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**Report on the geology and resources of the region in the vicinity of the forty-ninth parallel, from the lake of the woods to the rocky mountains**

**Dawson, George Mercer**

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Chapter XI.

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## CHAPTER XI.

### CAPABILITIES OF THE REGION WITH REFERENCE TO SETTLEMENT.

REGION IN THE VICINITY OF THE LAKE OF THE WOODS—Areas capable of cultivation—Barren region—Vegetation of the lake—REGION BETWEEN THE LAKE OF THE WOODS AND RED RIVER PRAIRIE—Country in the vicinity of the Government Road—Country bordering on the Reed and Roseau Rivers—Height of Land Muskeg—THE RED RIVER PRAIRIE—Soil, and nature of the surface—Measure of agricultural capacity—Wood—Climate—Progress of the spring here and at other points in the Fertile Belt—Rainfall—Water supply—COUNTRY OF THE SECOND PRAIRIE STEPPE—Pembina Escarpment—Western margin of the great plains—Turtle Mountain—Timber—Country in the vicinity of the Souris River—Meteorological cycle—COUNTRY OF THE THIRD PRAIRIE STEPPE—Plateau of the Tertiary—Eastern limit of buffalo—Big Camp of half-breeds—Fertile Belt at the base of the mountains—Timber of the mountains—Climate of the Third Steppe.

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619. In this chapter it is proposed to examine briefly the nature of the country in the vicinity of the 49th parallel; with regard especially to its adaptability for settlement and agriculture, and its superficial features. The nature of the surface, however, depends so closely on the underlying rocks, and especially on the drift deposits, where these are largely developed, that much has already of necessity been given, which might properly be included here. It is not intended to go over any of those general points which have received notice, but merely to touch on those which have not yet been mentioned, using the material of the foregoing chapters as a substratum.

#### *Lake of the Woods Region.*

620. A very small proportion of the country immediately surrounding the Lake of the Woods, is at all suitable for agricultural settlement. The northern and eastern shores are entirely composed of barren rock, and though valleys in this district—and especially in the part of it occupied by Huronian rocks—may be found of better appearance, the soil will probably be sandy and poor. Pine timber of fair growth occurs in some localities, but forest fires have already

denuded great areas of both trees and soil, leaving only the bare, rounded, rocky substratum of the country.

621. The areas capable of cultivation are chiefly those based on the low terrace level, which has already been described. Lacrosse Island, and other islands, and sheltered bays, show considerable remnants of this terrace. It also forms the flat ground surrounding the Northwest Angle, and has there been cultivated to a small extent, the Indians growing patches of maize, which thrives well considering the small amount of attention given to it. Wheat, I am informed, has been sown as an experiment, and succeeds well. Potatoes yield excellent crops, and all the ordinary vegetables and cereals would doubtless flourish, with careful farming; were there sufficient inducement for their cultivation. The same terrace forms some flat land in the chain of large islands of Sand-hill Lake, and it is also extensively developed on both sides of Rainy River, and from the accounts of Prof. Hind and others, would appear to run a long way up that stream. Westward from the mouth of the river, and forming the northern shore of Minnesota, it extends for about ten miles, and though generally swampy, has an elevation sufficient to admit of drainage, and sustains a fair growth of elm, poplar, cedar, spruce, and birch. The eastern front of Buffalo Point, probably belongs to the same terrace, though considerably higher than elsewhere. Its surface is dry and clad with a thick growth of poplar and birch. *Kit-a-gane-minis*, or Garden Island, has been from time immemorial cultivated by the Indians of the lake, and is one of their great meeting places and head quarters. Its area must be from one to two square miles, and though I was unable to visit it, it appears from a distance to be level, and to support a fair growth of timber. It is now almost deserted.

622. All these localities are based on the old plateau or terrace level, a former lake bottom; and the soil where I have examined it, is composed of fine sand and calcareous debris, deficient in vegetable matter; which when it occurs, is apt to form a peaty accumulation on the surface.

623. The greater part of the southern and western margin of the lake is utterly useless, and a more forbidding and desolate region can scarcely be imagined. The immediate border of the lake, is here formed by a low ridge of sand, often blown into miniature sand-hills, but sometimes bound together by the roots of various grasses. Behind this margin is very generally a stretch of grassy swamp and lagoon, of a mile or two in width, and bordered in the distance by a forest of

tamarack (*Larix Americana*) growing on a scarcely less flooded soil. In some places, low, swampy savannah fronts directly on the lake, and this I have seen fringed after a gale, by a belt many feet in width, of brown vegetable pulp, equally impossible to walk on, and impassable for the canoe. On other parts of the coast, on gaining the summit of a peaty bank a few feet in height, which is breaking off under the action of the waves, an expanse of swamp, with small dead tamarack trees, stretches as far as the eye can reach.

624. In the shallow water of the lake, a large species of rush abounds, and is used by the Indians for making mats. The root is also eaten at certain seasons. Where the water is quite shoal, and in reaches protected from the full force of the waves, the roseau grass (*Phragmites communis*) covers great areas. It does not appear to be tough enough for the manufacture of paper, and I do not know any other purpose to which it can be applied. The wild, or Indian rice (*Zizania aquatica*,—*ma-nu-min* of the Chippeways) does not occur abundantly in the southern part of the lake, so far as I have seen, but must grow luxuriently in some parts of the northern division, and especially in Lac Plat, where the Indians collect large quantities of the seed in autumn, for winter use. The plant appears to thrive best, where growing up through several feet of water in sheltered lagoons and inlets, and certain areas formerly noted for its production, have of late years, from the higher level of the water, become unproductive. Scarcely sufficient attention seems to have been given to this native grain. Growing far to the north, in areas altogether unsuited for other crops, it seems to afford a prospect of utilizing great regions of lake and swamp, otherwise irreclaimable. Its growth might no doubt be encouraged by the use of proper precautions, and improved varieties result from careful selection. The grain, though dark in colour, is palatable, and the straw is now coming somewhat extensively into use in the manufacture of paper.

625. Many of the less deeply submerged swamps would yield large quantities of natural hay. Those in the vicinity of the North-west Angle are already made to furnish hay for the stock kept there, which though rather coarse, it is found to be nutritious.

626. The flora of the country surrounding the Lake of the Woods, closely resembles that characteristic of the Laurentian region, north of the St. Lawrence River, and differs from that of the prairie country to the west. A few western and southern forms, however, occur in association with those of eastern and northern aspect. The majority of the forest

trees are coniferous, and from the swampy character of the country, the tamarack is perhaps most abundant. The cedar (*Thuja occidentalis*) was in a few places observed, forming groves of limited extent. The red pine, Banksian, or scrub pine, and white pine, (*Pinus resinosa*, *P. Banksiana*, and *P. strobus*,) also occur where the ground is dry, and especially on the sandy ridges separating the swamps; but not in very large groves. All the ordinary eastern spruces and firs are also represented. Of deciduous trees, the poplar is most common, and generally represented by the aspen or balsam poplar (*P. tremuloides* and *P. balsamifera*) willows of many species form thickets in the swamps and along the edges of the woods. Elm, oak, birch, and the ash-leaved maple, also occur sparingly.

627. The climate of the region immediately bordering on the Lake of the Woods, is much improved by it. The shallow expanse of water becomes heated by the rays of the sun, and in July and August was very generally found to have a temperature of from 70° to 75° Fahrenheit. Early frosts are thus prevented, and the nights, which at a like elevation on the prairie west of Red River are frequently cold, are here, as a rule, deliciously balmy. Should land for agricultural purposes ever become of value in this region, a great area of the bottom of the lake might be laid dry, at comparatively small expense, by removing the rocky barrier at Rat Portage, the water being thus lowered about eighteen feet.

*Region between the Lake of the Woods and the Red River Prairie.*

628. West of the Lake of the Woods, is an extensive wooded, and very generally swampy region, which extends to the eastern edge of the alluvial prairie of the Red River. Where crossed by the road from the North-west Angle to Winnipeg, the wooded region is about sixty miles in breadth; on the forty-ninth parallel, about seventy-five miles. On the northern line of section the character of the country is as follows:—From the North-west Angle to Birch Creek Government Station, is for the most part thickly wooded, but almost a continuous swamp, with here and there a rocky or sandy ridge rising above the general level. Much of the soil would dry up if the woods were removed, but appeared to be sandy and poor, and of little or no use for agricultural purposes. There is much tall, but slight, pine timber, suitable for railway sleepers, but not of much use for the saw mill. The sand of the ridges is generally of yellow ferruginous colour, and the gravel, when it occurs, is chiefly of small limestone

fragments. Ten miles east of Birch Creek, is the watershed swamp, here known as the Caribou Muskeg. It is a flooded savannah, of perhaps, a mile and a half in width, and is an extension of the swampy watershed region, crossed further south. From Birch Creek to White Mouth River, the surface slopes gently westward, yet more than half the area is occupied by swamps. The dry tracts are covered with a sandy soil, which though warm, is too light to attract the agriculturalist. The Banksian pine abounds. From this place to Broken Head River, and thence to the edge of the wooded region, near Point du Chêne, the surface is not so wet, but still shows numerous swamps; and the soil in no place compares favorably with that of the prairie to the west.

