

MARA MEADOWS ECOLOGICAL RESERVE # 42

INTRODUCTION

Submitted as a proposal by the North Okanagan Naturalists' Club in 1969 this unique area finally became a reserve in 1972 being enlarged to its present size 2 years later. Mara Meadows comprises 139 ha (465 acres) and can be reached from Highway 97A just west of Grindrod via Grandview Flats Road and Edgar Road.

The area comprises a tract of open, calcareous bog with associated forested bog set within dense forest transitional between Interior Douglas-fir and Interior Hemlock zones, giving both alkaline and acid conditions each with its own distinctive flora. The nearest similar calcareous bog is in the vicinity of Edmonton and nothing comparable is known to exist in British Columbia.

Two previous reports exist. The first dating from 1969 is unsigned but believed to be by John Shepard of N.O.N.C. and supported the first official approach to the Ecological Reserve Committee. Later, in 1971, a more detailed review was carried out on behalf of the latter by Richard Revel with the assistance of Dr. K. Beamish.

TOPOGRAPHY

The Okanagan at Mara runs roughly VNE. Some 365 m (1,100ft.) higher on the west side and separated from it by a ridge of low hills lies a small parallel valley dipping at a slight angle in both directions. Mara Meadows covers the divide and southwards. Its sinuous westerly boundary follows the line where an abrupt rise takes place from the meadow level (approximately 701m or 2,300 ft.) climbing then at a moderate angle to the top of Larch Hills (1063m or 3,500 ft. at this point). On the east side once the meadow is left the land becomes quite broken rising eventually to the ridge of low hills previously mentioned.

In the Mara Meadows valley three small but distinct hill features have all the aspects of drumlins - evenly shaped outline, elliptical or oval perimeter - and could well be glacial in origin. The largest forms the height between the east and west arms of the main meadow (see map 1); a second falls across the northern boundary and the third is beyond the reserve. No drumlins have been reported within the Okanagan Valley itself and those that are mapped have all been found in similar situations on level areas above and to the west.

So far as is known there are no official or unofficial names for features within the reserve and those shown on Map 1 were given only for convenience during this season's survey. South Trail is a good dirt road, muddy at times, used by the small logging operator holding a license east of the reserve. North Trail is unused though passable except where water bound for West Arm flows over its surface much of the year (blocked culvert?). Its two northern feeder roads are impassable due to scrub growth and fallen timber. Connecting the two Trails is a section of old logging track permitting a circuit to be made, and this too is negotiable only on foot.

HYDROLOGY

For any bog area the water budget is most crucial of all factors, mediating the balance between stability and change. It is understandable that no records pre-dating E.R. status would be available but it would have been useful to have water depth figures from the early 1970 s, particularly immediately following ditch construction to decide whether drainage has increased and if so to what extent.

Two markers were put in position this year to enable depth figures to be collected and also to monitor seasonal variation. The first (at a location below the lowest ditch dam and marked in red on map 1), gives an indication of drainage through the ditch outlet. The most effective and important dam on this whole system is of large logs where South Trail crosses the ditch and without it serious depletion of water in the meadow would result. As it is, the greater part of drainage continues along its original route to exit via the Violet Creek outlet further west. Another marker might have been useful at that point.

The other depth gauge in place (shown as "2" on map 1) is above the first effective dam at the start of the ditch, however, as most water still follows the natural channel east of the ditch a collateral marker should perhaps have been positioned in its bed. As these gauges have not been levelled their results cannot be related to each other. Readings for 1984 are as follows:

1984	#1	#2
4th May	29½ cm	42 cm
18th May	30	43
1st June	30	42
15th June	29	40
2nd July	29½	40
13th July	28	36

10th August	20½	35½
31st August	20½	26
24th September	22½	30

Inflow into the bog is multiple with no one source predominating. The main flows noted are lettered in blue on map 1 and clockwise are -

- A..... small stream drying up during the summer;
- B..... larger stream continuous in most years but reduced to a trickle in 1984;
- C..... area of seepage;
- D..... large area of forested bog providing most of the channelled flow to and through West Arm, seeps probably occur over much of the distance to the meadow;
- E..... line of seepages between West Bench and Drumlin #2 producing sizeable stream into North Meadow where drainage divides, some flowing north and some south where it becomes F;
- F..... collects seepage from the base of the ridge along which 2nd. North Road runs, emptying into East Arm;
- G..... seepages joining disseminated East Arm drainage;
- H..... permanent pool apparently fed by spring water.

Additionally, seepage seems to occur at the base of many slopes, most often indicated by forested bog, particularly along the east side of Drumlin #1, around the head of East Arm, down much of the sinuous west side of the reserve and at various sites east of Main Meadow. While relatively minor at each location, in total a substantial volume probably accrues to the bog from these sources.

Where the East and West Arm flows and seepage from "G" combine an area of permanent shallow pools provides suspect ground which it is unwise to enter alone. This is the only potentially dangerous part of the reserve.

With the cedar log dam by South Trail in place across the ditch it is questionable whether the ditch is of major significance in the overall drainage pattern. The many other smaller dams put in place over the last 10 years probably provide only a slowing action on flow along that route and have little effect on speed of outflow into Violet Creek which continues to be fed by the main outlet from the meadow in its south-west corner. No sediment is carried by inflowing water sources so the ditch will never silt up under present conditions; chemical precipitation and accumulated vegetation debris is making some slow contribution towards infilling.

