# CAMPBELL_BROWN ECOLOGICAL RESERVE No. 77

## Biological survey - 1989

---

## Introduction

In 1914 property now comprising the greater part of this reserve was acquired by the Campbell-Brown family and a residence constructed east of the highway close by Kalamalka Lake. Remains of an old wire fence indicated on Figure 1 may represent the western boundary at that time. Tree fruit production was attempted on lower land around the house and milk cows allowed to range over the upper slopes. Haying of wild grass was carried out wherever practical and for a period the sloping bench referred to in this report as "The Meadow" was plowed and sown to alfalfa to provide winter feed.

Later, additional grazing was obtained by extending the boundary of the central portion farther up hill to the west, however, farming operations must have been somewhat tenuous at best and as other family activities began to take precedence farming ceased in the 1930s or 1940s. Some selective logging took place in the same period following which the property was not utilized except for pasturing saddle horses. This continues under agreement currently with two horses present for approximately six months of the year.

In order to assure continuance of the property in an undeveloped state it was offered to the Crown in 1975 by Dr. Hugh and Mrs. Campbell-Brown in memory of his parents. Two years later it was created an ecological reserve.

## Access

Located on Highway 97, the reserve is easy to reach by driving south for approximately 15km from the last major cross-roads in Vernon. In the other direction the distance is roughly 4½km from Oyama. At this point a small parking area on the west side of the road allows vehicles to be left and the fence scaled by a wooden stile.

## Physiography

Frontage on Highway 97 extends for close to 3km along the somewhat sinuous right-of-way. Uphill from this line width is very variable due to jogs along the west boundary, and at its greatest extent is only about seven eighths of a kilometre by map measurement - considerably more when traversing back and forth across the steep upper slopes on foot. These slopes rise from an average of around 425m at road level to over 750m as marked on Fig. 1 and apart from the moderately angled Meadow and area from there to the south corner, are unremittingly steep. Metric contours mapped have been interpolated from Imperial measurement.

Deducting from the surface area is a power line right-of-way paralleling the highway resulting in a reported final figure varying between 105ha and 107ha according to source.

No flowing water exists. In a gully near the mid-point a shallow scoop allows seepage to accumulate in sufficient quantity for horses and wild animals to water. Farther south a little dampness shows on a rock face edging the main road which with a few sparse patches of willow and aspen indicates some unrelated areas of sub-surface moisture in a few places.

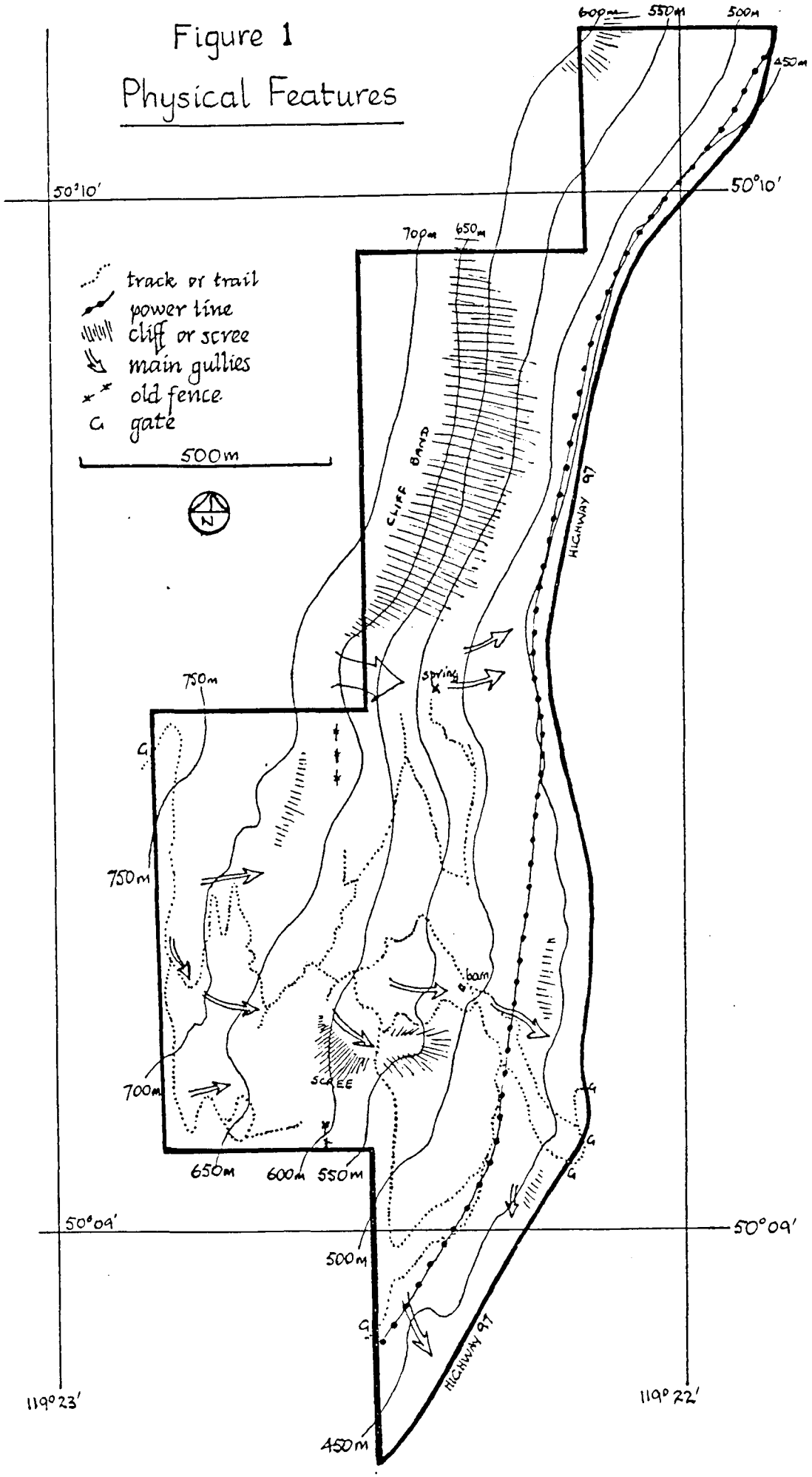
A prominent feature running through the northern half of the property is a band of cliffs forming an effective barrier to normal earth-bound humans. South of the Meadow a small rocky ridge leads to a hollow along one side of which is the talus slope, probably of no great age, marked on Fig. 1.

## Geology

From Vernon southward a prominent ridge separates Kalamalka and Wood Lake on the east from Okanagan Lake almost to Kelowna.

# Figure 1

## Physical Features



Campbell-Brown Reserve occupies a site on the steep flank of this ridge.

Structurally the area has great importance. A major fault trace is inferred running down the Okanagan, through Kalamalka Lake and onward to beyond the international border. In the subject area this is referred to variously as the Vernon Fault or Vernon Shear-zone. It divides highly metamorphosed Monashee Terrane on the east (now thought to be possibly a displaced fragment of the North American craton) from younger formations to the west that are believed to have become added to the continent by accretion during plate movement.

As part of the trauma during this process a period of intrusion took place. This complex is mapped as Nelson plutonic rock of Middle Jurassic age and, underlying the reserve, comprises a distinct pink granitic member. Although most likely this forms the whole bedrock a small outcropping was found on the ridge top nearby formed by a fine grained altered rock shot through with garnet, and a dark Eocene volcanic of which a larger outcrop occurs along the ridge southwards. These could be small dykes and may also be present within the reserve.

Nelson plutonics have not been found highly prospective for minerals in the North Okanagan but are not without showings. Following discovery of the Brenda mine in the late 1960s Cominco investigated the ridge for molybdenum without significant encouragement, however, actual results have not been seen. At the time of writing a group of claims (Bay 1,2,3 and 4) surrounds the north half of the reserve. Results from any exploration are not known.

## Surficial Material

Due to steepness of the slope little glacial drift seems to have remained in this area or, if amply deposited, was quickly removed by flushing down the unvegetated hillside soon after de-glaciation. As a consequence colluvial regosol forms the surface material over most of the reserve built up from the underlying pinkish granitic rock in particles ranging in size from sand to angular cobbles. No doubt shearing and fracturing along the Vernon Fault played a part in its prevalence. In places where the finer fraction has accumulated down-slope an overall sandy condition prevails, developed as a brunisol. This would probably equate with "Kalamalka Gravelly Sandy Loam" in Kelley and Spilsbury (1949).

Elsewhere the Meadow forms an exception. There a narrow layer (less than 1cm) of fine decomposed mull humus passes into a dark brown/black stoney chernozem soil artificially homogen--ized by plowing. Ultimate depth was not tested. Up hill through the central part of the property, the presence of open, grassy slopes usually indicates similar, though thinner, devel-opment of the same type, as opposed to the sparse discontinuous herbaceous cover where regosol predominates. Typically on the better grassed slopes 1cm of partly decomposed mull humus lies above 5cm of dark loamy chernozem before passing in to a grey limy layer of unknown depth variously stoney to rocky. As well as fairly continuous grass, another indicator of these patches of glacial veneer is the presence of Pocket gopher mounds as these animals show a preference for the greater depth they offer.

Treed gullies tend more to brunisols. Two sections investigated showed (a) moder humus made up of 1½cm L horizon and 4cm F horizon, 3cm dark, gritty, structureless loam, then light grey, gritty soil with angular stones merging into colluvium: (b) moder humus of 1cm L horizon and 4cm F horizon 6cm dark loam, in excess of 15cm grey-brown fine, gritty soil with some stones becoming lighter at depth.

Under cover of Ponderosa pine slow decomposition of fallen needles leads to a 2 to 3cm uncompacted L horizon and about the same of loosely compacted F horizon.