629. An examination of the southern part of the region lying west of the lake, was made by crossing it by the Reed and Roseau Rivers; the former, a small stream flowing into the Lake of the Woods, the latter, inscolating with it in the watershed swamp, is one of the largest tributaries of the Red River. The route thus indicated, in the main nearly follows the Boundary-line, though a considerable portion of the Roseau River, and the whole of Roseau Lake, lie a short distance south of it, and in the northern part of Minnesota. The crossing was effected in the latter part of August, 1873, with two men, and a single 'three fathom' bark canoe; and from the waters of the lake to those of the Red River, occupied nine days; much delay arising from obstructions by drift timber in the rivers, the state of the portage on the height of land, and the bad rapids on the lower part of the Roseau River. The route though long known to the Indians; and used by the Chippeways and Sioux as a war-path between their respective countries, has remained almost wholly unknown to explorers. Prof. Hind, and Mr. S. J. Dawson had intended passing by this route to Red River in connection with the Assineboine and Saskatchewan Exploring Expedition, in 1857, but were turned back by a large force of Indians collected on Garden Island.

630. On entering the mouth of the Reed River, a sand-bar is crossed, the water on which is, apparently, not more than four or five feet deep. The lower portion of the river itself, for about four miles, is both wide and deep, and not very tortuous. Near the mouth, it passes through a grassy swamp, and for some miles the shores continue swampy, though generally covered by bushes and small trees. Beyond this the river, though still deep, becomes narrow and tortuous, and retains this character throughout its upper part, which for several miles before reaching the source is often not more than sixteen feet in width. At the same time,

the current becomes much stronger, though not assuming anything of the character of a rapid. For about two and a half miles from the beginning of the narrow portion of the river, in a general south-westerly course, the banks rise several feet above the water, and support a moderately good growth of aspen and balsam poplar, with some oaks, and a few tamaracks. Most of this higher ground has, however, been burned over years ago, and the greater part of the timber thus destroyed. The soil is rather retentive, being composed of a fine, grey, sandy clay. Beyond this, and to its source, the stream is fringed by grassy swamps, bordered at a short distance by a dense growth of tamarack, scarcely, if at all above the level of the water. The current, however, is still strong, and the stream, though very narrow and tortuous, remains ditch-like and deep.

631. On approaching the east end of the Portage the tamarack first retreats further from the stream, and the latter remains merely as a narrow rut among the reeds. The bottom of the swamp, though here covered by a few inches of water and decayed vegetable matter, is hard, and firm, and consists of fine whitish arenaceous clay, of such a nature as to be almost completely impermiable to water. It here becomes necessary to track the canoe with ropes, and for a few hundred yards the swamp was found so shallow, that it was best to lighten the canoe, and portage the stuff by hand. On thus entering the Muskeg Portage Swamp, the tamarack trees become small and scattered, and soon remain only in isolated groves, standing out like islands in the grassy expanse. After passing the shallow edge of the swamp, above described, which may be about half a mile in width, it becomes softer and deeper, and is entirely composed of peaty matter and soft swamp muck, in which in some places one sinks from knee to waist deep, and often no firm bottom exists for a depth of five or six feet, and probably much more. In some spots small fishes were seen among the grass. In the softer parts, gas arising from the decomposing vegetable matter, buoys up portions of the sod, which, however, easily sink under any weight.

The surface of the swamp is usually grassy, but some extensive patches of *Spiræa* bushes occur. *Ledum latifolium*, or Labrador tea, *Sarracenia purpurea*, the pitcher plant, and *Andromeda polifolia*, also occur abundantly; *Lobelia Ka'imi*, *Parnassia Caroliniana*, and *Drosera longifolia*, were found in flower.

632. The source of the North-east Roseau River, is six and three quarter miles from that of the Reed River, in a south-westerly direction; but the track through the muskeg deviates considerably in some places,

to avoid tamarack groves, &c., and increases the actual distance which must be passed over in taking a canoe from one river to the other. On approaching the source of the Roseau River, the swamp again becomes shallow and hard-bottomed. The stream, as at first found, is a riunnel scarcely wide enough for a canoe, but falling westward with a swift current. The height of land muskeg, judging from the line of levelling on the forty-ninth parallel—about six miles south—and from the current of the Reed River, cannot be more than ten or twelve feet above the Lake of the Woods. It has all the appearance of having been at one time a shallow lake-basin, with a hard bottom of drift material; and has been gradually filled by the growth and decay of vegetable matter.

633. I believe that this and other swamps of the region of the watershed, might yield important supplies of peat fuel to the woodless prairie country to the west. The peat would, of course, require to be manufactured by one of the processes now employed elsewhere, and advantage might be taken of the upper part of the Roseau for its shipment. The peat here found must be pretty pure, though not formed by the accumulation of the *Sphagnum* or peat moss, but from grasses and other aquatic phænogamia.

634. The North-east Roseau, is at first narrow and tortuous, like the upper part of the Reed River, and the surrounding country is swampy and covered with tamarack, and willow bushes. The banks soon, however, begin to rise higher, and poplar becomes the prevailing wood. Fine oaks, elms, and ash-leaved maples also fringe the stream. The forest retains this character as far as Roseau Lake, and where small openings occur, rose bushes, asters, convolvulus (*Calystegia sepium*) wild hop (*Humulus lupulus*) the prickly cucumber (*Echinocystis lobata*) and high-bush cranberry (*Viburnum opulus*), form a tangled thicket.

635. About three miles from the source of the river, and two-and-a-half from its crossing with the forty-ninth parallel, a tributary nearly as large as the main stream enters from the north. A few miles above Roseau Lake, a second large stream comes in from the south-east, and may be called the South-east Roseau. The banks of this part of the river are usually high, and are as much as fifteen feet above the water level where it crosses the Line. As far as can be seen from the edges of the river, the land continues in most places dry, and supports a good growth of timber. For several miles before reaching Roseau Lake, however, the dry banks merely form narrow ridges at the sides, and open grassy swamp lies both north and south of them. The whole upper on North-east Roseau

river is at present much encumbered by jams of drift timber, and beaver dams.

636. Roseau Lake, is a shallow expanse of open water in the midst of a great region of reedy swamp. It lies about four miles south of the Line. The East Roseau enters at its southern part, and the West Roseau flows out on the same side, at less than a mile distant from it.

637. The upper part of the West Roseau River, for about ten miles following its course, has banks sufficiently high to support a small growth of poplar, oak, and willow bushes. The trees then disappear, the current becomes much more sluggish, and the river enters the Great Roseau Swamp. This vast muskeg is absolutely without trees or bushes of any kind, but is covered by a rank growth of grass and reeds, and interspersed with small ponds and lagoons. The distance through the swamp, following the course of the river, which is exceedingly tortuous, must be at least twenty miles. For a few miles before reaching the forty-ninth parallel, the river is again fringed with trees—oak and elm being abundant.

638. A short distance south of the Line, and before re-crossing it, the first island occurs, and boulders become plentiful in the bed of the river, which, though unencumbered and deep from Roseau Lake to this point, now becomes shallow and rapid, and so continues till the border of the Red River prairie is reached. The banks are high throughout, and this belt of country, about twenty miles in width, is of much improved appearance. The sub-soil is of gravel and fine sand—as already noted in connection with the drift deposits—and most of the surface is dry, though large swamps still occur. It is partly of a prairie character, but is broken up by extensive groves, which are usually of poplar. The soil, though lighter than that of the Red River Valley, shows in some places a considerable depth of vegetable mould; and would be warm and easily worked, and bring crops rapidly to maturity with careful cultivation. The presence of so much limestone debris in the drift, has a favourable influence.

Poplar, oak, and elm, attain a large size along the margin of the river in this part of its course.

639. In this region of oak and poplar 'openings,' there is, to some extent, a mingling of eastern and northern woodland plants, with those of the plains. East of the edge of the true prairie land, the coniferous forest comes to an end, in about longitude  $96^{\circ} 30'$ ; and coniferous trees are not again found in any force—with the single exception of the moun-

tains known as the Three Buttes—till the immediate flanks of the Rocky Mountains are reached

640. The West Roseau River would seem to be navigable by steam launches, or stern-wheel boats of light draught, from the Red River nearly to its intersection with the old St. Paul and Garry road. From this place to its crossing of the forty-ninth parallel, it is barred by the rapids above mentioned, which, from their shallow and boulder-strewn character, are difficult of navigation, even in a bark canoe. From a point a few miles south of the Line, a small steamer might pass through the Roseau Swamp and Roseau Lake, and possibly ascend the East Roseau, nearly to its intersection with the forty-ninth parallel.