CLIMATE

No close climatic records are available nor anything from

an elevation similar to Mara Meadows. The publication "Ecological Reserves in British Columbia" uses Salmon Arm (12km, 7½ miles west) and Sicamous (16km, 10 miles north-east) as comparisons. The figures below are for Enderby, 15km or 9½ miles south and 316m (1,006 ft.) lower, and are considered as being more representative.

	J	F	M	A	M	J	J	A	S	O	N	D
median day temp.(°C)	-5.7	-1.9	2.1	7.9	12.9	16.4	19.2	18.4	13.4	7.2	1.1	-2.9
total precipitation (mm)	55.5	34.8	42.1	24.2	31.2	44.0	31.5	36.1	35.2	33.5	47.2	57.2
annual average median day temperature	7.3°C											
annual total precipitation	472.5mm											

Undoubtedly Mara Meadows would be significantly colder, not just reflecting the greater height but also due to the cooling effect of forest growth. At mid-April large areas were still covered by remnant snow patches beneath the trees whereas in the Okanagan Valley directly below this stage was passed probably a month earlier. Height and forest cover would have an equally pronounced effect on precipitation.

1984 had a particularly dry summer with little rain through the June to mid-September period. Water depth as recorded in the previous section remained fairly steady into July before dropping sharply in August. This might be interpreted as a stable sub-surface supply from snow-melt gradually being overcome, as it eased, by evaporation and an absence of precipitation. July and August are the months of highest evaporation in the Okanagan and published figures have given an annual loss of 900mm (35½ inches) from lake surface at Osoyoos and 810mm (32 inches) from the northern part of Lake Okanagan. Admittedly Mara Meadows is higher and further north (reducing temperature), covered by vegetation (breaking wind velocity) and in a forested area (raising air humidity), all factors for reducing evaporation. Even so, evaporation must have a strong influence aided by transpiration from the dense bog vegetation. This would be at its height in July and August becoming less of an issue in September when a brief rainy period immediately prior to the September visit seems to have been quickly translated into an increment in water level.

GEOLOGY

Sparse outcrop makes the geological setting one more of inference than of fact. Most recent mapping shows the greater part of the reserve as being underlain by Tsalkom formation of the Mount Ida Group (greenstone, chlorite phyllite, amphibolite and minor black shale). Such in situ samples as were found in the forest east of Main Meadow during this season's survey

were all of greenstone. Although the overlying Sicamous Formation is indicated as being present under the northernmost part of the reserve none appears to break the surface. Because of widespread metamorphism, age of much of the Okanagan is poorly understood and the only helpful available lead in the subject area is that the Tsalkom Formation has not been affected by Ordovician intrusions whereas the underlying Silver Creek Formation elsewhere has been. It is tentatively dated, therefore, as mid- to late Palaeozoic with the Sicamous Formation as probably early Mesozoic.

In the area one to two kilometres south of the reserve where outcroppings are a little more frequent several mineral showings have been investigated in recent years with gold-lead, copper-lead and zinc-manganese values respectively. Approximately 4km (2½ miles) north-west on Larch Hills disseminated molybdenum has been found and some 3km (2 miles) north-east near Rosemond (Mud) Lake is a gold prospect. None of these is currently active but in total there are sufficient indications to rate the area as one of widespread low-level mineralization.

Apart from well drained sections of West Bench which is closer to being brunisol, soil over those forested parts of the reserve away from the bog is a coarse reddish-brown podzol. Subangular rock embedded within it suggests a glacial drift origin.

FORMATION OF THE BOG

In not a few instances valley bogs are a late episode in the life of a mature lake. With no evidence that there was ever a barrier, moraine or otherwise, at the south end of the meadow, this is not a supportable proposition at Mara. There may, though, have been a time early in the deglacial period when the thinner ice over the surrounding hills was degrading fast while the Okanagan Valley itself still carried a considerable thickness. Melt water under these conditions ponds up behind or along the edges of the valley ice giving rise to flanking lakes of short duration but long enough for a flat floor of silt to form. Subsequent drainage across the departed lake bed could have been further slowed by what is known as "post-glacial bounce". With removal of the weight of several thousands of feet of ice the underlying crust starts to rebound beginning in the warmer south and causing a tilt up-valley. From the present angle of old beach deposits further south this has been measured in the Okanagan as being as much as 0.75m per kilometre (3½ ft. per mile), certainly enough to confuse the drainage pattern of any slow moving water meandering through Mara Meadows valley.

Arguing against this are two other facts. One is the deeply incised nature of lower Violet Creek and the other a

wide, shallow fan deposit where this creek enters the Okanagan, sufficiently substantial to have caused the Shuswap River to make a sweeping curve around it. Both these point to a substantial volume of water flowing down from the meadow area at one time. The abrupt rise along the west side of the reserve could also be ascribed to water action although another possibility is perhaps preferable.