## Climate

Although the northern part of the Okanagan Valley is less hot and better watered than the south it is still very much influenced by arid conditions arising from being in the Coast and Cascade Mountains rain shadow. In most years evaporation and transpiration exceed precipitation almost continually from early March to the second half of October and require special responses from the biota.

Two climate reporting stations are close enough to be used as proxies for this reserve - Okanagan Centre 13km south-south-west and Vernon about 15km north-north-east. The first named occupies a similar lake-side location, although Campbell-Brown may be slightly drier due to the localized effect of being on the east side of Ellison Ridge. Figures for Vernon are from within the built-up area, not from the Upper Atmosphere Station south of town and, by being away from the moderating effect of lake water, are likely to be slightly more extreme than at Campbell-Brown. Elevation in both cases is similar except in so far as the reserve extends higher.

| | J | F | M | A | M | J | J | A | S | O | N | D | Total or Av. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean rainfall (mm) | | | | | | | | | | | | | |
| Vernon | 6.3 | 6.9 | 15.7 | 17.5 | 31.0 | 41.9 | 29.0 | 26.9 | 30.0 | 34.3 | 21.6 | 10.4 | 271.5 |
| Okanagan Centre | 16.3 | 13.0 | 15.5 | 16.8 | 27.7 | 32.3 | 24.4 | 24.6 | 25.1 | 31.7 | 25.4 | 19.3 | 272.0 |
| mean snowfall (cm) | | | | | | | | | | | | | |
| Vernon | 36.1 | 24.9 | 7.6 | 0.5 | | | | | | 1.5 | 14.0 | 39.1 | 123.7 |
| Okanagan Centre | 21.6 | 16.3 | 6.9 | 0.3 | | | | | | 0.3 | 5.8 | 23.9 | 74.9 |
| Mean total precipitation (mm) | | | | | | | | | | | | | |
| Vernon | 42.4 | 31.7 | 23.4 | 18.0 | 31.0 | 41.9 | 29.0 | 26.9 | 30.0 | 35.8 | 35.6 | 49.5 | 395.2 |
| Okanagan Centre | 37.8 | 29.2 | 22.4 | 17.0 | 27.7 | 32.3 | 24.4 | 24.6 | 25.1 | 32.0 | 31.2 | 43.2 | 347.0 |
| Mean daily temperature ($C^{O}$) | | | | | | | | | | | | | |
| Vernon | _4.9 | _2.7 | 2.7 | 8.9 | 13.8 | 17.1 | 20.2 | 18.9 | 14.4 | 7.8 | 1.6 | _1.8 | 8.0 |
| Okanagan Centre | _3.2 | _1.2 | 2.9 | 8.2 | 13.0 | 16.6 | 19.6 | 18.6 | 14.4 | 8.4 | 2.7 | _0.4 | 8.3 |

In most winters Kalamalka Lake remains unfrozen because of its depth and stirring action of wind. Years when ice does form and is slow to depart may have an effect on the number of frost-free days which are given as -

| | number of days frost-free | average last frost | average first frost |
|---|---|---|---|
| Vernon | 156 | May 1 | Oct 5 |
| Okanagan Centre | 171 | April 28 | Oct 17 |

In 1989 residual snow patches still remained under trees near the road on 24th March and at the highest level could be found facing north on 7th April.

## Vegetation

For a small property (less than 3km by 1km) on which two of three ecological factors (climate and soil ) are constant it should be expected that the third also (biological composition) would show little diversity. In the broadest sense this is so, however, sufficient subtleties occur, as they do practically everywhere, to generate numerous variations on a smaller scale.

Considerable refinement of treatment has allowed the Biogeoclimatic system of classification to be focused with increasing precision since its origination 20 years ago. Under latest terminology (Lloyd et al 1989) Reserve #77 falls within the Interior Douglas-fir Very Dry Hot sub-zone, Okanagan variant. At valley bottom elevation this unit runs from the south end of Wood Lake to Enderby, so the Campbell-Brown property is located near its southern extremity.

Although Ellison Ridge might be said to face roughly east across the lake, numerous gullies of various size seam its surface serving to angle land on their north side to the south, and on their south flank, northwards. In doing so, exposure to the sun is slightly increased or decreased according to orientation leading to minor variations in temperature, evaporation, etc. Near the centre of a large sub-zone this degree of variation might be insufficient to affect conditions enough to jog them into a different ground cover composition; the fact that they have been altered here would then be symptomatic of being near a transition. At Campbell-Brown, for instance, where a mixture of Douglas-fir and Ponderosa pine is the norm, a more southern aspect increases the latter to the point of elimination of Douglas-fir, while decreasing insolation results in pure stands of fir.

Successional variations are not an important factor in open dry forests of this type and climax species provide the seral community in cases of disturbance. Undoubtedly in such dry conditions fire is the major disturbing factor historically but steep slopes, sparse vegetation and little depth of organic matter would encourage it to travel fast with only limited damage. There are no signs of this having happened since settlement and man-made disturbance by logging has been insufficiently intensive to be important either.

The main agent of change here, as elsewhere, in the valley has been the invasion by "weed" species, in fact Diffuse knapweed, the worst Centaurea in the Interior, was first recorded in B.C. at Oyama, 4km away, in 1936 though may have been present for some time previously.

A characteristic of these coarse, arid soils is the lack of any continuous grass sod, it being replaced by well-spaced

tufted grasses unable to offer much resistance to invasion of intervening bare spaces. Surface disturbance through the thin crust of lichen and moss is almost automatic by any animal passing by, whether wild deer or domestic cattle and horses, the actual number probably not mattering much once an infestation has started. The previous owner went to great lengths to combat knapweed by chemical means (Tordon) and by seeding trails and disturbed areas, yet for all this effort the eventual outcome has probably been little changed. Both Diffuse and Spotted knapweed are common throughout. In the North Okanagan there is concern over increasing Common hound's tongue (Cynoglossum officinale) in some dry forested grazing areas. It has a good hold on the ridge above the reserve and several scattered individual plants were noted within its boundaries This may be the newest menace.

## Site associations

Lloyd et al (1989) offers nine site units within the Interior Douglas-fir Very Dry Hot sub-zone, Okanagan variant. These are

| | | | |
|---|---|---|---|
| driest | 2.1 | Py-Fd | Penstemon - Bluebunch wheatgrass |
| | 2.2 | Fd-Py | Bluebunch Wheatgrass - Pinegrass |
| | 3 | Fd-Py | Snowbrush - Pinegrass |
| | 4 | Py-Fd | Pinegrass - Fescue |
| zonal | 1 | Fd-Py | Snowberry - Pinegrass |
| | 5.1 | Fd-Py | Pinegrass - moss |
| | 5.2 | Fd-Py | Snowberry - Spiraea |
| | 6 | Fd-Py | Maple - Dogwood |
| wettest | 7 | Bp | Willow - sedge |

Campbell-Brown Reserve varies in several regards. Not all the species quoted for each sub-association are present; in no instance does wettness reach as high a level as in the table above, while edaphic dryness due to rock fragments adds a further degree of aridity at the other end of the scale.

The following associations have been selected -

| | | |
|---|---|---|
| driest | 2 | Woodsia - moss |
| | 3 | Penstemon - Woodsia |
| | 4.1 | Sumac - Lomatium |
| | 4.2 | Golden aster - Selaginella |
| | 5 | Bluebunch wheatgrass - Phacelia |
| | 6 | Saskatoon - Bluebunch wheatgrass |
| | 7 | Bluebunch wheatgrass - Pasture sage |
| zonal | 1 | Spiraea - bluegrass |
| | 8 | Oregon grape - Pinegrass |
| | 9 | Oregon grape - Snowberry |
| | 10 | Miner's lettuce - moss |
| | 11 | Maple - Oregon grape |
| wettest | 12 | Wild sarspirilla - Snowberry |

In addition, for full treatment of the area, two artificial categories have been added, these being -

13 The Meadow
14 trails and disturbed areas

As explained previously, the degree of exposure to sun as expressed in greater or lesser dryness can be seen reflected in the predominent tree species; thus, in general terms it can be said that units 8,1 and 9 constituting the greater part of the reserve have roughly equal amounts of Douglas-fir and Ponderosa pine (varying from 1:1 to 2:1). Lower association unit numbers have a predominence of pine (bearing in mind that excessive aridity eliminates all trees), and higher numbers a preponderence of Douglas-fir.

Unit 1 Spiraea - bluegrass association

| | | |
|---|---|---|
| Pseudotsuga menziesii | Spiraea betulifolia | Poa species |
| Pinus ponderosa | Amelanchior alnifolia | Calamagrostis purpurea |
| | | Festuca scabrella |
| | | Balsamorhiza sagittata |
| | | Aster conspicuus |
| | | Arnica cordifolia |
| | | Brachythecium albicans |
| | | Cladonia spp. |

Terrain: colluvial blanket and morainal veneer
Slope: 5° - 25°
Drainage: rapid
Position: mid-slope
Moisture: submesic - subxeric
Soil: sandy to lithic brunisol
Soil moisture: moderately to very dry
Soil nutrient: nitrogen medium

Note: Under the auspices of the B.C. Forest Service an alternate system of characteristics is being advanced. So far only coastal ecosystems have been adressed (Klinka et al 1989) but presumably it will be broadened to cover Interior conditions also. Its purpose is different from that of "Describing Ecosystems in the Field" which it will not supercede, however, in order to align the present report to the new system the last two characteristics above have been added.

Both Lloyd (1989) and Brayshaw (1970) gave Pinegrass a more pre-eminent position than that above, however, only in particularly well shaded patches was this found to hold true. This may follow from the subject area being close to the southern boundary of the sub-zone and the greater openness of canopy that results. Bluegrass as a group (P.fendleriana, P.canbyi P.compressa) were therefore taken as more generally spread. Tree cover is discontinuous ranging from 50% to 80%.

