Short Pine .....	11, 25, 27, 28
Grama .....	16, 18, 35	Hoarhound .....	30, 58
June .....	36	Hop .....	24, 41
Marsh .....	37	Hordeum .....	24, 36
Mat .....	31	Horsetail .....	33
Meadow .....	37	Humidity .....	23
Needle .....	29, 37	Humulus .....	24, 41
Pepper .....	46	Hirundo .....	83
Reed .....	35	Hydrophyllaceae .....	57
Redtop .....	24	Hyllocichla .....	87
Sand .....	29, 35	Hymenopappus .....	64
Squirreltail .....	24, 36	Hymenoptera .....	94
Spear .....	37	Hyssop .....	30, 58
Tickle .....	16, 34	Hisperis .....	94
Wheat .....	16, 18, 34	Histera .....	94
Wild rye .....	24, 36		
Wire .....	16	<b>I</b>	
Grasshoppers .....	17, 98, 93	Ictalarus .....	30
Grassy Flats .....	14, 22	Icterus .....	80
Grebes .....	68, 69	Ictiobus .....	30
Grindelia .....	16, 102, 62	Indian-Pipe .....	55
Grinnell, G. B., .....	68	Insects ..	13, 14, 29, 30, 31, 93
Grizzly .....	91	Inulca, tribe .....	63
Grosbeak .....	24, 82	Iridaceae .....	40
Gromwell .....	51	Iris .....	40
Grossulariaceae .....	48	Iva .....	64
Grouse, sharptailed ..	14, 23, 26, 73	Ivy, Poison .....	24, 101, 52
Grus .....	70		
Gull .....	69	<b>J</b>	
Gutierrizia .....	18, 27, 62	Jay .....	26, 98, 80
		Juncaceae .....	39
<b>H</b>		Juncaginaceae .....	34
Hackberry .....	23	Junco .....	26, 82
Halerpestes .....	30, 45	Juncus .....	30, 39
Haliaeetus .....	76	Juniper .....	26, 33
Haw, Black .....	23, 60	Juniperus .....	26, 27, 33
Hawks .....	96, 99, 75, 76		
Marsh .....	17, 75	<b>K</b>	
Redtailed .....	26, 76	Killdeer .....	17, 30, 71
Swainson .....	17, 76	Kingbird .....	24, 78
Sparrow .....	24, 76	Kingfisher .....	30, 77
Hawthorne .....	23, 49	Kinnkinick .....	55
Hawkweed .....	66	Koeleria .....	36
		Kuhnia .....	27, 61



L	Page	M	Page
Labiatae .....	58	Machaeranthera .....	27, 62
Lacinaria .....	16, 18, 60	Macrocalyx .....	57
Lactuca .....	66	Madia .....	64
Lampsilis .....	95	Magpie .....	24, 98, 79
Lanius .....	84	Mallard .....	69
Lappula .....	57	Malvaceae .....	53
Larus .....	69	Mamillaria .....	53
Lark, Horned .....	17, 20, 79	Mammals ....	14, 17, 20, 31, 87
Lasiurus .....	24, 92	Mann, Wm. M., .....	93
Lasionyctaris .....	91	Malvastrum .....	16, 19, 53
Lavauxia .....	54	Maple family .....	52
Lead-plant .....	16, 50	Mareca .....	69
Lebia .....	94	Marigold .....	31, 63
Legumes .....	16, 50	Marila .....	69
Legummosae .....	50	Marshes .....	29, 31
Lemna .....	38	Marsileaceae .....	32
Lemnaceae .....	38	Marsilia .....	32
Lepargyreae .....	23	Meadowlark ....	17, 21, 23, 80
Lepidoptera .....	94	Melanophus .....	93
Lepidium .....	46	Melanthaceae .....	39
Leptilon .....	102, 62	Melilotus .....	51
Leptinotarsa .....	98	Melospiza .....	82
Lepus .....	24, 90	Mentha .....	30, 58
Lesquerella .....	16, 47	Mentzelia .....	27, 53
Leucrinum .....	16, 19, 39	Mephitis .....	24, 91
Liatris .....	16, 60	Merganser .....	69
Lichens .....	66	Mergus .....	69
Light .....	15	Meridolix .....	16, 54
Liliaceae .....	39	Mertensia .....	58
Lily, Prairie .....	16, 39	Mink .....	30, 91
Gumbo .....	27, 54	Mice .....	14, 17, 24, 98, 89
Linumorchis .....	31, 40	Micropalama .....	71
Linaceae .....	52	Microtus .....	89
Linnaea .....	24, 60	Milfort .....	64
Linum .....	16, 19, 52	Mint .....	30, 58
Lithospermum .....	16, 57	Horse .....	24, 58
Lizards .....	13, 14, 92	Minus .....	86
Loasaceae .....	53	Minium .....	67
Loco .....	16, 26, 100, 50	Missouri, Little .....	11, 23
Locust .....	93	Mocking-bird .....	86
Longspur .....	17, 21, 81	Mollusca .....	95
Loon .....	69	Molothrus .....	80
Lophodytes .....	69	Monarda .....	24, 58
Lotus .....	16, 51	Monocots .....	16
Loxia .....	81	Monolepis .....	44
Lupine .....	16, 29, 51	Monotropaceae .....	55
Lupinus .....	16, 29, 51	Morning glory .....	56
Lutra .....	91	Bush .....	18, 57
Lycaena .....	94	Morse, L. P., .....	93
Lychnis .....	45	Mosses .....	67
Lycopus .....	30, 58	Moth, Sage .....	23
Lycodesmia .....	16, 18, 66	Mountain, Table .....	25
Lymnaea .....	30, 95	Moraceae .....	41
Lyneda .....	94	Mosquitoes .....	31
Lynx .....	24, 90	Muhlenbergia .....	36
		Mulberry .....	41
		Mus .....	89