Much of the high land west of Mara Meadows is underlain by Sicanous Formation made up partly by impure limestone (argillaceous limestone). Water arriving in the small valley below could therefore be highly charged in carbonates from this source which, concentrated by evaporation from the sluggish flow, become precipitated, building up the valley floor and further confusing drainage. Probing through the bog in the late 1960s met resistance often at a depth of around 2½m (8 ft.). Averaging this thickness of material over the 10,000 years since deglaciation would require the deposit of only one quarter of a millimetre of precipitate and vegetation debris annually. Today white flocculated deposit is very obvious in the "Marl Pools" area of the meadow and even in the relatively recent ditch a thick calcareous crust is present on vegetation in places.

It seems likely, then, that the bog surface is still being added to under present conditions and that, barring a major climatic change, it should be able to sustain itself. In the normal course of events, in a geological time sense, Violet Creek would be expected to cut down sufficiently to drain Mara Meadows, however, its present rate of flow, even at annual maximum, suggests this is an event of the very distant future.

PUBLIC USE

For most of its history Mara Meadows has probably been regarded as a useless area best kept away from. No doubt a little hunting went on within the drier and forested parts and may still do so. It is not clear when small-scale logging commenced as it pre-dates recording of this on forest maps; some done on a selective basis appears quite old but in all likelihood does not date back beyond the early post-WW II years. Areas where this occurred are hatched in green on map 1 and there may be others. In the north-west corner is a larger cleared block, part of an area extending outside the reserve felled in 1969. Use of South Trail to reach another logging area east of the reserve being operated by a small local mill owner continues.

It was in the late 1960s that an agricultural lease was applied for covering an area that included the meadow, ostensibly to prepare land for farming, but as bona fide farmers are also allowed cutting rights the real motivation is not

clear. Use of heavy equipment to create drainage of the meadow proved impossible even under winter conditions leading to the alternative use of explosives for construction. Soon after its completion steps to acquire the property under the Ecological Reserves Act began.

Cattle entry from north of the reserve then became a concern mostly over that part cleared by logging and a wire fence and Texas gate on Edgar Road has been effective in their exclusion.

Public entry over the year seems to be limited - local residents have little interest in the property and visiting naturalists are not frequent. A cross-country skiing organization has roadside direction markers to Mara Meadows and to their forest route known as "Thrush Trail" which runs along South Trail, the short connecting old logging track and along North Trail for a circular route. No damage or litter is apparent from this use, however, the group has erected a wooden pit toilet just off South Trail and undertakes brush clearance and removal of deadfalls along "Thrush Trail" in the fall prior to winter use. If this construction and cutting is being done without formal approval it is suggested that an official letter be considered asking that they first obtain approval before doing so, in order to maintain authority over the reserve.

PLANT COMMUNITIES

Varying between forest and open bog, wet and dry, acid and alkaline, altered and undisturbed conditions in a relatively condensed area, Mara Meadows offers as much floral diversity and interest as could be expected anywhere in the Province within a similar span. Nineteen plant communities, including sub-divisions, have been selected to characterize the differing environments. The impressively definite border to each type as shown on map 2 is actually highly gradational in most cases on the ground with inliers and outliers complicating the situation.

1.a.....Younger forest

Pseudotsuga menziesii/*Tsuga heterophylla* - (*Taxus brevifolia*) -
Paxistima myrsinites

Pseudotsuga menziesii
Tsuga heterophylla
Thuja plicata
Betula papyrifera

Taxus brevifolia

Paxistema myrsinites
Chimaphila umbellata
Linnaea borealis
Pyrola chlorantha

Hylocomium splendens
Pleurozium shreberi

Tree growth is so dense over much of this area as to allow little under-story or ground cover. Forest Service mapping indicates douglas-fir as everywhere predominant but as often as not hemlock appears in equal if not greater number. Locally one or other of Populus balsamifera, Picea engelmannii or Larix occidentalis joins the mixture in a limited way according to wetness or dryness.

L.b..... Older forest

Tsuga heterophylla/Pseudotsuga menziesii - (Taxus brevifolia) -
Paxistema myrsinites/Tiarella unifoliata - Hylocomium splendens/
Pleurozium shreberi

Tsuga heterophylla
Pseudotsuga menziesii
Thuja plicata

Tsuga heterophylla
Pseudotsuga menziesii
Thuja plicata

Taxus brevifolia

Lonicera involucrata
Alnus incana

Paxistema myrsinites
Linnaea borealis
Clintonia uniflora
Osmorhiza chilensis
Pyrola chlorantha

Tiarella unifoliata
Cornus canadensis
Mitella nuda
Aster modestus

Pleurozium schreberi
Hylocomium splendens
Rhytidiadelphus triquetrus

Hylocomium splendens

More light reaches the ground and allows a richer flora than in a. above. As this community extends east of the reserve and includes trees of mature size it is likely that logging will occur eventually adjacent to the east boundary. Near East Arm a cottonwood was measured as having 6 1/3 ft. D.B.H. or approximately 17 ft. circumference.

l.c.....Trails and openings in forest

- Salix bebbiana - Paxistema myrsinites/Linnaea borealis -
Stereocaulon/Cladonia/Peltigera ssp./Pleurozium shreberi/
Rhytidiadelphus triquetrus

Salix bebbiana
Alnus incana

Paxistema myrsinites
Linnaea borealis

Chimaphila umbellata

Stereocaulon tomentosum
Cladonia ecmoeyna
Peltigera apthosa
Pleurozium shreberi
Rhytidiadelphus triquetrus

Where thick forest has been opened, as for example along the old logging trails shown on map 2, this community is found with willow growth soon disrupting ease of access.