641. Of the wooded country between Lake of the Woods and the margin of the Red River prairie, a comparatively small proportion therefore appears to be fit for cultivation, though much of the surface could be reclaimed at small expense. The areas formerly occupied by small lakes show better soil than the ridges and higher grounds, which are generally sandy or gravelly. The chief present value of the region would however seem to be as a reserve of fuel, and timber for construction, for the more fertile prairie land bordering the Red River. A large quantity of valuable red pine (*Pinus resinosa*) lumber has been cut during the last few years on dry ridges near the Pine River, which runs into Roseau Lake from the north; and similar pine-bearing highlands, will probably be found in other parts of the area. The timber cut on Pine River, was floated into Roseau Lake, and thence by the West Roseau River, to Red River. It therefore passed for a portion of its course through the northern part of the State of Minnesota. The Roseau, and probably also the Rat River, may be used in the conveyance of fire-wood to the Red River country, should the demand require it.

#### *The Red River Prairie.*

642. Of the alluvial prairie of the Red River, much has already been said, and the uniform fertility of its soil cannot be exaggerated. The surface for a depth of two to four feet, is a dark mould, composed of the same material as the subsoil, but mingled with much vegetable matter. Its dark colour is, no doubt, in part due to the gradual accumulation of the charred grasses left by the prairie fires. The soil may be said to lie ready for the plough, and in turning the tough thick prairie sod, the first year, a crop of potatoes may be put in, though it is not efficiently broken up till it has been subjected to a winter's frost. When the sod has rotted,

the soil appears as a light friable mould, easily worked, and most favorable for agriculture. The marly alluvium underlying the vegetable mould, would in most countries be considered a soil of the best quality, and the fertility of the ground may therefore be considered as practically inexhaustible.

643. The area of this lowest prairie has already been approximately stated as 6,900 square miles, but of this the whole is not at present suited to agriculture. Small swamps are scattered pretty uniformly over its surface, and in some places very large areas of swampy land occur, as will be seen on reference to the large map of Manitoba lately published by the Government. The greater part of these swamps, are, however, so situated, as to be easily drained, either into the Red River or some of its tributaries, which are usually depressed thirty to forty feet below the level of the surface. At present the swamps in the vicinity of the settlements are made to yield supplies of natural hay; and until hay-grass is sown and regularly cultivated, the 'hay-swamps' will continue to be a necessary part of the economy of the settler. The wide overflow of these swamps in the spring, when the season is wet, or when the dissolution of the winter's snow takes place very rapidly, is shown by the large area often found to be strewn with the dead shells of fresh-water molluscs, chiefly of the genus *Limnæa*.

644. As a measure of the possible agricultural capacity of this great valley, take one half of the entire area, or 3,400 square miles equalling 2,176,000 acres, and, for simplicity of calculation, let it be supposed to be sown entirely in wheat. Then, at the rate of 17 bushels per acre—which, according to Prof. Thomas, is the average yield for Minnesota—the crop of the Red River valley would amount to 40,992,000 bushels.

645. The wooded area of this lowest prairie steppe is quite small. The Red River and its tributaries are fringed with trees, of which oak, (*Quercus macrocarpa*, var.) elm, (*Ulmus Americana*) poplar, (*Populus tremuloides*, &c.) and ash-leaved maple, (*Negundo aceroides*) are the most abundant. In some places the trees attain a large size, and the oak woods bordering many of the streams are especially beautiful. Much of the best timber has, however, already been culled out, and it is yearly decreasing, without any systematic attempt for its preservation. The steamers running on the Red River are among the largest consumers. Away from the immediate borders of the streams, the prairie, though covered with a luxuriant sod, is absolutely treeless. It is fortunately the case, however, that the Red River Valley is bordered on the east by the

forests already described, and on the west by the wooded district of Pembina Mountain and its northern extensions.

646. The climate of the Red River Valley, like that of the whole interior of the continent, is an extreme one, the cold of winter being exceedingly severe, and the heat of the summer season also excessive. The courses of the summer, and winter isothermal lines across the continent, do not require notice here, as they have already been ably discussed, and laid down as far as the observations now at command allow. It would seem, however, that between the Laurentian highlands on the east, and the Rocky Mountains, a great summer wave of warmth passes far to the north, reaching its highest latitude near the eastern base of the latter range; while in winter a compensating and long-continued flood of cold air invades the whole region of the plains, and the eastern and western flanking ranges.

647. The watershed between the Red River, and the St. Louis and other streams flowing into Lake Superior, forms a pretty well marked climatal line. The influence of the lake, and the high wooded ground forming a partial barrier to the north-westerly winds, renders the autumn in the latter region warmer; while in spring the ice accumulations of the lake, and wooded character of the surrounding country, keep the temperature much lower than in the Red River Valley. The temperature of the Red River country, like that of the prairies generally, depends very closely on the direction and origin of the wind, though in years to come, when great regions of the plains have been planted with trees, much amelioration may result. A single instance—though an extreme one—may be mentioned. On the 8th of May last year, a strong south wind raised the temperature at Dufferin to 100° F. At Winnipeg, 60 miles further north, the temperature was 94.5°, the mean temperature for the month being 52.52°. The Red River Valley, as the lowest trough of the interior region of the continent, would also seem to serve as a channel of efflux for the cold northerly winds in spring; for immediately on passing out of it, and up to the level of the second steppe, the vegetation was found to be slightly, but distinctly, more advanced.

648. The following notes taken at Dufferin in the Spring of 1874, will illustrate the advance of the season, and serve for comparison with other localities:—

*April 15.*—General surface of the prairie free from snow, and in some places already quite dry, though frozen below. Coulees holding large snow-banks. Ponds beginning to open. Ducks observed, and several of the smaller birds of passage.

- April 24.—Ploughing commenced, but ground still partly frozen.  
 “ 25.—First frog heard.  
 “ 26.—Many ducks, geese, and cranes, flying northward.  
 “ 27.—Quite a concert of small birds in the thickets for the first time. Buds of the earlier willows and poplars bursting.  
 “ 29.—Flies and Mosquitoes becoming abundant. Frogs noisy.  
 May 1.—Grass beginning to look a little green in swampy hollows.  
 “ 8.—First thunder-storm.  
 “ 9.—Most of the willows, and the aspen poplar (*Populus tremuloides*) in full bloom. Also elm, (*Ulmus Americana*) ash-leaved maple, (*Negundo aceroides*). Sweet Coltsfoot (*Nardosmia sagittata*) in flower. First Strawberry blossom found (*Fragaria Virginiana*).  
 “ 10.—Grass beginning to assume a general green tint.  
 “ 18.—Mosquitoes troublesome for the first time. Many geese flying overhead, with a favouring south wind.  
 “ 21.—Grass in hollows, where the ground has not been burned over, now forming pretty good feed; where the fire has passed last autumn, though very green, still quite thin. *Geum triflorum*, abundant in some localities; in full bloom *Anemone patens*, in many places with seed already forming, sepals having fallen. *Carex Douglasi*, *Ranunculus rhomboideus*, in full flower.  
 “ 22.—The common blue Violet (*Viola cucullata*), in full bloom, abundant. *Viola pedata*, *V. Canadensis* and *V. pubescens*, just in flower. The Service-berry (*Amelanchier Canadensis*) Choke-cherry (*Prunus Virginiana*) Wild Red Cherry (*P. Pennsylvanica*) Wild Plum (*P. Americana*); just about to bloom. Poplar groves showing green.

649. A reference to the catalogue of plants will serve to continue this record, though after the above date, the observations for 1874 refer to the country west of the Red River Valley. The plants in flower in June, 1873, can however be found by referring to the list.

650. The following list gives the arrival of some of the more important birds in the spring of 1874:—

*Birds arriving previous to April 15th.*

- Corvus Americanus*.—Common Crow.  
*Eremophila alpestris*.—Horned Lark.  
*Spizella monticola*.—Tree Sparrow.  
*Plectrophanes Lapponicus*.—Lapland Longspur.  
*Circus Hudsonius*.—Marsh Harrier.  
*Falco columbarius*.—Pigeon Falcon.  
*Accipiter fuscus*.—Pigeon Hawk.  
*Junco hyemalis*.—Black Finch.  
*Collurio borealis*.—Great Northern Shrike.  
*Scolecophagus ferrugineus*.—Rusty Grackle.

*April 15th to 20th.*

- Anas boschas*.—Mallard Duck.  
*Querquedula Carolinensis*.—Green-winged Teal.  
*Turdus migratorius*.—Robin.  
*Agelaius phoeniceus*.—Red-winged Blackbird.  
*Totanus melanoleucus*.—Greater Tell-tale.  
*Aegialitis vociferus*.—Kildeer Plover.  
*Gallinago Wilsonii*? Snipe.  
*Colaptes auratus*.—Golden-winged Woodpecker.  
*Passerella iliaca*.—Fox Sparrow.  
*Regulus calendulus*.—Ruby-crowned Kinglet

April 20th to 25th.