	Page
Musculium .....	95
Mustard .....	102, 46
Mycteris .....	92
Myiochones .....	78
Myotis .....	91

**N**

Naradaceae .....	33
Nastursian .....	47
Navarretia .....	57
Nelson, Aven .....	32
Neotoma .....	24, 27, 89
Nettion .....	69
Nettle .....	24, 41
Nimexia .....	24, 40
Nighthawk .....	17, 77
Niggerhead .....	16, 63
Nocturus .....	93
Nothocalais .....	66
Notropis .....	30
Nucipaga .....	80
Numenius .....	71
Nutcracker .....	80
Nuthatch .....	87
Nuttallornis .....	79
Nyctaginaceae .....	44
Nyctea .....	77
Nycticorax .....	70

**O**

Oak .....	12
Oenothera .....	54
Odocoileus .....	24, 87
Oleaceae .....	56
Oleaster family .....	53
Olive family .....	56
Omychomys .....	89
Onagra .....	16, 54
Onagraceae .....	54
Onion .....	16
Opeia .....	93
Ophioglossaceae .....	32
Opuntia .....	53
Orchid .....	31, 40
Orchidaceae .....	40
Oreocarya .....	16, 58
Oriole .....	80
Orobanche .....	29, 59
Orobanchaceae .....	59
Orthocarpus .....	16, 59
Orthoptera .....	93
Orthotrichum .....	67
Otocoris .....	79
Otter .....	30, 91
Ovenbird .....	85
Over, W. H., 13, 32, 86, 92, 95	
Ovis .....	88
Owls .....	96, 76, 77

	Page
Burrowing .....	17, 23, 76
Horned .....	26, 27, 76
Oxalis .....	16, 51
Oxyechus .....	71

**P**

Pachybrachus .....	94
Pachlophus .....	27, 54
Pandion .....	76
Panicum .....	36
Papaveraceae .....	46
Parmelia .....	67, 66
Paronychia .....	45
Parsnip family .....	55
Parthenocissus .....	24, 53
Passer .....	81
Passerculus .....	81
Passerina .....	83
Pea family .....	50
Pear, prickly .....	53
Pedeocetes .....	73
Pellea .....	32
Peltigera .....	67
Penny royal .....	58
Pentstemon .....	87
Pentstemon .....	16, 19, 59
Peromyocus .....	89
Petalostemon .....	16, 51
Petrochelidon .....	83
Pewee, wood .....	78
Phacelia .....	26, 57
Phalaenoptilus .....	77
Phalaris .....	31, 36
Philanthus .....	94
Philonotes .....	68
Phleum .....	36
Phlox .....	26, 57
Phoebe .....	26, 27, 78
Phoxinus .....	30
Phrynosoma .....	92
Phycoides .....	94
Physa .....	30, 95
Physalis .....	29, 102, 58
Physaria .....	47
Pica .....	79
Pierre clay .....	17
Pilsbry, H. A., .....	95
Pine 11, 12, 14, 23, 25, 102, 33	
Pinedrops .....	55
Pineaceae .....	33
Pink Family .....	44
Pink, Prairie .....	16, 18
Pinus .....	23, 25, 102, 33
Pipilo .....	82
Pipit .....	86
Piranga .....	83
Pisidium .....	95
Pisobia .....	71

