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Observations on the Flora of the Southern Rocky
Mountain Trench in British Columbia

By J. W. EASTHAM
Presented by H. T. GÜSSOW, F.R.S.C.

THIS paper deals with that portion of the Rocky Mountain Trench which lies between the Rocky and Selkirk Mountains, from the International Boundary north to Golden on the main line of the Canadian Pacific Railway. Only the vegetation below about 3500 ft. elevation was studied, and on this basis the above stretch of the Trench falls fairly definitely into three sections which may be designated Southern, Middle, and Northern, available soil moisture being the governing factor in determining the type of vegetation. Special attention was given to the southern section, where the valley floor is widest and conditions most varied. In this area, also, far-reaching plans are being made for dams on the Kootenay River and its tributaries, with the objectives of flood-control and power-development. If these are carried through they will also provide water to irrigate many thousands of acres, and change the agricultural development of the area, which is now mainly stock-range. For this reason, and also because the botany of this region has been much neglected, the writer believes that his observations, made in the summers of 1947 and 1948, may be of interest and provide a record of conditions liable to change greatly in the near future.

I. SOUTHERN SECTION

The area from the Montana Boundary, north to and including Canal Flats, bounded on the west by Cranbrook and on the east by Elko, forms a fairly definite vegetation zone. The altitude of the valley-floor is indicated by that of the following points: Canal Flats, 2,653 feet; Cranbrook, 3,013 feet; Elko, 3,000 feet; Newgate, almost on the International Boundary, 2,800 feet.

The surface is much broken up with rocky knolls and ridges, river and stream valleys, and some deep canyons, giving a great variety of drainage and exposure, with consequent changes in the composition of the vegetation.

Precipitation, as shown in the following table, is intermediate between that of Vernon and Kelowna, at the northern extremity of the Okanagan Dry Belt.

	Alt.	April	May	June	July	Aug.	Sept.	6 mos.	12 mos.
	Ft.	In.	In.	In.	In.	In.	In.	In.	In.
Cranbrook	3,013	0.67	1.24	1.81	1.13	0.94	1.14	6.93	14.16
Newgate	2,800	0.78	1.25	1.60	0.85	0.82	0.89	6.19	13.52
Kelowna	1,200	0.62	0.92	1.10	0.77	0.79	1.12	5.32	12.18
Vernon	1,383	0.77	1.16	1.74	0.98	1.14	1.28	7.07	15.60

The vegetation is that of the upper and moister levels of the Arid Transition Zone, modified perhaps by much severer winters than in the Okanagan and Kamloops areas. Sage-brush (*Artemisia tridentata* Nutt.) and cactus (*Opuntia* sp.), conspicuous plants of the Western Dry Belt, do not occur. Rabbit-brush (*Chrysothamnus nauseosus* (Pall.) Britt.) and balsam-root (*Balsamorhiza sagittata* Nutt.) are found only here and there on hot, dry, usually southern, exposures.

Although, as mentioned above, there are local variations in the character of the vegetation, there is little evidence of zonation, either regional or altitudinal, within our terms of reference, except that conditions become much moister and the vegetation more mesic at the base of the mountains. This is particularly well seen along the south-eastern edge of the area, where rainstorms originating in the Crowsnest Pass apparently debouch at Elko and follow the mountains south. Elko itself, at the entrance to the Pass, has an annual precipitation of 19.38 in., while as far south as Flagstone the vegetation is of a mesic type, streams are common, and irrigation and mixed farming occur, with even an occasional orchard.

In addition, there is a slight general change in the vegetation, not noticeable to the ordinary observer, in travelling from south to north, due to the varying degree to which certain plants, apparently of southern origin, have been able to establish themselves. Thus the reedgrass (*Calamovilfa longifolia* (Hook.) Scribn.) occurs chiefly just north of the Montana Boundary; *Eriogonum flavum* Nutt., *Orthocarpus tenuifolius* Benth. and *Phlox rigida* Benth. were only observed as far north as Wasa and Skookumchuck, while the antelope-bush (*Purshia*) stops about 10 miles south of Kootenay River Crossing at Canal Flats.