*Mergus cucullatus*—Hooded Merganser.  
*Spatula clypeata*—Shoveller Duck.  
*Bucephala albeola*—Buffle-headed Duck.  
*Dendroica coronata*—Yellow-crowned Warbler.

April 25th to 30th.

*Fulica Americana*—Coot.  
*Grus Canadensis*—Sand-hill Crane.  
*Dafila acuta*—Pin-tailed Duck.  
*Mareca Americana*—Widgeon.  
*Fuligula marila*—Scamp Duck.  
*Botaurus minor*—Bittern.  
*Ceryle alcyon*—Kingfisher.  
*Sturnella magna*—Prairie Lark.  
*Xanthocephalus icterocephalus*—Yellow-headed Blackbird.

The remaining birds appeared rapidly after this time.

May 8th—*Anthus vociferus*—Whippoorwill.  
 May 17th—*Trochilus colubris*—Ruby-throated Humming Bird.  
 May 17th—*Ectopistes migratorius*—Wild Pigeon.

651. Observations comparable with those above given for the Red River Valley, are on record for three points on the Saskatchewan River, approximate to various parts of the 'fertile belt.'

652. Sir John Richardson compiled the record for Cumberland House, from which the following extracts are selected, from his own observations, in 1820, and those of Chief Factor Lewis, in 1839-40\*. Cumberland House is situated in about lat. 54°, long. 102°20', or west of the Northern end of Lake Winnipeg.

- April 7.—Crows (*Corvus Americanus*) seen. Not till April 19th, in 1820.  
 " 8.—Snow-birds (*Plectrophanes nivalis*) seen.  
 " 9.—A Merganser seen, 1820.  
 " 10.—Willow catkins beginning to burst.  
 " 12.—Geese and Swans seen, 1820. In 1840 not seen till 20th.  
 " 13.—Buds of *Populus balsamifera* bursting 1820.  
 " 17.—Plovers, Grackles, and Orioles seen, and on the following day, Canadian Jays, and Fly-catchers, Frogs croaking.  
 " 20.—Coltsfoot (*Nardosmia palmata*) flowering. Sap flowing in Ash-leaved maple (*Negundo aceroides*).  
 " 26.—Alder flowering.  
 May 1.—*Anemone patens* in flower, leaves not yet expanded.  
 " 2.—A fall of snow to the depth of two feet.  
 " 13.—Planting potatoes.  
 " 14.—Sowing barley, 1820. *Negundo aceroides*, and gooseberry bushes in flower.  
 " 17.—Willows, gooseberries, and Aspen (*Populus tremuloides*) in leaf, 1820.  
 In 1840 the trees only bursting their buds at this time.  
 " 24.—*Ulmus Americanus* flowered, in 1820.  
 " 25.—*Prunus Pennsylvanica*, *P. Virginiana*, and *Amelanchier* in flower.

\* Journal of a Boat Voyage through Rupert's Land, Vol. II, p. 235.

The Spring of 1840 would appear to have been a remarkably late one. Allowing for this, the indications of the advance of the season, correspond very closely with those at Dufferin; leaving only a day or two in favour of the latter, though Cumberland House lies over 300 miles further north, and 220 further west.

653. At Carleton House, in lat.  $52^{\circ} 52'$ , long.  $106^{\circ} 15'$ , the progress of the spring is illustrated, by the following memoranda of events, compiled from Sir J. Richardson's observations in 1827,\* and Mr. Bourgeau's botanical notes in 1858.†

- March 13.—Sparrow Hawks, (*Falco sparverius*) arrived, and on the 17th several migratory small birds noticed, 1827.
- “ 29.—Large flocks of Snow-birds (*Plectrophanes nivalis*), 1827.
- April 1.—Many *Fringillidæ* seen, and on the 2nd, Swans arrived, 1827.
- “ 4.—Sap flowing in the *Negundo*, 1827. Not till April 10th, 1858.
- “ 6.—Geese, Kildeer Plover (*Ægialitis vociferus*) and several small birds arrived, 1827.
- “ 12.—Alder gathered, 1858.
- “ 13.—*Anemone patens*, 1858. In 1827 not till April 22nd.
- “ 14.—Four inches of snow fell, 1858.
- “ 18.—Buds of Poplars, Willows, &c. swelling, 1858.
- “ 22.—Robins (*Turdus migratorius*) and the Butcher-bird (*Collurio borealis*) seen.
- “ 27.—Frogs began to croak, 1827.
- “ 28.—Sand-hill Cranes (*Grus Canadensis*) arrived, 1827.
- May 1.—The Prairie Lark (*Sturnella magna*) appeared. Last flocks of *Plectrophanes nivalis* left for the north, 1827.
- “ 2.—Red-winged Black-bird (*Agelæus phæniceus*) and Rusty Grackle (*Scolecophagus ferrugineus*), 1827.
- “ 3.—*Phlox Hoodii* in flower, 1858. (On the 4th, 1827), also *Populus tremuloides*, *P. balsamifera*, two species of *Salix*, and *Corylus Americana*. (The latter with *C. rostrata*, flowered on the 7th, 1827), *Equisetum arvense*, 1858.
- “ 5.—*Ranunculus rhomboideus*, *Viola debilis*, *Nardosmia palmata*, and several *Carices* flowered, 1827.
- “ 6.—White-bellied Swallow (*Tachycineta bicolor*) and many Gulls, arrived, 1827. More species of *Salix*; two species of *Sheperdia*, and *Negundo*, flowered 1858. *Sheperdia Canadensis*, and *Negundo*, flowered on the 9th, 1827.
- “ 7.—*Androsace*, *Viola Canadensis*, *Fragaria Virginiana*, *Astragalus* (probably *A. caryocarpus*), &c., 1858. *Recurvirostra Americana* arrived 1827.
- “ 12.—Thermometer fell to  $14.5^{\circ}$  F. during the night, and nearly all the plants in flower frozen, and the season thrown back, 1858.
- “ 19.—*Viola Nuttalliana*, flowered, 1827. On the 20th, 1858.
- “ 20.—*Amelanchier Canadensis*, *Betula papyracea*, 1858.

It will be observed, on comparison, that the progress of events at Carleton House is distinctly in advance of that in the Red River Valley in 1874. The difference, however, does not seem to be more than a week,

\* *Loc. cit.*, p. 238.

† *Exploration of British North America*, p. 252.

and considering the generally admitted retardation of the spring of 1874, may be less.

654. Still further west at Fort Edmonton, in lat. 53° 31', long. 113° 17', the progress of vegetation in the spring of 1859 has been observed by Mr. Bourgeau. The dates at which the more important plants blossomed are as follows:—

April 22.—Hazel (*Corylus Americana*.)

“ 28.—Willow (*Salix* 2 sp.)

“ 20.—Alder (*Alnus*.)

May 2.—Poplar (*Populus tremuloides*.)

“ 8.—Other species of *Salix*. *Populus balsamifera*.

“ 17.—Strawberry (*Fragaria Virginiana*) *Ranunculus rhomboideus*, *Equisetum arvense*.

“ 18.—Wild Cherry, *Antennaria margaritacea*, Violet (*Viola Canadensis*.)

“ 19.—Shepherds'-purse (*Capsella bursa-pastoris*.)

“ 20.—Red Currant (*Ribes rubrum*) *Viola blanda*, and *Androsace*.

Comparing this with the spring of 1874, at Red River, though the order of flowering does not in some cases exactly agree, it would appear to give an advantage of a few days to Edmonton. A direct comparison of the dates for three years at Carleton, with those of 1859 at Edmonton, shows only a day or two of difference in favour of the former. The comparisons are based chiefly on the times of flowering of the plants, which are more trustworthy than those of the arrival of the birds of passage.

655. Too broad generalizations on the results of a few seasons would be unwise, especially as the years do not correspond, but enough is known to prove the remarkably uniform progress of the spring along the so-called 'fertile belt,' which, passing north-westward from the Red River Valley, nearly follows the Saskatchewan to the Rocky Mountains, and will be the first region occupied by the settler. From the data now at command, I believe that the difference in advance of the spring between any of the above four stations, is not so great as that obtaining at the same season between the vicinity of Montreal and that of Quebec.

656. The Red River country does not agree with the greater area of the western plains in showing a rainfall scarcely sufficient, or altogether too small for successful agriculture. With regard to the Western States, those who have examined the matter very generally concur in stating that beyond the 99th or 100th meridian agriculture is impossible unless irrigation be adopted. There are, of course, special small areas not included in this general condemnation, but there is probably also at least as great an area of the region east of the 99th meridian, which does not receive sufficient rainfall. The statements concerning

the nature of the western territories south of the Line, have passed through so many phases, that it is important to know that there is a practical limit to the tide of settlement in that direction. Since it has been discovered that a great part of this region is not of the nature of the typical desert, as had been supposed, there has been a tendency, aided by the statements of interested railway and other companies, to elevate it to the imaginary position of an agricultural country. Now, however, that the crucial test of experience is being applied, and systematic meteorological observations are being obtained, it becomes evident that if settlement for agricultural purposes is to pass the 99th meridian, it must do so slowly, and strengthening its advance by irrigation and arboriculture. The great area based on Cretaceous No. 4, would appear to be absolutely irreclaimable.