	Page		Page
Pityophis .....	92	Pyrola .....	24, 55
Planesticus .....	87	Pyrolaceae .....	55
Planorbis .....	30, 95		
Plants		<b>Q</b>	
Bee .....	29	Querquedula .....	69
Food .....	99	Quiscalus .....	81
Gum .....	102, 62		
Poisonous .....	100	<b>R</b>	
Resurrection .....	33	Rabbit	
Plants of steppe .....	16	Cotton tail ...	24, 98, 99, 90
Plantago .....	16, 59, 60	Jack .....	17, 20, 98, 99, 90
Plantin .....	16, 30, 34, 59	Raccoon .....	24, 91
Plectrophenax .....	81	Rail .....	70
Plover, Upland .....	17	Rallus .....	70
Plovers .....	71, 72	Ramalina .....	67
Poa .....	24, 36	Rana .....	93
Plum .....	23, 102, 49	Ranunculaceae .....	45
Podilymbus .....	69	Ranunculus .....	30, 45
Polanisia .....	29, 47	Rape, broome .....	29, 59
Polemoneaceae .....	57	Rat	
Polygala .....	16, 52	Musk .....	30, 31, 89
Polygalaceae .....	52	Pack .....	24, 27, 89
Polygonaceae .....	41	Ratbida .....	16, 19, 64
Polygonum .....	30, 42	Raven .....	79
Polypodiaceae .....	32	Ravines .....	14
Polytrichum .....	68	Recurvirostra .....	71
Pomaceae .....	49	Redpoll .....	81
Ponds .....	29, 30	Redroot .....	44
Porzana .....	70	Redstart .....	86
Poecetes .....	81	Redwing .....	80
Poorwill .....	77	Reptiles .....	12, 20, 30, 92
Poppy .....	46	Rera Gap .....	11, 12, 27
Populus .....	11, 12, 23, 26, 40	Rhus .....	24, 26
Porcupine .....	24, 27, 90	Rhynchophanes .....	81
Portulacaceae .....	44	Ribes .....	23, 48
Potentilla .....	26, 48	Riparia .....	84
Potomageton .....	30, 33	Rivers .....	11, 13, 29
Precipitation .....	11, 15	Robin .....	26, 87
Primba .....	94	Roripa .....	30, 47
Primrose, evening .....	16, 54	Rosa .....	16, 23, 29, 49
Primrose, family .....	56	Rose ...	16, 18, 23, 29, 48, 49
Primulaceae .....	56	Rowley, B. B., .....	32, 94
Procyon .....	24, 91	Rubiaceae .....	60
Primus .....	23, 26, 49	Rubus .....	49
Pseudoleskeella .....	68	Rumex .....	30, 42
Psoralia .....	16, 18, 19, 102, 51	Rush .....	30
Ptesospora .....	55		
Puccinellia .....	37	<b>S</b>	
Puccoon .....	16, 57	Sage .....	16, 26, 65
Puppy, mud .....	93	White .....	43
Pulsatilla .....	19, 45	Sagittaria .....	30, 34
Puma .....	14, 91	Salicaceae .....	40
Purse, Shepards .....	16, 46	Salix .....	40
Purslane .....	44	Salpinctes .....	86
Putorius .....	91	Salsola .....	18, 44
Pyramidula .....	96	Salvelinus .....	31
Pyramus .....	94	Samcula .....	24, 55
		Sandalwood .....	41