There are two general types of vegetation, namely, forest and climax grassland.

(1) Forest. This at one time has covered most of the area. Whitford and Craig (1918) state that the area was second only to the Coast in the value of its lumbering. Since that time logging has

been carried on so intensively that most of the larger mills have had to close down. It is, therefore, not easy to reconstruct the original picture. The most characteristic tree of the area is the yellow or bull pine (*Pinus ponderosa* Dougl.), which is abundant to Canal Flats, north of which it ceases abruptly. It occupies the hottest, driest areas, where it may form practically pure stands, as at Rampart, Waldo, and parts of Tobacco Plains. More usually it is mixed with Douglas fir (*Pseudotsuga taxifolia* (Lamb.) Britt) in varying degrees, and this may also form almost pure stands. Western larch (*Larix occidentalis* Nutt.) occurs typically in somewhat moister situations, but between Cranbrook and Kimberley as well as elsewhere, all these may be seen growing in the same clump. Spruce, both white and Engelmann's, occurs chiefly along creeks and river-flats, where there is abundance of moisture, but at St. Eugene Mission yellow pine and spruce may be seen growing side by side. Rocky Mountain juniper (*Juniperus scopulorum* Sarg.) is found occasionally throughout.

The forest type produced by these trees is mostly open (savannah) with a thin ground-cover, chiefly of grass, but with some forbs and dwarf shrubs. Where it has been logged and burned and there is perhaps a little more moisture, the typical dense stands of lodge-pole pine (*Pinus contorta* Dougl.) may occur, as is well seen along the road from Wardner to Jaffray. Along creek-bottoms, also, there is often a very dense growth of moisture-loving trees and shrubs—cottonwood (*Populus trichocarpa* T & G), aspen (*Populus tremuloides* Michx.), willows (*Salix* sp.), alder (*Alnus tenuifolia* Nutt.), mountain maple (*Acer glabrum* var. *Douglasii* (Hook.) Piper) and red osier dogwood (*Cornus stolonifera* Michx.).

The most characteristic shrub is the antelope-bush (*Purshia tridentata* (Pursh) DC), which occurs throughout except in the moist belt at the foot of the mountains. It reaches its maximum development both as to numbers and size of individuals, on logged-off land southwest of Elko. In the Western Dry Belt this plant extends into British Columbia for perhaps 40 miles north of the 49th Parallel, in the Southern Okanagan and Similkameen, in what is generally regarded as the Upper Sonoran Zone. It is associated there with sage-brush and cactus, both of which, however, extend for some 80 miles farther north into the Kamloops-North-Thompson region. It is not quite clear why *Purshia* should be so abundant in this area, while the more widely-ranging species associated with it in the western region are absent. However, the prevalence here of light sandy and gravelly soils is probably one, and perhaps the most important, reason.

Other common shrubs are roses (*Rosa* sp.), western choke-cherry (*Prunus demissa* Nutt.), mock-orange (*Philadelphus Lewisii* Pursh), bearberry (*Arctostaphylos uva-ursi* (L) Spreng.) and snow-berry (*Symphoricarpos occidentalis* Hook. and less commonly *S. albus* (L) Blake).