1.d..... Cleared forest

This unit varies so much as to be most difficult to characterize. In places its original dominant tree - *Pseudotsuga menziesii* - is re-establishing itself vigorously; elsewhere *Populus balsamifera* or *Populus tremuloides* have gained preeminence with *Salix bebbiana* common where more open. Veterans of *Thuja plicata*, *Tsuga heterophylla* and *Picea engelmannii* still stand, often in damper locations. The herb layer includes -

<i>Epilobum angustifolium</i>	<i>Lonicera involucrata</i>
<i>Leucanthemum vulgare</i>	<i>Lonicera utahensis</i>
<i>Paxistima myrsinites</i>	<i>Sambucus cerulea</i>
<i>Berberis aquifolium</i>	
<i>Anaphalis margaritacea</i>	
<i>Solidago canadensis</i>	
<i>Aster laevis</i>	

Additionally, many weedy species have taken advantage of the disturbance and lesser competition to invade including many of those mentioned under 10.

2.a.....Forested bog

Picea engelmannii/*Thuja plicata* - *Alnus incana*/*Lonicera involucrata* - *Typha latifolia*/*Lysichiton americanum*/*Glyceria striata*

This division differs from humid forest phases of 1.a. and 1.b. in the presence of standing water and hummocky ground. Mostly it appears to cover areas of spring and seepage and includes a large number of standing dead trees, victims of the saturated substrate. Along the west boundary a transition to *Populus balsamifera*, *Populus tremuloides*, *Salix bebbiana* takes place up slope.

<i>Picea engelmannii</i>	<i>Picea engelmannii</i>
<i>Thuja plicata</i>	<i>Populus balsamifera</i>
<i>Populus balsamifera</i>	<i>Populus tremuloides</i>
<i>Pseudotsuga menziesii</i>	
<i>Tsuga heterophylla</i>	
<i>Betula papyrifera</i>	

Lonicera involucrata
Alnus incana
Cornus sericea

Alnus incana

Mimulus guttatus
Ranunculus uncinatus
Erigeron philadelphus
Geum macrophyllum
Veronica americana

Epilobum angustifolium
Paxistema myrsinites

Picea engelmannii
Thuja plicata
Betula papyrifera

Alnus incana
Betula glandulosa
Ribes hudsonianum
Viburnum opulus

Glyceria striata
Cicuta douglasii
Mimulus guttatus
Epilobum ciliatum
Ranunculus uncinatus
Galium triflorum
Agrostis stolonifera

2.b.....Birch - willow bog

At the head of West Arm the transition for Forested Bog to Bog Meadow is through a zone of difficult progression where ground cover is mostly moss and the sod-forming meadow species have not yet appeared.

(Picea glauca) - Betula glandulosa/Salix candida - Petasites sagittatus - Campyllum stellatum

Picea glauca - P. engelmannii

Betula glandulosa
Salix candida

Petasites sagittatus
Menyanthes trifolium

Campyllum stellatum
Mnium spp.

2.c.....Sedge Woods

Picea engelmannii - Alnus incana - Carex rostrata

Picea engelmannii

Alnus incana

Carex rostrata
Cicuta douglasii
Aster modestus

Although only two modest areas of Sedge Woods were identified they were distinct enough to justify their own sub-section, having more water than the next section but without the typical bog assemblage.

3. Treed Meadow

Picea engelmannii - *Salix candida/mackenziana* - *Carex* spp./
Scirpus spp.

Much of the herb layer is what would be expected in the following communities describing Bog Meadow except that shaded and raised surface around trees and shrubs allows a few additional species. Overall, a widely spaced spruce and willow growth raises the question whether this was an area originally of true meadow now on its way to becoming forested, or a forested area losing its tree cover. If a choice has to be made the lack of many dead trees suggests the former.

Picea engelmannii

Betula glandulosa
Salix candida
Salix mackenziana

Trichophorum caespitosum
Eleocharis elliptica
Carex spp.
Triglochin maritima
Menyanthes trifolium
Petasites sagittatus
Aster borealis
Lobelia kalmii
Drosera rotundifolia
Platanthera dilatata
Parnassia fimbriata

4. At other times the meadows have been variously referred to as *Drepanocladus* Bog and as *Sphagnum* Peat Bog. In actual fact no *Drepanocladus* is present in the meadow and no *sphagnum* either except as described later under Pine Terrace and Northern Islands. The two moss species shown below greatly predominate over all others: the complete sequence being shown in the section on bryophytes.

Carices are rich in number and although these as identified can be found in the check list it would take a specialist to make sufficient determinations in the field to be able to allocate distribution and dominance. For this reason they are shown below as *Carex* spp.