As this unit passes up hill on to steeper slopes a thinning out of trees becomes noticeable to give a parkland appearance (unit 8) above which the angle eases again with a resumption of the zonal unit but with a slight variation of species. This is Unit 9.

Unit 2 Woodsia -- moss association

| | | |
|---|---|---|
| - | - | Woodsia scopulina<br>Dicranum scoparium<br><br>Cystopteris fragilis<br>Heuchera cylindrica<br>Poa juncifolia |

Terrain:avalanched colluvial Position:lower slope
Slope:25° - 30° Moisture:very xeric
Drainage:extreme Soil:regosol
Soil moisture:excessively dry
Soil nutrient:nitrogen poor

This is a small edaphic unit limited by the presence of talus at the base of a steep slope. It is strange in not having much cliff or outcropping above from which rockfall has taken place and much of the accumulation may be large fragments eroded and fallen from the steep fractured slope. Although the talus is loose under-foot it is more or less stable. Only the lower 10m or so has flora other than mosses and lichen and it may be that this has been able to gain a foothold as the soil surface underlying is closer and within reach of plant roots. Additionally moss tends to cover the rock completely at its lowest level holding water that becomes available for other plants.

Unit 3 Penstemon - Woodsia association

| | | |
|---|---|---|
| - | - | Woodsia scopulina<br>Penstemon fruticosa<br>var. scouleri<br><br>Arabis microphylla<br>Heuchera cylindrica<br>Polytrichum piliferum |

Terrain:colluvial and bedrock Position:upper slope (meso)
Slope:0° - 25° Moisture:xeric
Drainage:rapid soil:regosol and brunisol
Soil moisture:excessively dry
Soil nutrient:nitrogen poor

This unit covers rocky knolls and small patches of bedrock and is equivalent to Lloyd's association 2.1. Largest occurance is the rocky mass east from the hollow in which unit 2 is located. Although coarse soil is present this unit can be at least as dry as the previous due to is generally more exposed position. Tree and shrub growth is not supported.

## Unit 4.1 Sumac-Lomatium association

| | | |
|---|---|---|
| - | Rhus glabra | Agropyron spicatum |
| Pinus ponderosa | | Lomatium dissectum |
| | | Lomatium ambiguum |
| | | - |
| | | Achillea millefolium |
| | | Balsamorhiza sagittata |
| | | Bromus tectorum |
| | | Polytrichum piliferum |

Terrain: colluvial veneer
Slope: 10°-25°
Drainage: rapid
Position: mid-slope
Moisture:subxeric
Soil: regosol and brunisol
Soil moisture: excessively dry
Soil nutrient: nitrogen poor

Ground cover is noticeably sparse with substantial gaps among individual grass clumps. This, and the general stoneyness, makes for an unstable surface layer allowing only a few fast-growing annuals to survive. Although Sumac is not continuous it is frequent enough to be a useful marker. Pines, where they occur, are very widely separated.

## Unit 4.2 Golden aster-Selaginella association

| | | |
|---|---|---|
| - | - | Agropyron spicatum |
| Pinus ponderosa | Amelanchior alnifolia | Selaginella densa |
| | | - |
| | | Heterotheca villosa |
| | | Artemisia campestris |

Terrain: colluvial and morainal veneer
Slope:10°-20°
Drainage: fast
Position: mid-slope
Moisture: submesic/subxeric
Soil: brunisol
Soil moisture: excessively dry
Soil nutrient: nitrogen poor

Like unit 4.1, this is found scattered near the south boundary. Soil texture is finer, being sandy rather than gravelly; the angle is less allowing for a better cover of grass. Scattered pines are also more frequent.

## Unit 5 Bluebunch wheatgrass-Phacelia association

| | | |
|---|---|---|
| Pinus ponderosa | Amelanchior | Agropyron spicatum |
| Pseudotsuga menziesii | alnifolia | Poa canbyi |
| | Berberis | - |
| | aquifolia | Phacelia hastata |
| | - | Artemisia frigida |
| | Prunus | Lomatium dissectum |
| | virginiana | Penstemon fruticosa |
| | | var. scouleri |
| | | Heuchera cylindrica |

Terrain: colluvial veneer
Position: mid-slope
Slope: 10°-25°
Moisture: submesic/subxeric
Drainage: fast
Soil: regosol/lithic brunisol
Soil moisture: excessively dry
Soil nutrient: nitrogen poor/medium

It might be more correct to treat this as two sub-divisions - the ledges and terraces of the prominent cliff band at the north end of the property, and the steep unstable slopes below- but in practice the vegetation varies in only small ways between them. There is a tendency for pine to outnumber fir on parts of the cliff. Near the top they are quite stunted in size due to shallowness of soil over bedrock. Below the cliff less rock obstruction allows more continuous tree and shrub growth, although instability of the stoney surface makes for greater difficulty for herbaceous plants.

## Unit 6 Saskatoon-Bluebunch wheatgrass association

| | | |
|---|---|---|
| Pinus ponderosa | Amelanchior | Agropyron spicatum |
| | alnifolia | Festuca idahoensis |
| | | Balsamorhiza sagittata |
| | | Poa canbyi |
| | | Erigeron corymbosus |
| | | Castilleja thompsonii |
| | | Gaillardia aristata |
| | | Phacelia linearis |

Terrain: subdued morainal
Slope: 10°-15°
Drainage: fast
Position: mid-slope
Moisture: submesic
Soil: brunisol
Soil moisture: very dry
Soil nutrient: nitrogen poor/medium

Southerly from unit 1 at the lower levels a gradual change of angle faces the surface more towards the sun, giving the edge to pine over fir. No where are the trees dense so that overall cover is in the order of 50%, giving a general park-land appearance. A few narrow strips similarly pine covered can be found on the south-facing side of gullies elsewhere. This would seem to approximate Lloyd's unit 4 with the important exception that Pinegrass is a more infrequent member in this locality, whereas he has it as an indicator species.

Forbs become more varied than in preceding units but are decidedly scattered rather than focused. Both in this and the next unit Diffuse knapweed has invaded vigorously.

Unit 7 Bluebunch wheatgrass-Pasture sage association

| | | |
|---|---|---|
| Pseudotsuga menziesii | Amelanchior alnifolia | Agropyron spicatum |
| Pinus ponderosa | | Balsamorhiza sagittata |
| | Juniperus scopulorum | Artemisia frigida |
| | | Festuca idahoensis |
| | | Achillea millefolium |
| | | Lupinus sericeus |
| | | Zygadenus venenosus |
| | | Arabis hoelbellii |
| | | Phacelia linearis |
| | | Peltigera rufescens |

Terrain: morainal veneer, some colluvium
Slope: 20°-40°
Drainage: fast
Position: mid-slope
Moisture: submesic/subxeric
Soil: dark chernozem/brunisol
Soil moisture: very dry
Soil nutrient: nitrogen medium

Although the slopes covered by this unit are steeper than those below they appear to carry a somewhat thicker soil layer and as a consequence a more continuous grassy appearance. Tree cover drops to the 10° to 30° range with clumps and scatterings of isolated trees predominating, interspersed with linear groupings where gullies seam the hillside. Forb diversity increases further though indiviuals are still scattered rather than forming concentrated masses.

Unit 8 Oregon-grape - Pinegrass association

| | | |
|---|---|---|
| Pseudotsuga menziesii | Berberis aquifolium | Calamagrostis purpurescens |
| Pinus ponderosa | Spiraea betulifolia | Poa fendleri |
| | Symphoricarpos albus | Festuca idahoensis |
| | | Senecio intergerrimus |
| | | Arnica cordifolia |
| | | Erigeron triplinervis |

Terrain: morainal veneer
Position upper slope
Slope: 5°-15°
Moisture: mesic
Drainage: well drained
Soil: brunisol/dark chernozem
Soil moisture: very dry
Soil nutrient: nitrogen medium

This unit and succeeding ones are more humid than zonal unit 1. It takes up a position above Bluebunch wheatgrass-pasture sage association where the angle eases towards the top of the ridge, similar to the way unit 1 covers the area where the angle eases below. In many ways it is similar to the latter and could be regarded as a sub-unit of it, however, there are sufficient differences to make separation not difficult. One feature is the increase in Pinegrass which has the effect of bringing it more in line with Lloyd's zonal unit 1 for this subzone variant. Saskatoon falls off in number compared with below, while Douglas maple and Snowberry increase. Depending on other factors (water availability, thickness of soil, angle to the sun etc.) it tends to alternate between quite thick cover and grassy openings.