(2) Areas of climax grassland are small; the two most important being St. Mary's Prairie, between Cranbrook and Marysville, and Tobacco Plains, adjoining the Montana Boundary. These were noticed by the early explorers and travellers. (Tobacco Plains is said to have received its name from a much-prized strain of tobacco cultivated by the Indians which drew large assemblies from the surrounding country for trade. No trace of tobacco, growing wild or cultivated, could be found by the present writer.) Both St. Mary's Prairie and Tobacco Plains (but especially the latter) have been excessively overgrazed, and it is not easy to infer the nature of the original vegetation. Relatively undisturbed patches are small and not typical in situation of the general area. However, in such places blue bunchgrass (*Agropyron spicatum* var. *inermis* Heller) is usually the dominant grass, and as this is one of the best forage grasses it seems probable that it at one time occurred over the whole area and has disappeared through overgrazing. Rough fescue (*Festuca scabrella* Torr.) is also frequent throughout, as is also Idaho fescue (*F. idahoensis* Elmer), which seems to stand grazing better and is often dominant on St. Mary's Prairie. Other abundant grasses are *Koeleria cristata* (L) Pers., *Poa secunda* Presl and *Stipa columbiana* Macoun. Associated plants are poison camas (*Zigadenus venenosus* Wats.), *Delphinium bicolor* Nutt., *Heuchera glabella* T & G, poison milk-vetch (*Astragalus serotinus* Gray), silky lupin (*Lupinus sericeus* Pursh), *Antennaria parvifolia* Nutt., *Arnica sororia* Greene, dwarf Erigerons of several species, and *Gaillardia aristata* Pursh. It seems, therefore, that the original vegetation here was the *Agropyron-Festuca* association, or Upper Grassland Zone, as described by Tisdale (1947) and Spilsbury and Tisdale (1944). It differs from this, as described from the Western Dry Belt, in the much greater abundance of Idaho fescue and by the presence of a number of species peculiar to the Rocky Mountain region. (*Linanthus septentrionalis* Mason, a species little known in British Columbia was found to be frequent and often abundant on overgrazed range).

While the above applies apparently to most of the area, there are "islands" of considerable size, especially on Tobacco Plains, which are almost pure stands of *Stipa comata* Trin. & Rupr. or *Bromus tectorum* L., or mixed with *Poa secunda*. Tisdale (1947) considers such associations as derived by overgrazing from what was originally

Middle Grassland Zone, so this zone may also have been represented in the hotter drier places (chiefly on gravel).

Where overgrazing has been worst, grass may have almost disappeared and other vegetation taken its place. In some cases patches of many square yards are occupied with false dandelion (*Agoseris glauca* (Pursh) Greene), a tap-rooted perennial. An annual woolly composite, *Filago arvensis* L., introduced from Europe, and not known to occur elsewhere in North America, is very abundant on much of the overgrazed range south of Elko, in some places almost taking possession. It appears to be unpalatable to stock.

Skookumchuck Prairie, about 23 miles north of Fort Steele, is a small level area on gravel soil. The grass cover is almost pure *Stipa comata*, with some *Bromus tectorum* and *Koeleria cristata* in places. Forbs are abundant, *Erigerons*, pasture wormwood (*Artemisia frigida* Willd.), *Antennaria parvifolia*, bitter-root (*Lewisia rediviva* Pursh), *Phlox rigida*, *Eriogonum flavum*, woolly plantain (*Plantago Purshii* R & S), etc.

A considerable area of prairie at Wasa, about 12 miles north of Fort Steele, but on the east side of the Kootenay River, seems to be of the same character. Both are apparently derived from Middle Zone Grassland by overgrazing.

Correlation between soil formation and plant cover

Attempts to correlate the plant cover with the underlying soil formation, as determined by the soil surveyors, were not successful. Local variations of exposure, drainage and precipitation, apparently outweigh the difference between the soil types. This is well seen in observing the tree cover on the Elko Gravelly Soil Association from the old Newgate Railway Station to the present Flagstone Post Office and northwards. Almost pure stands of yellow pine change to Douglas fir, become mixed with lodge-pole pine and western larch, and along the base of the mountains with aspen, alder, and mountain maple. In other words, the complete extremes of forest cover in the whole southern Trench may occur on the same soil formation. In the case of the grassland the situation is further complicated by overgrazing and secondary associations.

Certain plants, however, are indicative of specially hot, dry situations. *Eriogonum flavum*, a perennial restricted in British Columbia to this section, is one of them. A bed of its bright yellow flower-clusters, often conspicuous at a distance, is an almost certain indication of a gravel soil. The less common *Penstemon eriantherus* Pursh likes a similar habitat, while the lesser paintbrush (*Orthocarpus*

tenuifolius), an annual, is very common in such situations, maturing and dying down early.