Both sub-divisions of this bog community - the actual Mara Meadows - are so similar that a single visit early in summer when water level is high would probably not readily produce evidence to justify their separation. By late summer 4.a. can be seen evidently more green than 4.b. as befits its position along the main drainage axes. Bog mosses, common everywhere, appear in greater concentration in 4.a. and the Carex flora could probably be shown to differ in subtle ways. Although an item may appear on one list below but not on the other it may be taken as present in both, the difference being one of degree, Viola nephrophylla being one of the few exceptions preferring to remain in the drier zone.

4.a.....Bog Meadow (wetter)

- Scirpus/Eleocharis/Carex spp. - Campylium stellatum/Scorpidium scorpioides

Trichophorum caespitosum
Eleocharis elliptica
Carex spp.
Drosera anglica
Drosera rotundifolia
Menyanthes trifolium
Utricularia intermedia
Lobelia kalmii
Liparis loeselii
Spiranthes romanzoffiana

4.b.....Bog Meadow (drier)

- Scirpus/Eleocharis/Carex spp. - Campylium stellatum/Scorpidium scorpioides

Trichophorum caespitosum
Eleocharis elliptica
Carex spp.
Triglochin maritima
Scirpus lacustris
Menyanthes trifolium
Lobelia kalmii
Zygadenus elegans
Parnassia fimbriata
Epipactis gigantea
Senecio pauperculus
Aster borealis
Solidago canadensis
Viola nephrophylla

5.a.....Marl Pools

Scirpus/Eleocharis - Scorpidium scorpioides

Distinguishing this area from others is the noticeable lack of vegetation. Sod-producing species are sparse usually

forming rims to the pools within which a little *Scorpidium* and *Utricularia* float unattached. A slight rise in the bog surface along the line of the Archipelago serves to impede water drainage causing pools to form in which the slowly moving water has greater time to evaporate and precipitate its load of alkaline salts.

Trichophorum caespitosum
Eleocharis elliptica
Drosera anglica
Drosera rotundifolia
Utricularia intermedia
Scirpus lacustris

Scorpidium scorpioides

5.b.....Bog Pools

Insufficient data was collected to describe this minor category except to say that it would fall between 4.a. and 5.a. in vegetation cover. Being at or near the junction of East and West Arm drainage flows, water presumably passes quicker than through the Marl Pools and leaves beds either mud coloured or in places reddish, sometimes with a surface oil sheen possibly due to algal concentration (or iron?).

6.a.....Pine Terrace

Pinus contorta - *Ledum glandulosum* - *Vaccinium oxycoccus*/
Menyanthes trifolium - *Sphagnum warnstorffii*

Pinus contorta
Picea engelmannii
Tsuga heterophylla
Pseudotsuga menziesii

Pinus contorta
Picea engelmannii
Tsuga heterophylla

Ledum glandulosum
Betula glandulosa
Thuja plicata (stunted)

Ledum glandulosum
Betula glandulosa
Thuja plicata (stunted)

Vaccinium oxycoccus
Menyanthes trifolium
Kalmia microphylla
Empetrum nigrum
Carex dispernum

Vaccinium oxycoccus
Kalmia microphylla
Vaccinium myrtilloides
Eriophorum viride ~~acarinatum~~
Cyprinedium calceolus

Sphagnum warnstorffii

Sphagnum warnstorffii

Of all the divisions within Mara Meadows this one raises some of the most perplexing questions bearing on the natural sequence leading to maturity of a bog. There is no obvious evidence that an episode of fire aided the establishment of these fairly homogeneous stands of lodgepole pine although it might be argued that the age difference between Younger forest

(1.a.) and Older Forest (1.b.) could also be explained this way.

Virtually no pine occurs in the forested areas to provide a source but it is present scattered on the slope west of the reserve and is regenerating in a small way on West Bench. Whether it is coincidence that Pine Terrace is found with some appearance of a regular pattern on the west side of both meadows can only be speculated on.

One noticeable feature is the abrupt edge between terrace and bog with a rise of about one third metre. If one were advancing on the other an irregular, degrading edge line might imply predominance by the bog whereas a straight, well-defined edge, as can be seen, might be inferred as superiority on the part of the terrace. If, the closer one approached the edge, the Northern Islands became more concentrated then a piecemeal advance could be underway where individual islands form and by expansion gradually become part of the terrace but this is not the case and all that can safely be stated is that at this time sphagnum growth appears to be active and positive in relation to the bog.

An awkward chicken-versus-egg question remains - did existing sphagnum patches provide a suitable medium for lodgepole pine to gain a foothold or did conditions under pine trees become sufficiently acid for sphagnum to establish itself. If the first were true then there should be developing sphagnum clumps awaiting seeding or newlyseeded by pine. If the second were correct young conifers should be expected that had not yet attracted a sphagnum cover. Seedling conifers in the bog are few to give credence to the latter argument (only one spruce was noted near the north end of the ditch and no pine seedlings at all) but there could be one newly developing terrace immediately west of the northern end of West Arm.