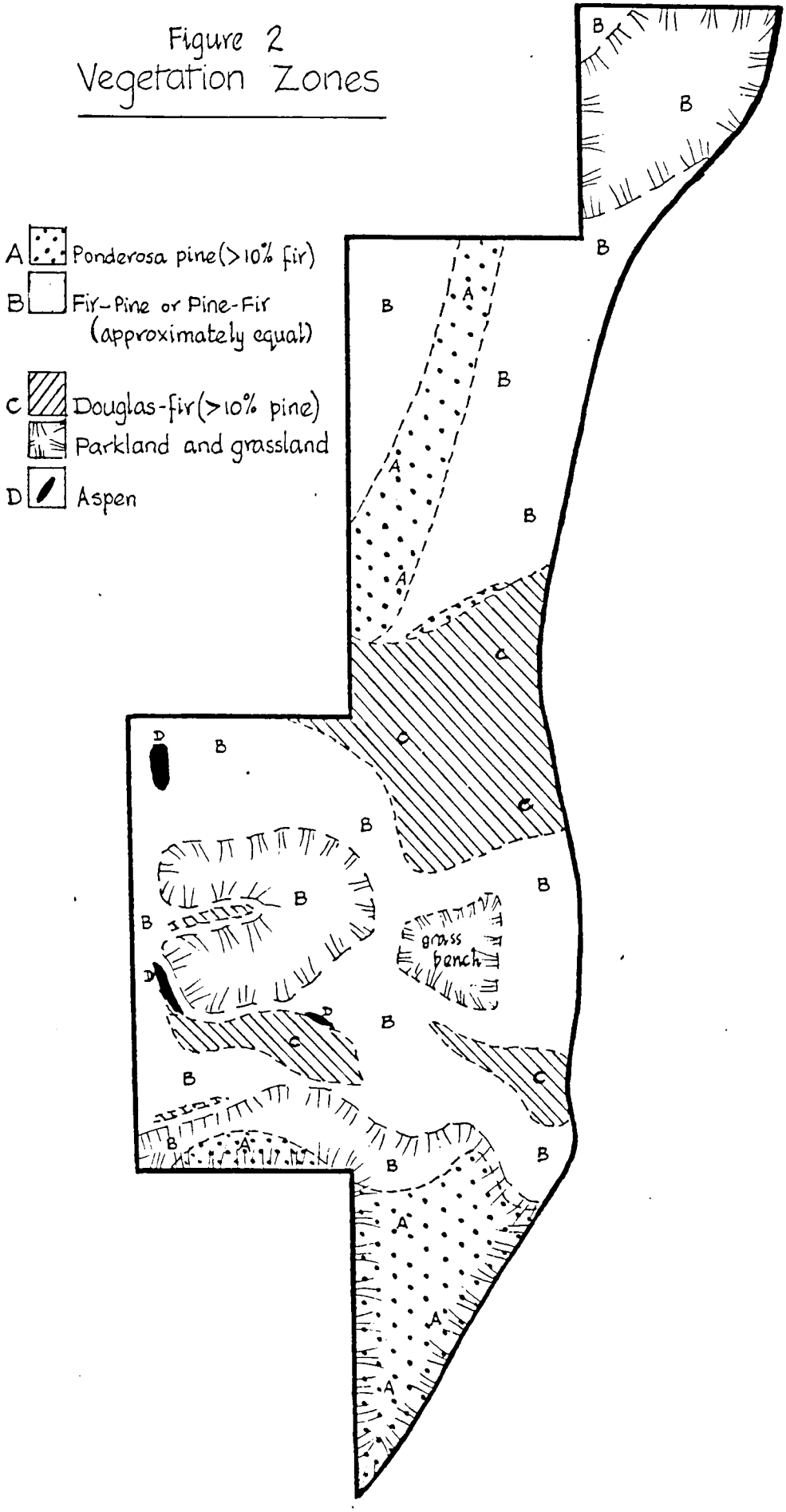
Unit 9 Oregon-grape - Snowberry association

| | | |
|---|---|---|
| Pseudotsuga menziesii | Symphoricarpos albus | Calamagrostis purpurescens |
| | Berberis aquifolium | Elymus glaucus |
| | | Erigeron triplinervis |
| | | Trisetum cernuum |
| | | Aster conspicuus |
| | | Brachythecium albicans |

Terrain: colluvial/morainal veneer
Position: mid and upper slope
Slope: 10°-25°
Drainage: well drained
Moisture: mesic
Soil: brunisol
Soil moisture: very dry
Soil nutrient: nitrogen medium/good

The controlling factor seems invariably to be angle to the sun, thus this unit can occur throughout the forested area wherever a northerly warp produces less insolation. A large area can be seen on Figure 2 roughly across the mid-point of

# Figure 2
# Vegetation Zones



the reserve with others up from the entry gate, also in and above the hollow where the talus slope is located. Even in the open grassy slopes above, narrow gullies are deep enough to cause long thin occurances that are too restricted to show on the map.

Douglas-fir dominates tree cover almost to the exclusion of everything else except some smaller Maple. Shrub understory can be extensive if light is adequate unless the angle is high or ground particularly rocky. In these cases mosses become widespread. Because of bias away from the sun this unit is akin to Lloyd's unit 5.2.

Unit 10 Claytonia-moss association

| | | |
|---|---|---|
| Pseudotsuga menziesii<br>Pinus ponderosa | - | Claytonia perfoliata<br>Lithofragma parviflora<br>Plectritis macrocera<br>Stellaria nitens<br>mosses |

Terrain: colluvial/
Slope: 5°-20°
Drainage: good to moderate
Position: mid-slope
Moisture: subhygric
Soil: brunisol
Soil moisture: moderately dry
Soil nutrient: nitrogen medium

In all cases where this small patch unit was found some factor resulted in seasonal dampness remaining for long enough into summer to enable a different suite of plants to establish itself. It is not restricted to any particular part of the sequence of associations. The main occurrance is surrounded by unit 1 and other limited expressions of it were seen within unit 6 and where trail construction had cut a bank in unit 7. None had any continuity or was large enough to affect composition of surrounding trees.

Unit 11 Aspen-Berberis association

| | | |
|---|---|---|
| Populus tremuloides<br>Pseudotsuga menziesii<br>Acer glabrum | Berberis aquifolium<br>Prunus virginiana | Ribes inermis |

Terrain: morainal veneer
Slope: 5°-10°
Drainage: good to moderate
Position: mid and upper slope
Moisture: mesic/subhygric
Soil: brunisol
Soil moisture: moderately dry
Soil nutrient: nitrogen medium/good

The small patches collectively making up this unit are hard to categorise satisfactorily, yet the lack of Aspen elsewhere, even scattered thinly, demand their being treated separately. Presumably sub-surface water is available in each case although none is evident.

The grouping near the base of the talus slope may be receivi moisture from under the rock. It merges quickly into Douglas-fir of the hollow and the only other plant feature is the presence of Thornless currant. At the top of the trail leading uphill to the west boundary is a strange deeply incised feature making a shallow defile that was possibly cut by post-glacial melt water. It must cut close enough to allow roots to reach the water table resulting in a strip of Aspen, Wild cherry and Maple. Berberis makes up most of the shrub cover and shallower-rooted forbs, unable to reach the water, are more or less the same as in adjoining unit 8.

In the north-west corner of the west projecting part of the reserve thicker forest of the unit 8 type includes a number of more scattered Aspen with Nootka rose and, surprisingly, a few Red-osier dogwood, a species that requires availability of water. Maple becomes common here but the whole effect is quite diffuse. The remaining Aspen clump is rather maverick in being at the north-east corner of the meadow in quite an exposed position.

Unit 12 Wild sarsparilla-Snowberry association

| | | |
|---|---|---|
| Pseudotsuga menziesii | Symphoricarpos occidentalis | Aralia nudicaule<br>Rhus radicans<br>Rubus parviflorus<br>Smilacina stellata<br>Campylium spp. |

Terrain: morainal/ colluvial veneer
Slope: 0°-15°
Drainage: poor to moderate
Position: mid-slope
Moisture: subhydric to subhygric
Soil: brunisol probably gleyed
Soil moisture: wet to moist
Soil nutrient: nitrogen rich

Only at this one spot indicated on Figure 1 can surface water be found. It seeps from a low bank cut into one of the gullies within unit 9. A low basin about one metre each way has been scooped out to collect seepage from where it dribbles across the path and down into the continuation of the gully, then is immediately lost into the ground. Although small, waterflow seems to continue in a normal year in sufficient quantity to support a number of plants not seen elsewhere on the reserve as well as serving wild and domestic stock. Its attraction to plants appreciating moisture is understandable

but Poison-ivy, usually where fairly dry and less intensely shaded, is an unexpected resident. Effect of the seep can be seen for perhaps 10m to 15m down-slope, while above it affects vegetation for barely more than one metre, so in total it is a very minor part of the whole scene. For all that, it remains a unique entity in an otherwise dry series of units.

For a comprehensive view of the whole reserve mention should be made of the disturbed areas. The two remaining artificial units are not plant associations in the same sense as the others having been induced by man. Both are heavy in introduced plants and could offer insights into competition and relative success by different species, as well as re-colonization by indigenous taxa.

Unit 13 Meadow

Terrain: morainal blanket
Position: mid-slope
Slope: 5°-10°
Moisture: subxeric
Drainage: rapid
Soil: disturbed chernozem
Soil moisture: very dry
Soil nutrient: nitrogen medium

No doubt originally, more than 60 years ago, this bench was lightly treed with well-spaced unit 1-type vegetation, possibly tending towards unit 9. It was brought to an arable state and sown to alfalfa but after milk cattle ceased to be kept must have been left to revert. It was probably the previous owner's concern to deter knapweed spread that led to its being reworked and sown with Crested wheatgrass which now forms its main cover. This has been reasonably effective in its task and invasion by a wide selection of uninvited adventitious species has so far failed to overwhelm it.

Either intentially left or naturally established, a few Choke-cherry clumps are present with successful suckering or seeding gradually enlarging them. Taking advantage of the shading effect and possibly better retention of moisture, Snowberry, Birch-leaf spiraea and Wood's rose have widened the circle of shrubs and in turn are helping the growth of herbaceous plants. Eventually Douglas-fir seedlings will find a suitable lodgement and the next stage of reversion to a treed state will be underway.

Unit 14 Tracks and trails

As these are found in most units throughout the reserve they have no particular set of characteristics other than those through which they pass. Many have had domestic grasses sown.

All are badly weed infested and it is ironic that those constructed mainly in the campaign against knapweed can be seen to act as a conduit in its spread. A number of natural members of dry open forest act opportunistically when presented with fresh openings and readily colonize the edges and banks of trails - Annual polemonium, Small-flowered forget-me-not and Thyme-leafed starwort among them.

Near the Meadow is an open-sided shelter for horse feed storage. Above and below it a different set of weeds introduced with the hay has been helped by animal trampling of ground round about virtually to eliminate everything else within a small radius. White campion, Stickweed and Chickweed are prominent here.

Vascular plants recorded in 1989

Based on observations a small number of differences arise compared with the list of vascular plants accompanying the original 1976 survey -

Antennaria racemosa should be A neglecta
Ceanothus velutinus should be C. sanguineus
Delphinium bicolor should be D. nuttellianum

Several others have name changes, while two - Habenaria unalaskhensis and Sedum stenopetalum - were not seen during the past season though are normal residents of these types of habitats and are probably present.