657. In estimating the least necessary amount of rainfall for the support of cereals, so many circumstances occur to complicate the subject, that it is often difficult to arrive at any very exact conclusion. Chief among these is the distribution of precipitation with regard to various seasons. In ordinary circumstances, only that rain which falls during the spring and summer, when the crops are in the ground, is of importance. Much, however, depends on the nature of the subsoil, for, where a considerable thickness of porous material is based on impervious rocks or clays, with a nearly horizontal, or slightly basin-shaped surface, a part of the autumnal and winter precipitation, and especially the flood-water of the melting snow in spring, may also be counted on. Many considerable areas of prairie country are thus situated. The general water level has in some cases been ascertained to be not far from the surface, even in the autumn, and the moisture rising by capillary attraction prevents the entire desiccation of the surface soil. The nature of the soil here enters as an important factor.

658. It is stated by Boussingault, however, that in Egypt, where no rain falls during the period of growth, that the distribution of seventeen and one-third inches of water over the surface, during the season, of one hundred and fifty days, suffices to bring the crops to maturity. The ground is here water-soaked to begin with. In India, in a season, of the same length, sixteen and one-third inches of irrigation water are distributed, the rainfall making the amount up to nineteen and one-half inches. The evaporative effect of the air of the western plains is no doubt usually less than that in the countries above named, rendering a somewhat smaller quantity of water necessary.

659. Prof. Thomas estimates the rainfall for the Spring and Summer months, on the western portion of the plains, at only 7.34 inches; the deficiency of which will at once be apparent, whether compared with the estimates given above; or with the rain fall in other and better known regions. During the same period, New York receives 23 inches, Cincinnati 25, Missouri 26, Michigan 18.\* At the town of Winnipeg, the average fall of *rain* during the spring and summer months, derived from the observations of the three past years, is 15.96 inches.

660. The following detailed table of rainfall at the last mentioned locality, for which I am indebted to Prof. Kingston, gives a better idea of its distribution throughout the year, and it will be apparent that the greatest precipitation takes place at the seasons when it is most required for agriculture.

Year	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Tot. Rainfall.	Melted snow.	Total Precipitation
1872	0.00	0.00	0.25	1.50	3.80	3.80	1.62	1.85	7.25	1.55	0.00	0.00	21.62	8.57	30.19
1873	0.00	0.00	0.00	0.87	2.38	3.37	3.55	1.17	2.22	0.02	0.00	0.00	13.58	3.51	17.09
1874	0.00	0.00	0.45	0.02	1.99	4.35	3.07	3.35	1.73	0.04	0.00	0.00	15.00	3.29	18.29

The precipitation in the Red River Valley would appear to be least near the Boundary-line, as at Pembina the average for three years is stated to be 13.16 inches. In 1873, it was 14.185 inches, against 17.09 at Winnipeg, while at Fort Abercrombie, 180 miles south of the forty-ninth parallel, it was about 15.5, and at fort Wadsworth, 50 miles further south, 29.45; the average for five years at the latter place being 18.95,† or probably about the same as at Winnipeg.

661. Prof. Dana's general means of total precipitation for different areas of the continent may be compared with the above. It is estimated that the eastern portion of the continent, from the Gulf States to Labrador, including the greater part of New England, New York, and the Atlantic States, and Tennessee and Kentucky; receive 40 to 45 inches or more. Michigan 30 inches. A large part of Ohio, Indiana, Illinois, and New York, toward the St. Lawrence, 33 to 40 inches. Regions beyond the Mississippi, 25 to 15 and 10 inches.

\* See Prof. Thomas in U.S. Geol. Surv. Territ., 1870.  
 † See Major Farquhar's Report on the Red River.

662. It would appear not only on theoretical grounds, but as the result of experience, that the rain-fall of the Red River Valley, assisted by the water remaining in the soil from the spring floods, is as a rule amply sufficient for agricultural purposes.

663. The question of water supply, seemed some years ago a difficult one in the Red River Valley. Great areas of level and fertile prairie, lie far from any stream, or are only traversed by coulées, which dry up completely during the summer. The structure of the country renders the existence of surface springs almost an impossibility. This apparent difficulty is, however, being solved in the most satisfactory manner; as it is found that there are few regions where ordinary wells of moderate depth do not succeed in finding ample supplies of water; and this not only far removed from the rivers, but in their immediate vicinity, though the water level of the stream may lie considerably lower than that of the bottom of the well. The rather impervious nature of the prairie subsoil, renders it probable that these wells are supplied either by intercalated coarser layers, or,—as appears to be more likely—by water circulating in fissures; which formed originally by the cracking of the soil at the surface, often penetrate its homogeneous mass to a considerable depth.

664. The success of artesian wells, at Winnipeg (§ 577) also tends to show that no apprehension need exist, with regard to water supply. Water is there formed in a gravelly stratum lying above the boulder-clay, and has, I believe, sufficient head to form flowing wells. It is further probable that a second water-bearing stratum might be reached by continuing the boring through the boulder-clay, to the more porous stratum which usually intervenes between it and the solid rock.

665. For the supply of the shallower wells first referred to, the water is no doubt mainly derived from that which falls during the wet months, on the surface of the prairie itself. The water obtained by the artesian wells, however, has not this source, and comes from below the most tenaceous beds of the alluvium. It is introduced, no doubt, at the edges of the more permeable layers where they come to the surface east and west of the alluvial valley. That there must necessarily be a considerable underground circulation of water, is rendered evident on inspecting the region near Pembina Mountain. The gaps worn in the front of this escarpment, are occupied by streams, some of which drain considerable areas, and are not dry even in the latter part of the summer. All these, except a few of the very largest, where they debouch on the low-level

plain, occupy coulées at some depth below its general surface, which, however, gradually die out, the stream at the same time disappearing.

*Country of the Second Prairie Steppe.*

666. The extreme western margin of the Red River prairie, in the vicinity of the slope of Pembina Mountain, is diversified by groves of oak, which stretch out from its base; and would no doubt, be much more extensively wooded, but for the constant recurrence of prairie fires. The front of the escarpment, and its summit, forming the edge of the second prairie steppe, are in some places thickly wooded, and always show extensive patches of timber. The forest-covered area increases north-westward. In the vicinity of the Line, the woods owe their preservation to the protection against fires afforded by the broken nature of the edge of the escarpment, by the great valley of the Pembina River, and its systems of tributary coulées, and to the frequent occurrence of patches of swamp. Poplar is probably the most abundant tree, though even after ascending the escarpment, groves of oak are found. The wooded region has, however, in all localities suffered much from local fires; most of the trees at present living are small, while traces of a former heavy forest growth frequently appear.

667. In some places pretty extensive prairie areas occur between Pembina Escarpment, and Pembina River, and with the exception of a few localities, near the edge of the escarpment, where the Cretaceous clays are near the surface, the soil is of excellent quality, and differs from that of the Red River Valley by the addition of a considerable proportion of sandy material. Swamps are here pretty thickly scattered, and some of them attain large dimensions in spring. Those parts of them which are permanently wet, however, bear luxuriant crops of natural hay-grass, and the general aspect of this region is favourable.

668. On crossing the Pembina River, the eastern margin of the great treeless plain is entered on. No woods now appear, except those forming narrow belts along the vallies of the streams, and soon, even the smaller bushes become rare. The shrubs met with are generally stunted, from the absence of shelter against the wind, and the frequent passage of prairie fires. The little thickets consist, according to situation, of dwarfish snow-berry (*Symphoricarpus occidentalis*) *Spiræa*, roses, and willows fringing the small swamps and pools. The metallic-leaved silver-berry (*Eleagnus argentea*), comparatively rare in the Red River Valley, now begins to occur in abundance on the drier areas. In the last

week of May, 1874, the common flowering plants on this eastern part of the first prairie steppe, were ; *Viola cucullata*, *V. pedata*, *Ranunculus rhomboideus*, *Anemone patens* then going to seed, and the whole prairie covered with its brownish woolly heads ; *Geum triflorum*, found most abundantly near the edge of the escarpment, less common westward ; *Astragalus caryocarpus*, becoming rapidly more abundant westward, *Atenaria plantaganifolia*, *Lithospermum canescens*, first blossoms.