6.b.....Northern Islands

For all intents and purposes this plant community is the same as 6.a. with the elimination of *Menyanthes* and inclusion of a broader range of conifers. Whereas the terraces do incorporate a scattering of conifers other than lodgepole pine, it is the pine that greatly predominates: on the islands examples can be found where pine provides the foundation but it has no exclusive position and hemlock, spruce and douglas-fir with cedar and white pine actually outnumber it with *Lonicera involucrata* and *cascara* minor shrub associates ranking after *Betula glandifera* and *Amelanchior alnifolia*. Overall the composition is too variable amongst those mentioned to be predictable and no sequence of predominance is really possible. Herbs remain much the same as for 6.a. Under the more intense light *Sphagnum fuscum* appears to replace *S. warnstorffii* of the terrace and *Tomenthypnum nitens* is common on the island edges.

7..... Southern Islands

Picea glauca - *Thuja plicata* (stunted)/*Betula glandulosa* -
Carex spp./*Ledum glandulosum*

Picea glauca
Tsuga heterophylla

Betula glandulosa
Thuja plicata (stunted)
Cornus sericea

Ledum glandulosum
Carex spp.
Fragaria virginiana
Smilacina stellata
Cyprinidium calceolus
Potentilla fruticosa

Distinguishing the Southern from the Northern Islands is the paucity of sphagnum and *Pinus contorta* and the gradual transition from drier Bog Meadow (4.b.) without any sharp boundary or sudden rise, nevertheless conditions are sufficiently acidic for *Ledum* and *Vaccinium oxycoccus* to maintain themselves. Locally in the Archipelago where the adjoining zone is wetter Bog Meadow (4.a.) some sphagnum can be found and there the boundary is more abrupt.

One previous species list made at Mara Meadows gave *Picea engelmannii* as the spruce present; *Picea glauca* was shown on the other. Examination this summer indicated both with trees answering to *P. glauca* tending to be in sites in and around the meadow and those further away satisfying the requirements for *P. engelmannii*. As hybridization occurs between these two species it is probable that most actually fall into a broad range of intermediaries.

With a few *Pseudotsuga menziesii* and such unlikely single specimens as *Juniper scopulorum* and *J. communis* the question arises whether Big Island and the Archipelago have been higher above water level in the past during periods of fluctuation, and whether they may have constituted more of a barrier at one time causing the main drainage channel to make its abrupt swing from the pond west to the Violet Creek outlet.

8..... Birch - Willow Fringe

- *Betula glandulosa* (*Salix* spp.) - *Carex* spp.

(a)	(b)	(c)
Betula glandulosa	Betula glandulosa	Betula glandulosa
Salix candida		Thuja plicata (stunted)
Salix pedicellaris		Salix pedicellaris
Salix mackenziana		
Carex spp.	Carex spp.	Carex spp.
Zygadenus elegans	Scirpus lacustris	Trichophorum caespitosum
Epipactis gigantea	Zygadenus elegans	Eleocharis elliptica
Parnassia fimbriata	Epipactis gigantea	Epipactis gigantea
Cyprinoidium calceolus	Parnassia fimbriata	
	Thragmites australis	
	Equisetum spp.	

As constituted this is a very variable category and could well be sub-divided according to location. Its two most distinctive features uniting all variations are that it forms the bordering community around practically the whole perimeter of the Bog Meadow, and secondly, that everywhere Betula glandulosa is the predominant taller plant.

Type (c) has least diversity and makes up most of the narrow strip along the eastern side of the meadow. Type (b) accounts for the wider example west of West Arm and is light on willows compared with the others, while type (a) fills in the west side of East Arm between meadow and Forested Bog.

Small size of the North Meadow has the effect of bringing the Birch - Willow Fringe on each side relatively close together so that the open space is not as "clean" as in the Main Meadow. Whether this presages a gradual replacement of meadow by one of the treed communities will have to be watched.

9.a..... Pond

- Utricularia vulgaris/Myriophyllum spicatum

Utricularia vulgaris
Myriophyllum spicatum var. exalbescens
Potamogeton gramineus
Sparganium minutum
Chara sp.

fringed by Carex sp., Potentilla palustris, Scirpus lacustris.

9.b..... Lower Ditch Channel

- Utricularia vulgaris - Chara sp.

Utricularia vulgaris
Potamogeton gramineus
Sparganium minutum
Polygonum amphibium
Chara sp.

fringed by *Typha latifolia*, *Juncus ensifolius*, *Carex oederi*; in outlet channel below the last dam vegetation is mostly *Equisetum fluviale* and *Potentilla palustris*.

These two sub-divisions provide the only deep water habitats.

10..... Altered and Disturbed

Where North Trail meets Edgar Road a cleared area may have been used for log loading at one time. It was later seeded with domestic grasses with a wide variety of pasture weeds. Depending on the exact location of the boundary some of this may be in the reserve, however, it has been excluded except in so far as many of the species present have been carried fortuitously along North Trail. These, and similar introductions along South Trail and to a lesser degree in the Cut Forest area, will be found in the check list. Occasioning special comment is a vigorous patch of *Ranunculus acris* - not a common species in the Okanagan.

Indigenous species that appear to have benefitted from road construction and have increased under these conditions are *Salix bebbii*, *Fragaria virginiana*, *Aster laevis*, *Leucanthemum vulgare* and (South Trail only) *Juncus bufonius*.

Survey Transects

Background data from before blasting of the drainage ditch or even from immediately after its construction is not available. Some opinion of regular visitors suggests an expansion of range by Birch - Willow Fringe but this is subjective and based only on judgement.