Although no surprising finds were made the following are worthy of comment:-

Polypodium hesperium and Polystichum lonchitis - only a few of each were seen. Less remarkable higher or in moister forest, they were unexpected in such dry surroundings.

Legousia perfoliata and Polemonium micranthum - both are included by Straley et al (1985) as rarities in B.C. In the southern Interior, however, both can be rather weedy in disturbed ground and would only be singled out as of interest by non-residents of the area.

Stellaria nitens, Castilleja thompsonii and Plectritis macrocera - are also noted by Straley et al (1985) as being very localised in south central B.C.

Centaurea paniculata - what appears to be this species was collected late in the season. Previously only specimens from the Victoria-Ladysmith area have been known to occur in Canada. Systematics of this group in Centaurea are quite confused and the close relationship between C.paniculata and C.maculosa has been given as a case of species and subspecies, or intergradation, or a species and a hybrid by various authors.

A better specimen will be obtained earlier in 1990 for attention by an expert. It would be ironic, knowing how vigorously the previous owner pursued the elimination of knapweed, if all the time he was harbouring one of the rare species.

After each name on the list below are the dates (day/month) each was seen in flower followed, in brackets, by the unit number and an indication of abundance in that unit using the scale -

r = rare (one or two only)
# = uncommon
1 = scattered or common only locally
2 = general
3 = abundant

Names follow Taylor and MacBride (1977) and Douglas et al (1989).

Aspleniaceae
Cystopteris fragilis (2/1,3/#)
Polystichum lonchitis (1/r)
Woodsia oregana (2/1)
" scopulina (1/#,2/2,3/1)
Polypodiaceae
Polypodium hesperium (1/r,3/r)
Selaginellaceae
Selaginella densa (4/1)
" wallaceii (1/1,3/#)
Equisetaceae
Equisetum arvense (12/#)
Cupressaceae
Juniperus communis (1/1)
" scopulorum (1/r,7/1,8/#)
Pinaceae
Pinus ponderosa (1/3,4/1,5/2,6/3,7/2,8/1,9/1)
Pseudotsuga menziesii (1/3,4/1,5/2,6/1,7/1,8/3,9/3)
Aceraceae
Acer glabra var. douglasii 17/4 (1/1,8/1,11/#)
Anacardiaceae
Rhus glabra 29/6, (4/1)
" toxicodendron (12/1)
Apiaceae
Lomatium ambiguum 17/4 (4/2)
" dissectum 17/4,28/4,12/5 (1/2,4/2)
" geyeri 24/3,7/4,17/4,28/4,(1/1,5/1,6/2,7/2)
" macrocarpum 28/4 (7/#)
Osmorhiza chilensis (9/1,8/1)
Apocynaceae
Apocynum androsaemifolium 9/6 (1/#)
Araliaceae
Aralia nudicaule (12/1)
Asclepiadaceae
Asclepias speciosa (1/r)

Asteraceae
Achillea millefolium 12/5,26/5,29/6 (1/#,7/2,8/#)
Antennaria microphyllum 28/4,24/5,9/6 (1/r,6/#)
" neglecta 12/5,26/5 (1/1)
" umbrinella 26/5 (1/r)
Arnica cordifolia 12/5,26/5,9/6 (1/1)
" fulgens 9/6 (1/r,6/1)
Artemisia campestris 29/6,1/9 (4/2)
Antennaria dimorpha 26/5 (3/#,7/1)
Artemisia dracunculus 1/9 (1/#,7/1)
" frigida (5/1)
Aster conspicuus 29/6,28/7,1/9 (1/2)
" ericoides var. pansus 1/9,15/9 (1/1)
" laevis 1/9 (1/r)
Balsamorhiza sagittata 28/4,12/5,26/5,9/6 (1/2,6/2,7/2)
Centaurea diffusa 29/6,28/7,1/9 (1/1,4/2,6/2,7/3,8/1,14/3)
" maculosa (14/1)
" paniculata 30/10 (14/;)
Chrysothamnus nauseosus (5/r)
Circium arvense 30/10 (14/#)
" undulatum 30/10 (7/#)
Conyza canadensis 28/7 (13/1,14/#)
Crepis atrabarba 9/6,29/6,1/;,7/1,8/1)
" intermedia (6/#)
Erigeron compositus 28/4 (6/1)
" corymbosus 9/6,29/6 (6/1,7/1)
" divergens 29/6 (9/#)
" filifolius 9/6,29/6 (6/#,7/#)
" subtrinervis var. conspicuus 9/6,29/6(1/3,8/2,9/1)
Filago arvensis 28/7 (13/#,14/1)
Gaillardia aristata 9/6,29/6,28/7 (6/1,8/#)
Heterotheca villosa 9/6,29/6,28/7,1/9(4/1,5/1)
Hieracium albiflorum 29/6 (9/#)
" scouleri 28/7 (1/r)
" umbellatum 28/7 1/#)
Lactuca serriola 28/7 (13/1)
Matricaria discoidea (14/#)
Microseris nutans 26/5 (6/r)
Senecio integerrimus 12/5 (8/#)
Taraxacum laevigatum 29/6 (14/#)
" officinale 28/4,12/5,26/5 (13/#,14/1)
Tragopogon dubius 26/5,9/6,29/6,28/7 (14/1)
Berberidaceae
Berberis aquifolium 12/5,26/5 (1/#,5/2,8/2,9/2)
←Boragaceae
Asperugo procumbens 9/6 (14/1)
Cynoglossum officinale (14/;)
Lithospermum ruderale 28/4,12/5 (6/r,7/#)
Buglossoides arvensis 26/5 (14/1)
Myosotis stricta 17/4,28/4,12/5,26/5,9/6(1/#,4/1,6/1,7/1)

Brassicaceae
Alyssum alyssoides 12/5 (13/1,14/1)
Arabis glabra (13/#)
" holboellii 28/4,12/5,26/5 (1/#,4/1,6/1,7/2)
" microphylla 7/4,17/4 (1/#,3/2,6/r)
" sparsiflora 26/5 (1/#)
Camelina microcarpa 9/6 (14/r)
Capsella bursa-pastoralis 9/6,29/6 14/1)
Descuranis pinnata 26/5,9/6 (5/1,13/#,14/1)
Draba cana 12/5 (2/1)
" nemophila 28/4 (1/#,4/1,6/1)
Erophila verna 7/4,17/4,28/4 (1/1,4/2,6/1)
Sisymbrium altissimum 26/5,9/6,29/6,28/7 (13/1,14/#)
Cactaceae
Opuntia fragilis (4/r)
Campanulaceae
Legousia perfoliata 29/6 (13/1)
Caprifoliaceae
Lonicera ciliosa 9/6 (9/#)
Symphoricarpos albus 9/6,29/6,(1/2,8/1,9/213/1)
" occidentalis 28/7 (12/1)
Caryophyllaceae
Arenaria serpyllifolia 26/5,9/6 (6/1,14/1)
Moehringia lateriflora 29/5 (8/#)
Silene alba 29/6, 28/7,1/9.15/9 (14/1)
" antirrhina 9/6 (13/;)
Stellaria media 28/7,1/9,15/9 (14/1)
" nitens 17/4 10/1)
Chenopodiaceae
Chenopodium album 9/6,29/6 (14/#)
" fremontii 9/6,29/6 (5/#,14/1)
" hybridum 28/7 (1/r)
Cornaceae
Cornus sericeus (11/#)
Eleagnaceae
Shepherdia canadensis (1/#,9/#)
Ericaceae
Arctostaphylos uva-ursa (1/1,8/1)
Fabaceae
Astragalus miser 12/5,26/5,9/6,29/6 (1/#,7/1)
Lotus denticulatus 29/6 (13/2)
Lupinus sericeus 12/5,26/5,9/6,29/6 (6/;,7/1)
Medicago lupulina 29/6,28/7 (13/1,14/#)
" officinale 29/6,1/9 (14/#)
" sativa 29/6,1/9 (14/#)
Melilotus alba 29/6,22/7 14/#)
Trifolium hybridum 29/6 (14/1)
" pratense 29/6 (14/#)
" repens 29/6,28/7 (14/#)
Grossulariaceae
Ribes inerme (11/1,12/#)
Hydrangeaceae
Philadelphus lewisii 9/6,29/6 (1/1,8/1)
Hydrophyllaceae
Hydrophyllum capitum 17/4,28/4,12/5 (6/r,8/#)
Phacelia linearis 12/5,26/5,29/6 (6/1,7/2)
" hastata 26/5 (5/1)