669. The undulating character of the prairie between Pembina Escarpment and Turtle Mountain, and the occasional occurrence of stony and gravelly hillocks, has received mention in the chapters on the drift. With reference to the soil west of Pembina River, nearly the same remarks apply as to that east of it. It is fertile, though not so deep or inexhaustible as that of the Red River Valley, and rests on a gravelly, drift sub-soil. Swampy bottoms bearing a good growth of hay-grass abound, but their area is quite small as compared with that of the dry ground. Toward the end of the summer, most of these swamps dry up completely, and extensive regions are then without other water supply than that derived from the streams and rivers, which lie in deep vallies, and are often far apart. I do not think, however, that difficulty would be found in obtaining water, by wells sunk in any of the lower parts of the prairie. The rainfall of this region is probably slightly less than that of the Red River Valley, but appears to be sufficient for agricultural purposes.

670. It seems probable that at a period not very remote, a great part of this district was covered with forest trees. The humidity of the soil and climate is sufficient for their growth, and in some places, little hummocks, resembling those formed in a forest, and known as 'cradle hills' were observed. On approaching Turtle Mountain, the tendency of this part of the prairie to reclothe itself, is shown by the occurrence of thickets of seedling poplars on the sheltered sides of the undulations, wherever the fires have not passed for a few years. Between Pembina River and Turtle Mountain, and especially toward the latter place, the deep narrow paths, or ruts, made by the buffalo when travelling, are still quite apparent ; though the animal has not been known so far east for many years. They have here a remarkably uniform north-west and south-east direction.

671. The water of the swamps and ponds of this part of the prairie is generally sweet, but one distinctly saline lake was seen. It had not the thick fringe of grasses and sedges of the other ponds, and here, for

the first time, the *Salicornea* was met with in some abundance. There were also many dead shells of *Limnæa*, and *Planorbis parvus*; but whether these molluscs lived in the saline water, or were washed thither from some neighboring swamp, I was unable to determine.

672. The extent and general contour of Turtle Mountain have already been described in another connection (§ 511). Forming as it does, a more or less thickly wooded area, which may be estimated as over 300 square miles, it cannot but be a valuable nucleus for the utilization of the surrounding treeless plains; serving as a supply of fuel and building material, and as a refuge for wintering stock, which during the summer has been herded at large over the prairie. Though the elevated and broken area of the 'mountain' is pretty nearly equally divided by the Line, the northern half is more uniformly covered with woods, and probably embraces two-thirds of the forest area. There are also large regions of the so-called mountain, which, though more boldly undulating than the prairie, show good soil, and will eventually be cleared for agriculture. There are indications that this wooded area receives a much more copious rainfall than that of the surrounding country. The 'mountain' is now the head quarters of a large band of Sioux Indians, many of whom were concerned in the Minnesota massacre. They are a rather good looking and well-disposed race, and derive a moderately comfortable subsistence from hunting the moose, wapiti, &c.

673. The wood is chiefly poplar (*P. tremuloides*, *P. balsamifera*, &c.) Oak (*Quercus macrocarpa*) however, occurs abundantly along the margins of the forest, and forms groves on the ridges, or grows interspersed with other trees. White birch (*Betula alba*) is abundant, though not forming large groves, and black birch (*B. lenta*) also occurs. The ash-leaved maple, or 'box elder' (*Negundo aceroides*), and the elm (*Ulmus Americana*) are also found, the latter attaining considerable dimensions in some of the more sheltered vallies. The largest poplars observed must have been over two feet in diameter at the base, and of good height. The average size in many groves is about eighteen inches. The oak and birch are seldom over two feet in diameter, and the latter are generally much less; but growing in thick masses, and very tall. Most of the swamps are grassy, and would yield excellent hay. They are generally fringed thickly with willows of different species. The underwood is composed of hazles (*Corylus Americana*), choke cherries (*Prunus Virginiana*), thorns (*Crategus coccinea*), roses, raspberries (*Rubus strigosus*), &c. Peas and vetches are abundant, and occur with the fire-

weed (*Epilobium angustifolium*), and various species of *Solidago* and *Aster*.

674. Fires are evidently of frequent occurrence, and sweep over the areas where a sufficient depth of vegetable matter, and peaty soil, have accumulated; thus preventing the trees from obtaining a large average size, and favouring the spread of the poplar, and other species of rapid growth. Some cases were noticed, however, where a fire passing quickly through the woods, had been sufficient to kill nearly all the poplars, while the oaks had escaped, owing to the protection afforded by their thick bark. The young growth on burned areas is generally of poplar, forming dense, and sometimes almost impenetrable thickets of saplings.

675. The streams flowing northward from Turtle Mountain, which during the summer are very small, fall into White-water Lake, about seven miles distant. The lake appears to be a large sheet of water, but is said to be very shallow, and surrounded by an extensive swampy region.

676. Westward from Turtle Mountain the prairie rapidly loses its abruptly undulating character, and becomes almost perfectly level before reaching the Souris River, at the 170 mile point. There are, however, still many shallow, basin-shaped hollows, which must be filled with water in early spring, but soon show a fine tall growth of swamp-grass; which in the autumn was found in many places to stand considerably higher than a horse's back, and contrasts strikingly with the short crisp sod of the surrounding prairie. The vegetable soil is not very deep, often only six or eight inches, and is somewhat light and sandy, but is based on whitish marly drift, which forms a good subsoil.

677. A few miles east of the first intersection of the Line and Souris River, the first stone circles marking the former positions of Indian skin lodges, or tepees, were observed. Westward these circles are very abundant, and mark every spot favourable for camping; but eastward, though suitable stones strew the surface in many places, they have not been used.

678. The valley of the Souris River is here nearly a mile wide. It includes some flat and very fertile alluvial land, and a limited quantity of timber—chiefly elm—is found along the immediate banks of the stream, and is massed in fine groves on the peninsulas formed by its devious windings.

679. The region between the first and second crossings of the Souris River by the Line, about fifty miles in width, presents features similar

to those of that last described. It is gently undulating, with a soil which is in some places, perhaps, rather thin and gravelly; but which is deeper and richer in the vicinity of the North and South Antler Creeks—tributaries of the Souris. Along the valley of the South Antler, a good belt of trees extends for many miles. The surface is everywhere covered with a strong sod of short grass. The only shrub growing on the general surface of the prairie is the *Elæagnus*, which forms little thickets scarcely two feet in height. The vegetation of this part of the second prairie steppe, appears to be slightly in advance of that of the Red River Valley. In the early part of September, 1873, the *Liatris*, still showing bloom in the latter region, was here found past flowering, and with seed well advanced. This may arise as much from the warm and dry character of the soil, as from any absolute difference of temperature.

680. The Souris, at its second crossing, flows in a valley with rounded grassy banks, somewhat narrower than before, and with the immediate bed of the stream proportionately deeper. It is still well fringed with wood, and continues to be so as far as Wood End—262 mile point—or about eighty miles by the course of the stream. On the night of the 8th of June, last year, a frost occurred in this valley. The grass was covered with a light hoar frost, and thin films of ice were formed on water standing out in vessels. It did not, however, seem to affect the vegetation, and its occurrence was quite exceptional. A very strong and cold north wind (temperature  $42^{\circ}$ ) blew during the morning of the 8th, but fell toward evening, leaving the sky quite transparent and clear. The country being thus flooded with cold air, the temperature was reduced during the night by radiation, to a point below  $32^{\circ}$ .

681. From the second crossing of the Souris to the foot of the Missouri Coteau—from 215 to 290 mile points—the prairie still shows a gently undulating surface, and in most places a short, thick growth of grass. The soil, however, in passing westward, shows a tendency to become more sandy and stony, and some large tracts are covered with boulders in such profusion, as to be rendered permanently unfit for agriculture. No sudden change in the character of the soil, marks the passage from the Cretaceous to the Tertiary, in this region; the surfaces of both formations being completely masked by the thick deposit of marly drift.

682. About the middle of September, 1873, the prairie between Turtle Mountain and the Coteau had a uniform yellow tint, except in the hollows; the grass being dead nearly to the roots, over the general surface of the

plain. Last year, this region was passed over during the last days of September and first of October, and had then a general green tint, the grass being fresh and good. The short prairie grass, however, even when dry, proves nourishing food for animals, and is preferred by them to that of the swamps and hollows.

683. West of Turtle Mountain, the country is unquestionably dryer than before. The short buffalo-grass (*Bouteloua oligostachya*) becomes abundant, and it would appear at least doubtful, whether the rainfall over much of this region is sufficient for the maturing of crops, with a soil and subsoil too light to retain much moisture. Irrigation, though much talked of as a remedy for the deficient rainfall of many western regions, is only applicable over those comparatively small districts, where water can be obtained at a sufficient elevation. Most of the western rivers flow in vallies much depressed below the general level of the plains, and having a very small rate of descent, cannot be used in this way. It would appear that vast areas of the western plains, south of the Fertile Belt of the Saskatchewan region, and west of the Missouri Coteau, must remain as pasture grounds, for which they are in great part well fitted.