In an attempt to provide a basis for long-term monitoring two survey lines were established to cross interfacies between adjoining communities and thus disclose any movement back or forth. Both comprise contiguous blocks one metre square based on a survey line of 15m (approximately 50 ft.). As these were layed out late in the season some of the material was not determined, particularly the *Carex* flora, and should be resurveyed earlier next year. Individual numbers of plants are only approximate and percentages may be present for both ground cover and herb layer, in which case the total would appear to exceed 100%.

Transect #1 (First Archipelago island entering meados from South Trail: line runs due magnetic south from prominent spruce encircled with red tape to white pine sunk in the bog: individual blocks fall on east side of base line)

- Block 1 *Cornus sericeus* 1, *Thuja plicata* (stunted) 1, *Betula glandulosa* 1, *Ledum glandulosum* 1, *Salix mackenziana* (seedling) 1, *Typha latifolia* 2, *Carex* (thin leaf), *Leptodictyum* * ground cover.
- Block 2 *Betula glandulosa* (0.5m) 1, *Typha latifolia* 2, *Scirpus lacustris* 6, *Ledum glandulosum* 4, *Vaccinium oxycoccus*, *Fragaria virginianum* 10%, *Carex* (thin) 30%, *Carex* (wider leaf) 2, *Leptodictyum* ground cover.
- Block 3 *L. glandulosum* 3, *C. sericeus* (0.5m) 1, *T. plicata* (0.5m) 1, *S. lacustris* 10, *V. oxycoccus*, *Parnassia fimbriata* 5%, *Carex* (thin) 70%, *Carex* (wider) 30%, *Leptodictyum* 40%, *Campyllum stellatum* 60%.
- Block 4 *B. glandulosa* 5%, *Aster borealis* 1%, *T. latifolia* 5, scattered plants of *Lobelia kalmii*, *Fragaria virginiana*, *P. fimbriata*, *Prunella vulgaris*, *Spiranthes romanzoffiana*, and *V. oxycoccus*, *Trichophorum/Eleocharis*[#] 5%, *Carex* (thin) 30%, *Carex* (wider) 10%, *C. stellatum* 30%.
- Block 5 *B. glandulosa* (0.5m) 5%, scattered plants of *Menyanthes trifoliata*, *L. kalmii*, *P. fimbriata*, *Triglochin maritimum*, *Senecio pauperculus*, *Trichophorum/Eleocharis* 25%, *Carex* (thin) 40%, *Carex* (wider) 25%, *C. stellatum* 70%, *Leptodictyum* 20%.
- Block 6 *B. glandulosa* 2, *S. lacustris* 1, *Carex* (thin) 20%, *Carex* (wider) 5%, *Trich/Eleo* 70%, *C. stellatum*.
- Block 7 *B. glandulosa* 3, scattered *P. fimbriata*, *L. kalmii*, *Trich/Eleo* 90%.
- Block 8 *B. glandulosa* 1, *S. lacustris* 3, scattered *S. pauperculus*, *P. fimbriata*, *A. borealis*, *T. maritimum*, *M. trifoliata*, *Carex buxbaumii* 5%, *Trich/Eleo* 70%, *C. stellatum* 20%, *Scorpidium scorpioides* 10%.
- Block 9 *B. glandulosa* (0.5m) 1, *S. lacustris* 3, scattered *L. kalmii*, *M. trifoliata*, *Trich/Eleo* 90%, *S. scorpioides* 50%.
- Block 10 *B. glandulosa* (25cm) 2, *S. lacustris* 3, scattered *P. fimbriata*, *S. pauperculus*, *Carex* (wider), *Trich/Eleo* 90%, *C. stellatum* 10%.
- Block 11 *B. glandulosa* (30cm) 3, *S. lacustris* 1, scattered *L. kalmii*, *A. borealis*, *C. buxbaumii* 10%, *Trich/Eleo* 90%, *C. stellatum* 20%.
- Block 12 *S. lacustris* 1, scattered *L. kalmii*, *Trich/Eleo* 60%, *C. buxbaumii* 10%, *Carex* (thin) 20%, *S. scorpioides* 20%.
- Block 13 scattered *Drosera anglica*, *S. romanzoffiana*, *Muhlenbergia racemosa*, *Trich/Eleo* 55%, *Carex* (thin) 30%, *C. buxbaumii* 5%, *S. scorpioides* 10%, *C. stellatum* 10%.
- Block 14 *Carex* (thin) 85%, *Trich/Eleo* 5%.
- Block 15 scattered *M. trifoliata*, *Carex* (thin) 45%, *C. buxbaumii* 35%, *S. scorpioides*.

* - moss sample not in collection -referred to as *Leptodictyum* for convenience.

- Jointly *Trichophorum caespitosum* and *Eleocharis elliptica* which look similar in gross aspect.

Transect #2. (Base line runs to white pipe marker in Marl Pool from red-taped lodgepole pine on Terrace in slight embayment to the south of a 4-tree outlier (2 cedar, 1 pine, 1 spruce) from Terrace approximately mid-way from west end of Archipelago and two small isolated sphagnum islands within the Marl Pools: blocks lie on south side of base line.)