Loasaceae
Mentzelia albicaulis 26/5,29/6 (5/#,7/#)
Loranthaceae
Arceuthobium douglasii (1/1)
Onageraceae
Epilobum angustifolium 29/6 (2/#,14/r)
"paniculatum (7/1)
Polemonaceae
Collomia linearis 9/6 (8/#,13/#)
Microsteris gracilis 17/4,28/4 (1/#,7/#)
Polemonium micranthum 17/4 (7/1,14/1)
Polygonaceae
Polygonum convolvulus (1/#,2/;,14/#)
" douglasii 17/4 (1/#,7/1)
Eriogonum heracleoides 9/6 (6/#)
Rumex acetosella 29/6 (14/#)
Populaceae
Populus tremuloides (13/1)
Portulacaceae
Claytonia lanceolata 17/4,28/4,12/5 (1/#.6/#,8/1)
" perfoliata 17/4,28/4 (1/r,10/2)
Primulaceae
Dodecatheon pulchellum 28/4 (1/r)
Ranunculaceae
Clematis occidentalis (9/r)
Delphinium nuttellianum 12/5,29/6 (5/1,6/1,7/1)
Ranunculus glaberrimus 24/3,7/4,17/4,28/4 (1/1,6/1,7/2)
Rhamnaceae
Ceanothus sanguineus 9/6 (1/#)
Rosaceae
Amelanchior alnifolium 28/4,12/5 (1/1,5/#,6/2,8/r)
Fragaria vesca 26/5 (9/#)
" virginianum 12/5,26/5 (1/#,5/1,6/1,11/1,13/1)
Holodiscus discolor 29/6 (1/#,)
Potentilla glandulosa 26/5,9/6,29/6 (1/r,8/#)
" norvegica 12/5 (8/r)
" recta 29/6 (13/2,14/1)
Prunus virginiana 12/5,26/5 (1/#,6/1,11/1,13/1)
Rosa gymnocarpum (4/1,9/#)
" nutkana 26/5,9/6 (1/#)
" woodsii 9/6 (1/#,13/1)
Spiraea betulifolia 26/5,9/6,29/6 (1/3,8/2,13/1)
Rubiaceae
Galium aparine 12/5,9/6 (2/;),8/;),14/1)
" boreale 29/6 (8/r)
Salicaceae
Salix scouleri (1/#)
Santalaceae
Commandra umbellatum 12/5 (7/1)

Saxifragaceae
Heuchera cylindrica 12/5,26/5,29/6 (1/1,2/1,3/1)
Lithophragma glabrum 17/4,28/4 (6/#,7/#,10/1)
" parviflorum 28/4,12/5 (1/1,6/1,7/2,8/1,10/1)
Saxifraga integerrimum 12/5 (1/r)
Scrophulariaceae
Castilleja hispida 12/5,26/5,9/6 (1/#,8/1)
" thompsonii 26/5 (6/1)
Collinsia parviflora 17/4,28/4,12/5,26/5 (6/1,7/1,8/1,
10/1,13/1,14/1)
Linaria dalmatica 139,15/9(14/#)
" vulgaris 28/7 (14/#)
Penstemon fruticosa var. scouleri 12/5,26/5,9/6(3/2,5/2)
Verbascum thapsus 28/7,1/9.15/9 14/#)
Veronica arvensis 9/6 (13/1)
Valerianaceae
Plectritis macrocera 17/4,28/4,12/5,26/5,9/6 (6/r,10/1)
Cyperaceae
Carex macloviana gp. 29/6 (8/#)
" praticola 12/5 (8/#)
" rossii 17/4 (3/1)
" ~~xerantiaca~~ 29/6 (7/r)
Poaceae
Agropyron cristata 29/6 (13/3,14/2)
" spicatum 9/6,29/6 (1/#,4/3,5/1,6/3,7/3,8/#)
Agrostis scabra (14/r)
Bromus anomalus 9/6,29/6 (1/r,9/#)
" hordaceus 29/6 (14/#)
" inermis 9/6,29/6 (14/1)
" japonicus 29/6 (7/1,14/1)
" tectorum 26/5 (1/1,3/1,4/2,5/1,6/#,7/1,13/1,14/1)
" vulgaris 29/6 (9/r)
Dactylis glomerata (14/1)
Elymus glaucus 9/6 (9/#)
Festuca idahoensis 9/6,(1/2,6/3,9/#)
" rubra 26/5,9/6 (14/#)
" scab~~r~~ella 9/6 (1/2,6/1)
Koeleria macrantha 26/5,9/6 (1/#,5/r)
Calamagrostis purpureus 29/6 (1/1,8/2,9/2)
Phleum pratense 29/6 (14/#)
Poa canbyi 12/5 (1/2,7/1)
" compressa 29/6,1/9 (1/1,14/2)
" fendleriana 12/5 (1/2)
" juncifolia 9/6 (2/1,9/#)
" pratense 9/6 (14/#)
" secunda 12/5 (1/1)
Schizacne purpureus 9/6,29/6 (1/#)
~~Stipa occidentalis~~ 9/6,29/6 (14/#)
Trisetum cernuum 9/6 (9/#)
Vulpia octoflora (1/#)
Liliaceae
Asparagus officinale (14/r)
Calochortus macrocarpus 29/6 (6/#)
Disp~~orum~~ trachycarpum 17/4,28/4 (9/1)
Fritillaria lanceo~~l~~ata 17/4,28/4 (1/r,10/1)
" pudica 7/4,17/4 (1/r,6/#)

Lilium columbianum (9/r)
Smilacina racemosa 12/5,26/5(1/1,8/1)
stellata 12/5,26/5 (11/#,12/#)
Zygadenus venenosus 28/4,12/5,26/5 (1/r,6/2,7/1)
Orchidaceae
Goodyera oblongifolia 28/7 (9/#)

## Cryptogams

Collections of mosses, liverworts and lichens were made for study and identification. None was examined by authorities in these fields except two lichens confirmed by Trevor Goward and Neofuscia verruculifera identified by him.

Although not the driest biotic zone in Canada, even less among the driest in North America, low level Interior douglas-fir forest imposes strict climatic conditions on its constituent flora. This can be seen to have a severely curtailing effect on bryophytes in particular where only saxicolous Grimmias present any real diversity of species. Probably most widely spread moss of all is Tortula ruralis, a characteristic plant of the dry Interior. Despite the aridity, all feather mosses were represented in thicker parts of the forest although Hylocomnium and Ptilium were only nominally represented. The one wet unit around the seep seemed too small and spatially isolated from other wet areas to attract anything other than the two Campylium spp. listed.

By contrast, lichens have greater tolerance of difficult conditions. Ample rock in the talus fall and elsewhere provides plenty of scope for crustose varieties and Umbilicarias. Peltigeras, particularly P.rufescens, are important members of the exposed grassland community and, as usual, a wide diversity of Cladonias can be found under trees. Leprocaulon albicans is a small lichen not commonly noted, but this might be because of its size. Normally Xanthoria elegans would not be expected on acidic rock of this area and its presence in distinctive stripes on the top edge of certain boulders below one of the porcupine dens suggests additional nitrogen at various favoured urination or marking spots is too good to forego.

Mosses

Habitats are divided as follows: 1=shaded soil or humus, 2=exposed soil or humus, 3=shaded rock, 4=exposed rock, 5=tree, 6=around spring.

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Aulacomnium androgynum (Hedw)Schwaegr | x | | x | | | |
| Brachythecium albicans (Hedw)BSG | x | | x | | | |
| Bryum caespiticium Hedw | | | x | | | |
| " capillare Hedw | x | | | x | | |
| " ?algovicum Sendt | | | | x | | |
| Campylium hispidulum (Brid)Lange | | | | | | x |
| " chrysophyllum (Brid(Mitt | | | | | | x |
| Ceratodon purpureus (Hedw)Brid | | x | | | | |
| Dicranum montanum Hedw | | | x | | | |
| " scoparium Hedw | x | | x | | | |
| " tauricum Sapehin | x | | | | | x |
| Eurhynchium pulchellum (Hedw)Jenn | | | | | x | |
| Grimmia apocarpa Hedw var. apocarpa | | | x | | | |
| " affinis Hornsch | | | | x | | |
| " montana BSG | | | | x | | |
| " ovalis (Hedw)Lindb | | | | x | | |
| " pulvinata (Hedw)Sm | | | | x | | |
| " trichophylla Grev | | | x | x | | |
| Hedwigia ciliata (Hedw)P Beauv | | | x | | | |
| Homalothecium nevadense (Lesq)Ren & Card | | | x | x | x | |
| Hylocomnium splendens (Hedw) BSG | x | | | | | |
| Orthotrichum laevigatum Zett | | | | x | | |
| " ?rupestre Schleich | | | | x | | |
| Phascum cuspidatum Hedw | | x | | | | |
| Pleurozium schreberi (Brid)Mitt | x | | | | | |
| Pohlia cruda (Hedw)Lindb | | | x | | | |
| " nutans | | | | | | x |
| Polytrichum juniperinum Hedw | x | | x | | | |
| " piliferum Hedw | | x | | x | | |
| Pterigynandrum filiforme Hedw | x | | | | x | |
| Ptilium crista-castrensis (Hedw)De Not | x | | | | | |
| Rhacomitrium heterostichum Hedw)Brid | | | | x | | |
| Rhytidiadelphus triquetrus(Hedw)Warn | x | | x | | | |
| Tortula ruralis (Hedw)Gaertn | | x | | x | | |

Liverworts

| | | | | | | |
|---|---|---|---|---|---|---|
| Barbilophozia floerkei (Web & Mohr) Loeske | | | x | | | |
| " kunzeana (Hüb)Garns | x | | | | | |
| " lycopodioides (Wallr) Loeske | x | | | | | |
| Cephaloziella sp. | x | | x | | x | |
| Ptilidium pulcherrimum (Gild)Hampe | | | x | | x | x |