684. The precipitation during the summer months, on these great plains, appears to be almost wholly of the nature of local showers, accompanied by discharge of electricity. The extreme uniformity of the surface of the country,—when the weather is settled—allows a well marked meteorological cycle to recur. The mornings are generally clear and often completely cloudless, but as soon as the sun's heat begins to be felt, small cumulus and cirro-cumulus clouds appear, produced by local ascending currents from the heated surface of the ground. These growing continually larger, and more numerous, drift with the prevailing wind—which is generally westerly—and about three or four o'clock in the afternoon, small local thunder storms are developed. Several of these may often be seen at one time, and though occasionally the clouds coalesce to form larger storms, this is comparatively rare. During the night the storms generally dissipate, and equilibrium is restored before dawn.

685. It would seem that the character of the second prairie plateau where crossed by the forty-ninth parallel, is that of much of the northern part of this great steppe. While its more fertile eastern border rapidly expands northward, its south-western edge appears to become in the vicinity of the Qu' Appelle, and South Saskatchewan Rivers, even drier and less inviting.

*Country of the Third Prairie Steppe.*

686. A general description of the Missouri Coteau, is introduced more appropriately in connection with the drift deposits. (§522 *et seq.*) The strip of broken country embraced under that name, from where it crosses the Boundary-line to the Elbow of the South Saskatchewan, has an area of about 7,500 square miles; of which the greater part must always remain unsuited to agriculture, from its tumultuous and stony character. It would, however, be an excellent stock raising district. Though some of the steeper hills are but scantily clad with vegetation, a good growth of short nutritious grass covers most of the surface; and swamps and sloughs with excellent hay-grass, are scattered everywhere. In its physical features the Coteau resembles Turtle Mountain, and like that place would no doubt naturally be thickly wooded, but for the prairie fires, which here sometimes run hundreds of miles in the dry weather of the autumn. As it is, the want of wood is one of the most serious drawbacks; and animals fed over these hills in summer, would require to be wintered in some of the river vallies to the north, or in the wooded ravines of the Tertiary plateau to the south.

687. A sample of the efflorescent saline matter, of one of the 'Alkaline' lakes of the Coteau, gave on analysis, the following result:—

Magnesian sulphate .....	49.06
Sodic sulphate .....	47.73
Sodic chloride .....	0.75
Iron .....	traces

The iron occurs as protoxide, and appears to be protected by organic matter present in the mass. A qualitative examination of a similar saline incrustation from the Souris Valley, near Wood End, showed the presence of magnesian and sodic sulphates, only. A small quantity of this saline matter or 'alkali' is not found to be injurious to crops, in the Western States, where sufficient moisture exists; nor does it appear to be detrimental to the growth of grass.

688. South and west of the Coteau, lies the great plateau of the Lignite Tertiary, which may be said to begin about the 350 mile point, and extend as a well defined table-land, as far as White Mud River—a distance of 115 miles—in the vicinity of the Line. Its form is very irregular, but its area may be about 12,000 square miles. The soil of this plateau, appears as a rule to be of a fertile character, but the indications are that the rainfall, except in a few favoured spots, is too small for the growth of the ordinary crops. Its elevation also, no doubt, renders it

more subject to early and late frosts, than the prairie to the east, though the winter is probably not so severe as that of the Red River Valley. On reaching this part of the third plateau in June of last year, the vegetation—from a comparison of the flowering plants—appeared to be about a week behind that of the second steppe. The plateau of the Tertiary is for the most part, only adapted for pastoral occupation; but being covered with a good growth of grass, is well suited for this use. The strip of country between the plateau and southern edge of the Coteau, partakes in some measure of its character, but has a less favourable appearance.

689. An important advantage of this plateau, is the existence along its edges of sheltered ravines and vallies, containing groves of poplar; and also the presence beneath it of great deposits of lignite coal. In one of these sheltered valleys, the half-breed settlement known as Wood Mountain, is situated. No cultivation of the ground has been attempted by the few families frequenting the place, and its prosperous days are already over, as the buffalo, on which its existence depends, now rarely come so far east. It is, in fact, merely a base for a certain number of hunters and traders, who have found it convenient to erect wintering shanties there.

690. South of the plateau, as far west as Wood Mountain, the region draining to the Missouri, is also based on the Tertiary, and generally bears a close, short growth of grass. Beyond Wood Mountain, the low ground, both to the north and south of the plateau, is based on the Cretaceous clays, and is, in most places, dry and barren. The 'grease-wood' (*Sarcobatus*) and other peculiar chenopodiums, now appear in the flat, clay-bottomed vallies of the streams; and many varieties of 'sage' (*Artemisia*), and other shrubby compositæ are found. The disc-leaved cactus (*Opuntia Missouriensis*), in some places forms extensive beds, and in the last week in June, was found to be in full flower. The drier slopes, which are scarcely capable of supporting a sod, show among the stunted grass *Selaginella rupestris*, and a small species of lichen. Many peculiar southern, or extreme western plants, were here met with for the first time, and here also the 'jack rabbit,' and 'sage cock' (*Centrocerus urophasianus*) find their eastern limit.

691. The White Mud River, or Frenchman's Creek, may at present be considered the eastern limit of the buffalo, in this latitude. During the last sixteen years, their front has been driven back, in the vicinity of the Line, over two hundred miles, and it is probable that their northern limit has been contracted to at least a like amount.

692. West of White Mud River, to the 505 mile point, an undulating prairie is passed over, resembling in its vegetation the surface of the Tertiary plateau. It is deeply drift-covered. Beyond this point, an outlying portion of the Tertiary plateau stretches for about thirty miles. It is much cut up by ravines, and sometimes very stony, but is covered in general by a close sod, and shows a few swamps with good grass.

693. There is evidence that over the whole eastern part of the third prairie steppe, and especially over the Tertiary plateau, the season of 1874 was an exceptionally dry one. Grasses on the drier hill-sides, which had ripened their seeds the season before—as evidenced by the seed stalks—in 1874 showed no flower, and even the leaves were scarcely green.

694. Beyond this portion of the Tertiary plateau, an arid plain stretches with little interruption for fifty miles, or nearly to the Milk River. It also extends far north-westward toward the Cypress Hills, and appears to coalesce, along their western front, with a similar desert region, which—according to Palliser—exists to the north. It appears to be irremediably sterile and useless, being based on Cretaceous No. 4, and in great part composed of the debris of these rocks. (§ 351.) In early spring it is evidently, in many places wet, but in summer, dry, hard, and fissured, and scarcely supporting a sod. It is traversed by the vallies of the East and West Forks of Milk River, which rise in the vicinity of the Cypress Hills; but both the main streams and their tributary coulées become nearly dry before the end of the summer.

695. The western limit of this plain, is formed by a strip of more elevated land, lying between it and the Milk River, and about five miles wide. This is again based on the Lignite Tertiary formation, and shows a uniform, short sod; with some lakes and swamps, surrounded with fine hay-grass, along its eastern border.

696. Here, during July and August of last year, the greater part of the 'Big Camp' of the half-breeds, was situated. The hunters and traders in this region congregate for mutual protection, and form, as it were, a tribe among the Indians. They live under no law or restraint, other than that imposed by necessity and by the general consent, or by the priest who accompanies them. Spending the summer at large, in the neighbourhood of any district which happens to be well stocked with buffalo, they fall back eastward for winter quarters. A few of them going to Wood Mountain, but most to the White Mud River, south of the Line, near a trading post known as Fort N. J. Turnay. A compara-

tively small proportion of the robes obtained by these people, find their way to Winnipeg; most of the trade being carried on toward the Missouri. The summer hunt is chiefly to obtain *peimican* meat, the skins of the buffalo killed being frequently wasted, In the autumn and early winter, when the skins are *prime*, robes are the chief object. The Indians, though some of them are friendly to these half-breeds, and glad enough to trade with them, are naturally jealous of their hunting, and slaughtering buffalo for themselves. In July last, the 'Big Camp' consisted of over two hundred tepees, most of them of dressed skin, like those of the Indians, but some of canvas. Every family owns carts, at least equal to in number to that of its members; and when the camp is made, these are arranged in a circle, to form a 'corral' for the horses; the tents being pitched round the whole. The total number of horses possessed by the camp was stated to be about 2,000, valued at from \$20 to \$100, according to their aptitude in buffalo running. A few weeks before our arrival, the half-breeds had been in the Cypress Hills, and had there assisted, or countenanced, the Sioux in a fight with the Blackfeet, in which eight of the latter tribe were killed. The camp is assiduously guarded, to prevent surprise or horse stealing.

697. From what I could learn, I believe, that at the present rate of extermination, twelve to fourteen years will see the destruction of what now remains of the great northern band of buffalo, and the termination of the trade in robes and *peimican*, in so far as regards the country north of the Missouri River.

698. Westward from the Milk River, the infertile Cretaceous clays do not recur, the country being based on the Lignite Tertiary. To the base of the East Butte, the surface, though not of the same desert character as that met with east of Milk River, is covered by a short, thin sod only, and is in many places stony also. The unfavourable appearance of all this region, does not arise so much from any deficiency in the soil itself, as from the absence of sufficient moisture. The vegetation, in fact, depends chiefly on the saturation of the ground by the water of the melting snow, and spring rains; and, when this is exhausted, is brought to an end as effectually as if by the onset of winter, though long before that event.