As elsewhere in the Dry Belt, alkali-grass (*Distichlis stricta* (Torr.) Rydb.) and the poisonous arrow-grass (*Triglochin maritima* L.) were found to be indicative of moist alkali spots; for example around the ponds at Rampart and on the flood-plain of the Kootenay River at Doyle. *Poa juncifolia* Scribn., not uncommon in the area, is supposed to indicate alkali in drier situations.

Transitional areas

On the east the southern section of the Trench ends abruptly against the Rocky Mountains, except at the entrance to the Crowsnest Pass, where Elko is located. Even here, however, the change is abrupt. Within a few hundred yards, travelling east from Elko into the Pass, all the characteristic plants of the Trench have disappeared and been replaced by those of the moister Canadian Zone.

On the west, from Cranbrook, the change is more gradual. *Purshia* does not extend much beyond Cranbrook; the last of the characteristic Rocky Mountain plants, *Hedysarum sulphurescens* Rydb., disappears about 8 miles west of the town. Before reaching Moyie, bracken (*Pteridium aquilinum* var. *pubescens* Underw.) appears, together with hunch-berry (*Cornus canadensis* L.), thimble-berry (*Rubus parviflorus* Nutt.), and other plants of the Canadian Zone, though the yellow pine persists more or less to Kingsgate. Between Yahk and Kitchener the highway lies mostly in the Canadian Zone; western larch, hemlock (*Tsuga heterophylla* (Raf.) Sarg.) and cedar (*Thuja plicata* D. Don) are common; balsam fir (*Abies grandis* Lindl.) is frequent and white pine (*Pinus monticola* Dougl.) occasional. Bracken and thimble-berry are abundant. The cultivated bench lands of the Creston district are in the upper levels of the Arid Transition Zone.

II. MIDDLE SECTION

This extends from Canal Flats northwards nearly to Brisco. The valley floor is occupied by the Columbia and Windermere Lakes, and farther north by extensive swamps and flood-meadows of the sluggish Columbia River. No study was made of this semi-aquatic vegetation, as having an abundance of moisture, it remains fairly constant over large areas, and bears little relation to changes in land conditions.

The benches are mostly rather steep, with comparatively little level land. The vegetation, although still of the Arid Transition type, indicates a less arid condition than obtains in the southern

section, but this is probably due less to higher precipitation than to a more retentive soil. (The average precipitation for the six months, April to September, is 6.94 inches at Invermere as against 6.93 at Cranbrook.) Porous gravelly soils and subsoils cover much of the southern area, while in the middle section there is much deep, fine silt, well seen in the "hoodoos" at Dutch Creek.

The most conspicuous difference in the forest cover is the absence of the yellow pine (*P. ponderosa*), which thins out rapidly and ends about 4 miles north of Canal Flats. Douglas fir now becomes the dominant tree, often forming almost pure stands, mostly of an open character, on the lower benches. These have probably been denser in the past, and thinned out by selective logging. Scattered trees of Rocky Mountain juniper (*Juniperus scopulorum*) are frequent in the Douglas fir association.

In moist hollows aspen, cottonwood, and birch (both *Betula fontinalis* Sarg. and *B. papyrifera* var. *occidentalis* (Hook.) Sarg.) occur. Western larch does not seem to descend much below 3500 feet, but above that is often abundant. Along the creeks spruce (both Engelmann's and white), mountain fir (*Abies lasiocarpa* (Hook.) Nutt.), mountain maple and white pine occur.

The shrubs are much the same as farther south except that antelope-bush (*Purshia tridentata*) has disappeared. Dwarf Oregon grape (*Berberis repens* Lindl.), *Rosa* sp., bearberry (*Arctostaphylos uva-ursi*), *Shepherdia canadensis* (L.) Nutt., western snowberry (*Symphoricarpos occidentalis*), and rabbit-brush (*Chrysothamnus nauseosus*) are all frequent.

Of herbaceous plants a number already mentioned as peculiar to the southern section have disappeared, but most of the others persist. A few years ago the dry southern slopes of hillside ranges at Windermere were brilliant with scarlet mallow (*Sphaeralcea coccinea* (Nutt.) Rydb. known otherwise in British Columbia only in the Kamloops district, but this has disappeared, at least temporarily, probably as a result of overgrazing with sheep.