Lichen

Habitat types are divided as follows: 1=shaded rock (incl. humus over rock), 2=exposed rock (incl. humus over rock), 3=wood, branches, 4=wood, trunks, 5=shaded soil and humus, 6=exposed soil and humus, 7=moss.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Aspilicia cinerea (L)Körber | | x | | | | | |
| (?caesiocinarea) | | | | | | | |
| " sp. | x | | | | | | |
| Bryoria fuscescens (Gyel)Brodo/Hawks | | | x | | | | |
| " simplicior (Vam) Brodo/Hawks | | | x | | | | |
| Buellia disciformis (Fries)Mudd | | | | x | | | |
| Caloplaca saxicola (Hoffm)Nordin | | x | | | | | |
| Cetraria canadensis Räs | | | x | | | | |
| " erecetorum Opiz | x | | | | | | |
| " merrillii Dr | | | x | | | | |
| " platyphylla Tuck | | | x | | | | |
| Chrysothrix ?chlorina (Ach)Launden | x | | | | | | |
| Cladina mitis (Sandst)Hale/Culb | x | | | | | | |
| Cladonia bellidiflora (Ach)Schaer | x | | | | | | |
| " cariosa (Ach)Spreng | | | | | x | | |
| " carneola (Fr)Fr | x | | | | | | |
| " cenotea (Ach)Schaer | x | | | | | | |
| " cervicornis ssp.verticillata | | | | | | | |
| (Hoffm)Schaer | | | | | x | | |
| " chlorophaea (Flk)Spreng | x | | | | | | |
| " coccifera (L)Willd | x | | | | | | |
| " cornuta (L)Hoffm | x | | | | | x | |
| " decorticata (Flk)Spreng | | | | | x | | |
| " fimbriata (L)Fr | x | | | | | | |
| " furcata (Huds)Schrad | x | | | | | | |
| " gracilis (L)Willd | x | | | | | | |
| " multiformis Merr | x | | | | | | |
| " phyllophora (Ehrh)Hoffm | x | | | | x | | |
| " pyxidata (L)Hoffm | x | | | | | x | |
| Diploschistes scroposus (Schreb)Norm | | | | | x | | |
| Hypogymnia imshaugii Krog | | | x | | | | |
| " metaphysodes (Asah)Räs | | x | | | | | |
| " physodes (L)Nyl | | | x | x | | | |
| Lecanora sp. | | | x | | | | |
| " sp. ?rupicola (L)Zahl | | x | | | | | |
| Lecidea sp. ?lapicidia Ach | x | | | | | | |
| Lepraria incana (L)Ach | | | | | | | x |
| " membranacea | x | | | | | | |
| Leprocaulon albicans (Th Fr)Nyl | | x | | | | | |
| Letharia vulpina (L)Hue | | | x | x | | | |
| Melanelia exasperata (Nyl)Essl | | | x | | | | |
| " loxodes (Nyl)Essl | x | x | | | | | |
| " substygia Räs | x | | | | | | |
| Neofuscelia verruculifera (Nyl)Essl | | x | | | | | x |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Nephroma parile (Ach)Ach | | | x | x | | | |
| Ochrolechia ?laevigata (Raes)Vers | | | | x | | | |
| Parmelia saxatilis (L)Ach | x | | | | | | |
| " sulcata Tayl | | | x | x | | | |
| " sp. ?separata | x | | | | | | |
| Peltigera aphthosa (L)Willd | x | | | | x | | |
| " canina (L)Willd | x | | | | | | |
| " malacea (Ach)Funck | | | | | | x | |
| " polydactyla (Neck)Hoffm | x | | | | | | |
| " rufescens (Weis)Hunb | x | | | | x | x | |
| " venenosa (L)Baumg | | | | | x | | |
| Pertusaria amara (Ach)Nyl | | | | | | | x |
| " sp. ?leucostoma (Bernh)Mass | x | | | | | | |
| " sp. ?ophthalmiza (Nyl)Nyl | | x | | | | | |
| " sp. | | | | x | | | |
| Phaeophyscia constipata (Norrl)Moberg | | x | | | | | |
| Physcia phaea (Tuck)Thoms | x | | | | | | |
| " caesia (Hoffm)Hampe | | x | | | | | |
| Platismatia glauca (L)Culb & Culb | | | x | x | | | |
| Psora globifera (Ach)Massl (?P. rubiformis (Ach)Hook) | | | | | | x | |
| " sp. ?nipponica (Zahl)G.Schneider | | | | | | x | |
| ?Ramelina sp. ?dilacerata (Hoffm)Hoffm | | | x | | | | |
| ?Rhizocarpon badioatrum (Floerke)Th.Fr | | x | | | | | |
| " gemminatum Körber | | x | | | | | |
| ?Sarcogyne sp. ?privigna | x | | | | | | |
| Stereocaulon tomentosum Fr | x | | | | | | |
| ?Toninia sp. ?aromatica | | | | | x | | |
| " caeruleonigricans (Light)Th.Fr | | x | | | | | |
| Trapeliopsis granulosa (Hoffm)Lumbsch | | | | x | | x | |
| Umbilicaria hyperborea (Ach)Ach | | x | | | | | |
| " phaea Tuck | | x | | | | | |
| " polyphylla (L)Baumg | x | | | | | | |
| " torrefacta (Lightf)Schrad | | x | | | | | |
| " vellea (L)Ach | x | | | | | | |
| Usnea hirta (L)Wigg | | | x | | | | |
| " sp. ?glabrata (Ach)Vain | | | x | x | | | |
| " lapponica Vain | | | x | | | | |
| " subfloridana Stirt | | | x | | | | |
| Xanthoria elegans (Link)Th.Fr | | x | | | | | |

Fungi

Through much of the spring and summer adequate moisture favoured fungi. From July on this changed so that a long dry fall ran on into the first frosts without giving damp

conditions for the usually flourishing late fungi crop, consequently the following list probably represents only part of the flora that might be expected in a more favourable year.

One particularly notable absence was that of large bracket fungi on living or dead trees. These cannot play a large recycling part in dry forests and although a few small fungi were found on wood (Cryptoporus, Scutellina) bacterial action may be relatively more important.

| | month seen |
|---|---|
| Russulaceae | |
| Lactarius rubrilactis Hesler & Smith | 9 |
| Russula brevipes Peck | 6,9 |
| " integra gp. | 9 |
| Hygrophoraceae | |
| Hygrocybe sp.(?H.gliocyclus Fr | 9 |
| Tricholomaceae | |
| Clitocybe sinopica (Fr)Kummer | 9 |
| Collybia dryophila (Fr)Kummer | |
| Hygrophoropsis aurantiaca (Fr)Maire | 10 |
| Leucopaxillus albissimus (Pk)Singer | 10 |
| Marasmius androsaceus (L)Fr | 7,9 |
| Mycena alcalina (Fr)Quel | 9 |
| " epipterygia (Fr)S.F.Gray | 9 |
| Omphalina postii (Fr)Singer | 9 |
| Strobilurus sp. (?S.trullioatus) | 9 |
| Tricholoma sp. (?T.leucophyllum) | 9 |
| Tricholomopsis rutilans gp. (?T.decora) | 9 |
| Agaricaceae | |
| Agaricus campestris Fr | 9 |
| " silvicola (Vitt)Saccardo | 5 |
| Coprinaceae | |
| Coprinus plicatilis Fr | 5 |
| Strophariaceae | |
| ?Psilocybe sp. (?P.polytrichophila or P.montana) | 4 |
| Stropharia semiglobata (Fr)Quel | 9 |
| Paxillaceae | |
| Paxillus involutus (Batsch)Fr | 5 |
| Gomphidiaceae | |
| Gomphidius subroseus Kauf | 9 |
| Boletaceae | |
| Suillus lakeii (Murr)Smith & Thiers | 6,9 |
| Polyporaceae | |
| Coltricia perennis (L)Murr | 5 |
| Cerrena (=Daedalea) unicolor Fr | 4 |
| Cryptoporus volvatus (Pk)Hubbard | 5 |
| Stereaceae | |
| Thelophora terrestris (Ehrh)Fr | 5 |

Lycoperdales
Lycoperdon perlatum Pers 9
" pyriforme Pers 9
Nidulariales
Crucibulum laeve DC)Kambly & Lee
Pezizaceae
Scutellina scutelata (Fr)Lambotte 6

As some microfungi were evident early in the season a little attention was given to these. DrJ.A.Parmlee of Biosystematics Research Centre kindly identified those marked with an asterisk.

Apiosporina collinsii (Schw)Hochn on Amelanchior alnifolia
Asteromella fritillaria (Bonar & Cooke)Petrak * on Fritillaria lanceolata
Gymnosporangium nidus-avis Thaxt on Juniperus scopularia
Phyllachora graminis (Pers)Fckl * on Schizachne purpureus
Puccinia jonesii Peck * on Lomatium geyeri

Birds

With orchards and gardens not far away to the south, it was noticeable that the lower elevations of the reserve carried more visiting birds of this type of habitat, even though only conifers awaited them. Robins were particularly common and some may nest, but Brewers blackbird, Barn swallow and possibly House finch are more temporary. Not all the latter were checked so it is possible that some may have been Cassin's finch. Both Northern oriole and Red-eyed vireo appearances were probably short-term forays up from the lake frontage.

Cattle grazing on ridge-top grasslands held some appeal for starlings and the one Western meadow-lark seen, and it was over this type of habitat that the lone Turkey vulture was cruising on its way north. Elsewhere under forested or broken cover Northern flicker, Black-capped chickadee, Mourning dove, Pygmy and Red-breasted nuthatch, Steller's jay, Ruffed grouse and Rufus-sided towhee were present on practically every occasion. These make up the largest part of the bird fauna. Appearances of Clarke's nutcracker and Yellow-rumped warbler represent seasonal movements.

Following each name are the dates (day/month) of observations. Order follows A.O.U. listing.