	Page		Page
Sandhill formation	16, 28	Sparogemon	93
Sandpipers	30, 71	Sparrow, Lark	24
Santalaceae	41	Sparrows	81
Saponaria	45	W. Vesper	17, 81
Saprinus	94	Spartina	30, 37
Satyris	94	Spatula	69
Saunders, A. A.,	68	Speoty	77
Saxifagaceae	47	Sphaerium	95
Sayornis	78	Spiders	17
Scaphiopus	93	Spilogale	24, 91
Scaups	70	Sphaerium	30
Schedonnardus	37	Spinas	81
Scirpus	30, 88	Spizella	82
Sciurus	88	Sporobolus	37
Scoliopteryx	94	Spurge	19, 29, 52
Scrops	16, 59	Squirrel, red	88
Sedge	30, 37	Star, Blazing	16, 18, 60
Seed, tick	63	Steppe	
Seiurus	85	Birds	21
Selaginella	33	Conditions	15
Selaginellaceae	33	Insects	21
Senicio	19, 27, 65	Mammals	20
Setophaga	86	Plants	16
Shade, night	58	Reptiles	21
Shepherdia	27, 53	Stereodon	68
Short Pine Hills	11, 25	Sticktight	57
Shrew	91	Stipa	29, 37
Shoveller	69	Strife, loose	56
Shrike	24, 84	Stieronema	24, 56
Shrimp	31	Strophostyles	51
Sialia	87	Sturnella	80
Sideranthus	16, 62	Suaeda	44
Sieversia	26, 49	Succession, seasonal	19
Silene	45	Succinea	17, 95
Siskin	81	Sunflower	16, 64
Sisyrinchium	40	Sunac	52
Sitta	87	Susan, Blackeyed	63
Skunk	17, 24, 96, 91	Swallows	27, 83
Skin Buttes	11	Swift, white throated	26, 28, 78
Smilaceae	40	Swift, Prarie	17, 20, 90
Smilacina	24, 40	Symphorocarpus	23, 60
Smilax	24, 40		
Snails	17, 30	<b>T</b>	
Snake-root	24, 55	Talinum	44
Snakes	14, 20, 96, 92	Tanager	26, 83
Bull	17, 20, 92	Tansey	102, 47
Garter	30, 92	Teal	69
Rattle	17, 20, 92	Temperature	15
Soil	12	Tern	69
Solanoceae	58	Terraces	22
Solanum	98, 58	Terrapin	92
Solidays	16, 19, 24, 62	Tertiary	13
Solomon-Seal, false	24	Thalictrum	46
Sonchus	66	Tharraos	94
Sophia	16, 47	Thermopsia	27, 51
Sora	70	Thistle	24, 65, 66
Sorex	91	Thistle, Russian	18, 44
Sorrel, wood	51	Thrasher	24, 86

	Page		Page
Thrush .....	87	Warbler, yellow .....	24, 85
Water .....	85	Washingtonia .....	55
Tick, beggars .....	30, 63	Wasps .....	17
Thindium .....	68	Water, ground .....	22
Thonmomys .....	27, 89	Watercress .....	30
Toad .....	93	Waterleaf .....	57
Toadflax .....	41	Waxwing .....	26, 84
Tomato, wild .....	102, 58	Weasel .....	17, 96, 91
Tongue, Beard .....	59	Weather, unseasonable .....	19
Topography .....	11, 12, 14	Weeds .....	103
Tortula .....	68	Chick .....	44
Totanus .....	71	Clammy .....	29
Towhee .....	24, 26, 82	Duck .....	38
Townsendia .....	19	Knot .....	42
Toxostoma .....	86	Fire .....	54
Trahescantia .....	29, 39	Prairie .....	62
Triglochisn .....	30, 33	Hawk .....	66
Trirhabda .....	94	Milk .....	56
Troglodytes .....	86	Resin or gum 16, 18, 102, 62	
Troximon .....	66	Pond .....	30, 33
Tryngites .....	71	Smart .....	30
Turnip, Indian .....	18, 102	Tar .....	64
Turtles .....	14, 92	Tumble .....	18, 44
Tympanuchus .....	72	Williams, R. S. ....	66
Typha .....	31, 33	Willow .....	40
Tyrannus .....	78	Wilsonia .....	86
<b>U</b>			
Ulmaseae .....	41	Wind .....	15
Ulmus .....	23, 102, 41	Wintergreen .....	24, 55
Umbelleferae .....	55	Wire-grass formation .....	16
Upland, Grass-covered, see Steppe		Wolf .....	17, 20, 90, 96
Ursus .....	91	Woodpeckers .....	24, 26, 77
Urtica .....	24, 41	Woods 14, 23, 24, 25, 26, 102	
Urticaceae .....	41	Woodsia .....	26, 32
Usnea .....	67	Worms .....	14
<b>V</b>			
Valley, lily .....	40	Wormwood .....	16, 29, 64
Vallonia .....	95	Wort .....	59
Vegetation .....	12	Milk .....	16
Vebena .....	58	Spider .....	29, 39
Veronica .....	59	Wren .....	
Vervain .....	58	House .....	26, 86
Vetch .....	16, 51	Rock .....	26, 27, 86
Viburnium .....	23, 60	<b>X</b>	
Vicia .....	16, 51	Xanthium .....	64
Viola .....	19, 53	Xanthocephalus .....	80
Violet .....	53	<b>Y</b>	
Vireo .....	85	Yarrow .....	16, 26, 102, 64
Vireosylva .....	85	Yellow-legs .....	71
Vitacene .....	53	Yellowthroat .....	86
Vitis .....	53	Yucca .....	26, 39
Vole .....	17, 20, 89	<b>Z</b>	
Vlupes .....	90	Zamelodia .....	82
Vulture .....	75	Zapus .....	24, 90
<b>W</b>			
Warber, Audubon .....	26, 85	Zenaidura .....	75
		Zonitoides .....	96
		Zonotrichia .....	82
		Zygodemus .....	19, 39

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