It is doubtful if there has been any extent of original grassland in this section. Probably most of the present range-land was open forest, cleared or thinned-out by logging. Most of the ranges have been so overgrazed that it is difficult to infer the original composition. However, from examination of some range at Fairmont which had been allowed to recover, it would appear that typical *Agropyron spicatum* (Pursh) Scribn. & Sm. replaces var. *inermis*, the dominant form in the southern section.

There are three other interesting botanical features of the section:

(1) Two ferns, rare elsewhere in British Columbia, are abundant in the dry limestone cliffs above Fairmont, a rather unusual habitat for ferns. These are *Cheilanthes Feei* Moore and *Pellaea Suksdorfiana* Butters. Ferns are scarce in both the southern and middle sections, one site of *Cystopteris fragilis* (L.) Bernh. and a few collections of *Woodsia scopulina* D. C. Eaton and *W. oregana* D. C. Eaton being the only ones seen in addition to the one to be mentioned later.

(2) A number of plants found in Alberta, and mostly with an extensive range east of the Rocky Mountains, but not otherwise known from British Columbia west of the Rockies. These are *Andropogon scoparius* Michx. and *Gaura coccinea* Pursh; *Arabis glauca* (Nutt.) Rydb. and *Plantago eriopoda* Torr.; *Calamagrostis montanensis* Scribn.

The first two are known only from small solitary sites at Fairmont and Windermere Beach respectively, both popular tourist resorts, and may perhaps have been accidentally introduced by man; the next two occur over a larger area of alkali meadow at Windermere; the last-named extends for some miles north and south of where the highway from Banff, Alberta, enters the Trench and extends across the valley to the benches of Invermere and Wilmer. In a small protected area above Windermere Beach it proved to be the dominant grass. There are two specimens in the United States National Herbarium collected by J. Macoun in 1904 in "Rocky Mt. Park," which may be the present Kootenay or Banff National Park, and the species appears to be common in Alberta. It seems possible, therefore, that it may have migrated along the passes through which the Banff-Windermere highway now goes, perhaps helped inadvertently by human agency.

(3) The flora of the hot springs at Fairmont. Here the most remarkable plant is the maiden-hair fern of the florists (*Adiantum capillus-Veneris* L.). A few years ago this was extremely abundant not only around the spring from which water was carried to the swimming-pool, but sprouted out in hundreds from the chinks of the wooden flume. "Improvements," including a new flume, have destroyed much of it, but there is still a fine bed of it around an "undeveloped" spring. As the nearest stations as given in Abrams (1923) are Utah and southern California, one's first surmise is that it must have been planted by some enthusiast. Apart, however, from the fact that there is no knowledge or tradition of this among the local residents, there is some historical evidence that it was well-established at the earliest stage of the settlement of the valley. (A fuller discussion appears in Eastham, 1949.)

Other interesting and unusual plants found around the hot springs or along their effluents are *Triglochin palustris* L., *Muhlenbergia glomerata* (Willd.) Trin., *Panicum thermale* Boland (abundant, and the only known station in B.C.), *Juncus Torreyi* Cov., *Epipactis gigantea* Dougl. and a white-bracted *Castilleja* of uncertain taxonomic status—possibly an undescribed species.

III. NORTHERN SECTION

This section does not appear to possess any features of special interest, but, for various reasons, was studied more cursorily than the other two. The change to the Canadian Zone begins gradually some miles south of Brisco, which itself is 49 miles south of Golden. The Mariposa lily (*Calochortus macrocarpus* Dougl.), a common plant from the Montana Boundary, was last seen at a point 55 miles south of Golden. *Chrysothamnus* ceased a few miles earlier. The Douglas fir begins to show a denser growth and to form thicker stands. The grass-cover becomes taller and thicker, and Kentucky blue-grass (*Poa pratensis* L.) becomes the dominant grass along the roadsides, replacing the *Koeleria*, *Stipas* and *Agropyron* bunch-grasses. Aspen, birch, and spruce become steadily more plentiful, but cedar (*Thuja plicata*) was not noticed until near Golden.

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