Turkey vulture 29/6
Sharp-shinned hawk 7/4,17/4
Red-tailed hawk 17/4,29/6,12/5
Blue grouse 7/4
Ruffed grouse 24/3,17/4,28/4,12/5,29/6,15/9
California quail 12/5
Mourning dove 24/3,7/4,17/4,28/4,12/5,26/5
Northern flicker 24/3,7/4,17/4,28/4,12/5,26/5,9/6,29/6, 28/7,1/9,15/9
Downy woodpecker 28/7,17/4,30/10
Western flycatcher 28/7,1/9
Violet-green swallow 12/5,29/6
Barn swallow 29/6
Steller's jay 24/3,7/4,17/4,12/5,28/7,1/9,30/10
Black-billed magpie 24/3,7/4,30/10
Raven 7/4
Clarke's nutcracker 28/4,30/10
Black-capped chickadee 24/3,7/4,17/4,12/5,26/5,9/6,29/6 28/7,1/9.30/10
Mountain chickadee 7/4,17/4,29/6,28/7,1/9,30/10
White-breasted nuthatch 12/5
Red-breasted nuthatch 24/3,7/4,17/4,12/5,26/5,9/6,28/7 1/9,15/9,30/10
Pygmy nuthatch 24/3,28/4,12/5,26/5,9/6,29/6,28/7
American robin 24/3,7/4,17/4,28/4,12/5,26/5,9/6,29/6, 28/7,1/9
Townsend's solitaire 17/4,28/4,9/6
Golden-crowned kinglet 24/3,7/4,17/4,1/9
Cedar waxwing 9/6
Starling 7/4
Red-eyed vireo 29/6
Yellow-rumped warbler 17/4,28/4
Western meadow-lark 7/4
Northern oriole 9/6
Brewer's blackbird 9/6,29/6
House finch 17/4,28/4,12/5
Evening grosbeak 26/5,9/6,29/6
Rufous-sided towhee 7/4,12/5,26/5,9/6,29/6,28/7,1/9
Dark-eyed junco 24/3,7/4,17/4,29/6
Chipping sparrow 28/4,12/5,26/5,29/6

Mammals

An alternative name for this property might be Campbell-Brown Porcupine Reserve. Four dens were found distributed

where cavities existed among rocks - one on the prominent rocky feature east of the talus slope, another on a small cliff face above, and two on the long cliff band across the north end of the reserve. It is not easy to survey the latter area and there could well be more. Denning cavities were in the 30 to 40cm range at their mouths, narrowing inside but long enough to allow animals to withdraw from the weather.

Damage by bark stripping is widespread and particularly noticeable in spring when wood exposed during the winter is still fresh and bright. With one exception (Douglas maple) all the gnawing was on Ponderosa pine from diameters of about 10cm to 30cm. The younger are liable to be ringed and killed but pine and Douglas-fir seedlings of all sizes are general throughout the property and well able to replace any losses under existing climatic conditions. Apparently those animals nearest the hay barn make a regular winter routine of visiting to share the horses'supplies.

It is on the steeper forested slopes that deer tracks are most in evidence interlacing among rocky outcrops, but even on open grassy areas where less constrained by topography favoured routes can be found disturbing soil between the widely spaced grass tufts and allowing weeds to make inroads. Animals partly seen among the trees appeared to be White-tailed deer.

Pine chipmunk and Red squirrel are scattered throughout and mounds of Northern pocket gopher show where soil depth satisfies their need to get below frost depth. No trapping of small rodents was carried out.

Although no coyotes were seen, scat indicates the reserve is on a regular itinerary of one or more individuals. One old scat deposit near the upper boundary appeared to be from Black bear but visits must be very few and far between.

Insects - Not investigated

Spiders

Specimens collected in different environments throughout the reserve were identified with his usual courtesy by Dr. C.D. Dondale of Biosystematics Research Centre, Ottawa.

Lower, more frequented parts of the Okanagan have been sampled by others previously. With little by way of unusual habitats in the reserve it was unlikely that finds of any great novelty would be made at Campbell-Brown, and this was the case. There was, however, one mysterious unidentified item from the talus slope which could not even be allocated to family and at Dr. Dondale's request an attempt will be made to find more this year, most particularly an example of the other sex. Worthy of special note were the Dictyna chitina previously known in B.C. only from near Kaslo, and an immature funnel web spider that might be Agelenopsis dirksia, in which case it would be a new record for the province. Several Meioneta spp. were not named beyond genus as the group is being revised, but it is of interest that previous finds have all been coastal.

Uloboridae
- Hyptiotes gertschi Chamberlin & Ivie

Dictynidae
- Dictyna chitina Chamberlin & Gertsch

Amaurobiidae
- Callobius sp.

Linyphiidae
- Meioneta sp.
- Neriene radiata (Walck)
- Oreonetides sp.
- Pityhyphantes sp.

ARCUPHANTES SYLVATICUS Chamb + Ivie
LEPTHYPHANTES COMPLICATUS (Em)

Erigonidae
- Eperigone trilobata (Emerton)
- Pelecopsis sculpta (Emerton)
- Symmigma minimum (Emerton)

Araneidae
- Araneus gemma (McCook)
- " sp.
- Araniella displicata (Hentz)
- Hypsosinga sp. (?H.pygmaea)
- Neoscona sp.

Agelenidae
- Agelenopsis sp. (?A.dirksia)
- " sp.

Mimetidae
- Mimetus sp.

Lycosidae
- Pardosa mackenziana (Keyserling)
- Schizocosa mccooki (Montgonery)

Gnaphosidae
- Drassyllus depressus (Emerton)
- Gnaphosa muscorum (L.Koch)
- Sergiolus montanus (Emerton)
- Zelotes fratris Chamberlin

Clubionidae
- Phrurotimpus borealis (Emerton)

CASTIANEIRA sp.

THERIDIONIDAE
THYMOITES CAMANO lev.

Anyphaenidae
Anyphaena sp.
Thomisidae
Misumena vatia (Clerk)
Xysticus elegans Keyserling
" sp.
PhilodromidaE
Philodromus rufus pacificus Banks
Thanatus sp.
Tibellus oblongus (Walck)
Salticidae
Evarcha hoyi (Peck & Peck)
Metaphiddipus sp.

The tick Dermacentor andersoni is common in scrub and low vegetation.

Reptiles

Detailed study of Northern pacific rattlesnakes (Crotalus viridis) in the Vernon area of the North Okanagan has included the den on Campbell-Brown Reserve (Macartney 1985, Macartney and Gregory 1988). In most cases research data is aggregated with that from dens in other locations and cannot be abstracted, however as it supports generalizations of phenology and reproduction pertinent to the whole area it is of interest.

One specific point brought out by Macartney is that the reserve den differs from all others he studied by being within rocks in an earthy mound as opposed to being in eroded rock outcrops and talus. The reason for this could be historical. The fact that the point of land jutting out into the lake below has been called Rattlesnake Point for a great many years shows the presence of snakes is not recent. Apparently a former den was located closer to the point before being destroyed during an earlier phase of road building, requiring returning snakes to find this present, less normal, den site (Mrs.M. Campbell-Brown, pers. con.). As the current location is, from this point of view, somewhat artificial it would not alter the situation materially if a new completely artificial den were constructed in the area, into which facilities for research and monitoring could be incorporated during construction, if Ecological Reserves Program and Dr. Gregory agreed. Public viewing from a distance would be more easily arranged.

Macartney's work suggested about 100 individuals of all ages use the Campbell-Brown den, with their numbers fairly stable. During 1989 two were seen around the den opening on 7th April, rising to six on 28th April following which numbers dropped off through May as daytime temperatures increased and animals dispersed. By 1st September snakes were gathering at the site again. At the end of April one snake was encountered in the prominent rocky ridge near the porcupine den east of the talus slope. It may already have left the main den, alternatively there may be some hibernation in this rocky area, although Macarthy does not mention it.

A month earlier (24th March) a single Common garter snake (Thamnophis sirtalis) was encountered higher on a grassy slope far from any water or even seasonal dampness. This species also hibernates communally and the question arises whether it shares the rattlesnake's den.

## Management

Unlike most ecological reserves, #77 sits right on a well travelled highway and even though entry is not restricted a sign at road level attracting attention to its presence is probably unwise in the circumstances. Nonetheless a fair amount of use appears to take place with special relevance to the snake den area, indeed it is believed some guided parties are taken in specifically to view it.

The question of liability arises if no warning of hazard is in place. In comparable situations Parks Branch has warning/explanation signage at entrance points. If this is decided upon for Campbell-Brown Reserve a suitable site would be where the first rise up from the gate meets the old track up to the meadow. Here it would not be visible from the road, neither would it be close enough to the den itself to draw attention to its exact location. In addition to a generalized warning, a few remarks giving information on timing of use through the year, size of population, etc. would be appropriate with emphasis on the infrequency of suitable denning conditions and necessity for not disturbing the site or interfering with its inmates.

With Western wood-tick being plentiful mention of this could be added to any information sign.

A group of mineral claims has been staked enveloping the north end of the reserve (Bay #1 to 4). Local mining consultants are not aware of any significant results from this area.

Although the perimeter fence is a little delicate in places

it is complete and standing. Two horses are pastured inside for roughly six months of the year. No livestock was seen on adjacent properties but cows have grazed on the ridge above in recent times and may still do so. A break in the fence allowed them entry at one time but has been corrected. Garbage is no problem and apart from weeds the reserve is in good condition.

## Bibliography


Brayshaw,T.C.1970 The Dry Forests of British Columbia, Syesis 3:17-43

Brayshaw, Pojar,Foster 1976 Application for Ecological Reserve (#251)

Clement,C.J. 1981 Vegetation Resources of the Vernon Map Sheet Area, APD Bulletin #9

Douglas, Straley, Meidinger 1989 The Vascular Plants of British Columbia, Part 1

Jones, A.G. 1959 Vernon Map Area, GSC Memoir 296

Kelley,C.C.,Spilsbury,R.H. 1949 Soil Survey of the Okanagan and Similkameen Valleys, B.C.

Klinka, Krajina, Ceska, Scagel 1989 Indicator Plants of Coastal British Columbia

Lloyd,Angove,Hope,Thompson,Ivanco 1989 A Field Guide for Identification of Ecosystems in the Kamloops Forest Region

Macartney, J.M. 1979 The Ecology of the Northern Pacific Rattlesnake,Crotalus viridis, in British Columbia

Macartney J.M.,Gregory, P.T. 1988 Reproductive Biology of Female Rattlesnakes (Crotalus viridis) in British Columbia

Straley,Taylor,Douglas 1985 The Rare Vascular Plants of B.C.

Taylor R.L., MacBryde B. 1977 Vascular Plants of British Columbia


MALCOLM MARTIN

M.E.Martin,
Vernon, B.C.,
February 1990