699. The general appearance and extent of the Sweet Grass Hills, or Three Buttes, have already been noticed (§ 303.) Their height and mass is sufficient to cause the formation and arrest of clouds in their immediate vicinity, where the rainfall is in consequence much more copious.

These mountains, and the broken ground around them, form a favourite haunt of the buffalo; which here find abundance of food and water. The spring, arising from some parts of the Buttes are very copious, and form streams, which on leaving the shelter of the wooded vallies, and issuing on the plains, are rapidly absorbed by the dry soil and atmosphere—at least in the summer season. One of these was observed to be a rapidly flowing brook during the night and morning hours, but in the afternoon became quite dry. The timber of the Buttes is chiefly pine, (*P. Banksiana* ?) much of it has been burned, but it shows a tendency to renew itself. The trees are not of great size, and generally in somewhat inaccessible parts of the mountains, but cannot be considered unimportant in a country so treeless. A few of the plants, found at elevations above 6,000 feet in the Rocky Mountains, appear also on the summits of the Buttes.

700. The country surrounding the Buttes, is said to have been for a long time a neutral ground between various hostile tribes of Indians. That it has been so, is evidenced by the almost complete absence of buffalo bones in their neighborhood, and the rare occurrence of the circles of stones, marking camping places. The region is at present a debatable ground between the Blackfeet, Peagans, and Bloods of the west; the Sioux and Assineboines of the east, and the Crows and other tribes of the Upper Missouri. It is not passed through save by war parties, strong in numbers, and travelling rapidly. Ten miles north of the central Butte, the bodies of over twenty Crow Indians were found, unburied, on the scene of a conflict.

701. From the Sweet Grass Hills, toward the Rocky Mountains, the country improves in appearance, and shows evidence of a greater rainfall. The cactus, grease-wood, and *Artemisia* cease to appear. To the Second Branch of Milk River—a distance of 55 miles—the country is generally much broken, but shows remains of a former more elevated surface, in somewhat extensive flat-topped hills, which, when ascended, are found to be nearly of equal height, and show much drier and more gravelly soil than elsewhere found in the region. There is usually a close, thick growth of grass, and the swamps and sloughs, which are numerous, generally hold grasses and Carices to the exclusion of the rushes formerly most abundant. The watershed region, from the Second Branch of Milk River, to the St. Mary River, is of a similar character.

702. The portion of the fertile belt fringing the eastern side of the Rocky Mountains, in the neighbourhood of the forty-ninth parallel, is

about twenty-five miles in width. On crossing the St. Mary River, a very marked and rather sudden change for the better is observed. The surface, at the same time, becomes more undulating and broken, and is quite hilly before the actual base of the mountains is reached. It is now covered with a thick vegetable soil, supporting a luxuriant growth of grass; and wherever the fire has spared them, trees are to be found in all stages of growth. Many plants, last seen in the neighbourhood of Pembina Mountain and the Red River Valley, and which across the more arid plains have been lurking only in sheltered hollows and damp coulees, now re-appear over the surface of the country generally. The rivers and streams, also, entirely change their character, and instead of flowing sluggishly with a milky opacity, now hold clear blue water, run swiftly over stony and gravelly beds, and are filled with trout.

The thickets are generally of poplar, but in the immediate vicinity of the mountains show birch and coniferous trees also. The *Eleagnus* found in stunted thickets on the plains, now forms a well-grown bush, and the vallies and hill-slopes in August were gay with various species of *Aster*, *Solidago*, *Epilobium*, *Castilleia*, and with *Geranium Fremontii*.

703. I was informed by traders, who had wintered in the vicinity of St. Mary River, that the snow does not lie here for more than about three months, the temperature also being much milder than in localities further east. It would appear probable, however, from the altitude of the country, that early and late frosts may shorten the season agriculturally, to a greater extent than indicated by the above statement. As the Mounted Police are, I believe, at present wintering in this neighbourhood, more authentic information on the climate will no doubt soon be forthcoming. The buffalo are said to frequent the foot-hills of the mountains in winter, in great numbers, and their remains were found in the South Kootanie Pass, as far as the last patch of meadow land, on the east side of the watershed.

704. For this part of the country, the mountains form an inexhaustable source of wood for construction, and also for fuel, though extensive areas are known to be underlaid by coal. The timber in the mountains is chiefly coniferous, and not of large size, except in certain secluded vallies. A species of pine, somewhat resembling the Banksian pine, but which I believe to be *Pinus contorta*, is found pretty abundantly in some localities, especially on the gravel terraces, and valley bottoms. It would afford good straight timber, but does not attain a great girth. The Douglas pine (*Abies Douglasii*), also occurs on both sides of the

watershed, but is generally small. The largest timber observed, was in some of the higher and more secluded vallies. The trees resembled the black spruce, but were probably *Abies Engelmanni*. It is unnecessary here to enter into detail with regard to the alpine and arctic flora of the higher parts of the mountains. I was only able to devote a few spare hours to the collection of plants, but a number of very interesting forms were obtained, and will be found catalogued in the appended list.

705. The foregoing descriptions will show that the character of the third steppe is much more varied than that of either of the others; but also that no part of its southern extent compares favourably with the land of the Red River Valley, or that of the best parts of the second steppe—always excepting the land along the immediate base of the mountains. At the same time, the explorations in connection with the Boundary Survey have served to show, that this country, formerly considered almost absolutely desert, is not—with the exception of a limited area—of this character; that a part of it may be of future importance agriculturally, and that a great area is well suited for pastoral occupation and stock farming.

706. The fertile region at the base of the Rocky Mountains, according to Palliser and other explorers, narrows somewhat about fifty miles north of the Line, but then spreads eastward, while the mountains tread to the west, and includes a great area of fertile country in the vicinity of the North Saskatchewan, the more northern position of which is more than compensated for, by its decreased altitude, and the lower and more open mountain passes to the west.

This fertile belt to the north, must form the basis for the settlement and utilization of the western plains. The cactus-covered desert tract does not seem to stretch far to the north of the Line; but there is an extensive region of the third prairie steppe south of the fertile belt which is described as having a poor soil, with scanty herbage, and no wood, except on northern exposures.

707. With regard to the climate of the third prairie steppe in the vicinity of the Line, not much information is at command. In two places, I was able to observe the temperature of copious springs, flowing out at such a depth from the surface, as to render it probable that their waters were not far from the mean annual temperature. On both occasions, the thermometer indicated 46° F. One of the localities is near longitude 106° 30'; the other at 113°. The mean temperature of

the greater part of Montana, to the south, is estimated to be  $48^{\circ}$ \*; showing, if the observations are to be trusted, a lower mean temperature by two degrees on the forty-ninth parallel. Climatal lines, however, are not very strict or well marked on the western plains, and it is probable that the climate of a great part of the third steppe nearly coincides with that of northern Montana, where more continuous records exist than any available for the region to the north.

708. The mean temperature for each month at Fort Shaw, one hundred miles south of the Line on the 112th meridian, is, in the following table, placed side by side with that of Winnipeg †:—

	Ft. Shaw.	Winnipeg		Ft. Shaw.	Winnipeg.
January .....	21·28	2·91	July .....	70·22	65·87
February.....	30·39	2·99	August .....	67·15	64·75
March .....	36·58	9·00	September.....	54·04	51·29
April .....	46·51	30·21	October.....	49·12	40·01
May .....	56·04	51·18	November .....	39·92	14·58
June.....	64·98	63·64	December.....	26·75	0·56

The mean annual temperature of Fort Shaw is  $47\cdot33$ , while that of Winnipeg is  $32\cdot59$ . The temperature of the six warmer months, May to October inclusive, in northern Montana and the Red River country is pretty nearly equal, showing a balance of only about four degrees in favour of the former. The six winter months are, however, very much colder in the eastern locality; and this notwithstanding the fact that Fort Shaw is about 3,000 feet higher than Winnipeg. Thus, while the mean annual temperature of the Red River Valley stands about 14 degrees lower than that of Montana, this is not brought about by any great deficiency of summer heat, but by the long continuance of steady cold weather in the winter. The extreme of winter cold is probably almost as great in Montana as in the Red River country, the thermometer at Deer Lodge showing a minimum of  $-30^{\circ}$  F. in several years, but the cold weather is not of long continuance. The snow fall is very light, and seldom exceeds a few inches in depth at any one time. The total annual precepitation—mean of two years—amounts to  $8\cdot95$  inches only.

As a pastoral and stock-raising country, the higher mean annual temperature gives the third plateau an important advantage over the region to the east.

\* U. S. Geol. Surv. Territ., 1872, p. 811.

† Temperature of Fort Shaw from the mean of two years. U. S. Geol. Surv. Territ., 1871, p. 266. That of Winnipeg, from three years observations, is kindly supplied by Prof. Kingston.