- Block 1 scattered *Menyanthes trifoliata*, *Epilobium palustre*, *Carex* (taller), *Ledum glandulosum* 10%, *Vaccinium oxycoccus* 10%, *Empetrum nigrum* 5%, *Sphagnum* cover.
 - Block 2 *Betula glandulosa* (1m) 1, *Scirpus lacustris*, scattered *Carex* (taller), *Vaccinium myrtilloides*, *E. palustre*, *M. trifoliata* 5%, *V. oxycoccus* 5%, *Sphagnum warnsdorffii* ground cover.
 - Block 3 *B. glandulosa* (1m, 0.5m, 30cm) 3, *S. lacustris* 1, scattered *M. trifoliata*, *V. oxycoccus*, *Carex* (taller), *Parnassia fimbriata*, *S. warnsdorffii* 60%, *Leptodictyum* 40%.
 - Block 4 *S. lacustris* 8, *B. glandulosa* 10%, *Carex* (taller) 30%, *V. oxycoccus* 5%, *M. trifoliata* 5%, *Leptodictyum* cover.
 - Block 5 *S. lacustris* 2, scattered *Zygadenus elegans*, *Vaccinium oxycoccus*, *B. glandulosa* 35%, *Carex* (taller) 40%, *Leptodictyum* ground cover.
- Edge of meadow
- Block 6 *B. glandulosa* 15%, *Carex* (taller) 15%, *Trich/Eleo* 40%, *Campyllum stellatum* 60%, *Leptodictyum* 20%.
 - Block 7 *B. glandulosa* 1, *S. lacustris* 2, scattered *Drosera anglica*, *Lobelia xalmii*, *Erionhyllum viridicarinarum*, *Trich/Eleo* 35%, *Carex* (taller) 10%, *C. stellatum* cover.
 - Block 8 *S. lacustris* 2, scattered *E. viridicarinarum*, *Triglochin maritimum*, *D. anglica*, *Trich/Eleo* 20%, *C. stellatum* cover.
 - Block 9 *S. lacustris* 3, *Trich/Eleo* 30%, *D. anglica* and *C. stellatum* cover.
 - Block 10 *S. lacustris* 2, scattered *Spiranthes romanzoffiana*, *Trich/Eleo* 60%, *Carex* (green) 5%, *D. anglica* and *C. stellatum* cover.
 - Block 11 *S. lacustris* 2, *Trich/Eleo* 60%, *D. anglica* and *C. stellatum* cover.
 - Block 12 *S. lacustris* 2, scattered *T. maritimum*, *Trich/Eleo* 50%, *D. anglica* and *C. stellatum* cover.
 - Block 13 *S. lacustris* 1, *Trich/Eleo* 50%, *Carex* (green) 5%, *D. anglica* and *C. stellatum* cover.
 - Block 14 *S. lacustris* 1, scattered *T. maritimum*, *Utricularia intermedia*, *Trich/Eleo* 50%, *Carex* (green) 5%, *Scorpidium scorpioides* 5%, *D. anglica* and *C. stellatum* cover.

Marl pool

Block 15 S.lacustris 8, scattered T.maritimum, Trich/Eleo 20%,
S.scorpoides 30%, C.stellatum 10%.

Check List and Phenology of Vascular Plants

Of the plants listed by Revel in 1971 several were not seen during this season's work - *Lonicera ciliosa*, *Chimaphila menziesii*, *Listera cordata*, *Listera caurina*, *Shepardia canadensis*, *Potentilla rivalis* (?) and *Mentha arvensis*. It appears that his listing of *Ledum groenlandicum* should have been *L. glandulosum* and *Oxycoccus microcarpus* (= *Vaccinium microcarpum*) should have been *V. oxycoccus*. None of the regular visitors to Mara Meadows has ever seen *Cypripedium montanum* which he reports and it may have been a case of his having assumed comments regarding "a white lady's slipper orchid" referred to that species rather than to *C. passerinum*.

Names and order of listing below conform with "Vascular Plants of British Columbia" by Taylor and MacBryde. To give an idea of approximate abundance the following classes have been used, A- plentiful throughout the zone shown:

B- scattered throughout the zone shown or plentiful in a limited area:

C- localized or rare:

D- 1 or 2 specimens seen.

species	1	2	3	4	5	6	7	8	9	10	11	zones
<i>Athyrium filix-femina</i>												B 2a
<i>Gymnocarpium dryopteris</i>												A 1a 1b
<i>Pteridium aquilinum</i>												C 1c
<i>Equisetum arvense</i>												B 1c 2a
<i>fluviatile</i>												B 2a 4 3b
<i>laevigatum</i>												B 4b 6a
<i>scirpoides</i>												C 2a
<i>variegatum</i>												B 3
<i>Lycopodium annotinum</i>												B 1b 1c
<i>complanatum</i>												C 1b 1c
<i>Botrichium virginianum</i>												D 1c
sub. v.												
<i>Juniperus communis</i>												D 7
<i>scopulorum</i>												D 7
<i>Thuja plicata</i>												B 1 2 3 6 7 8

(see next page for column headings)

Column headings 1 to 10 refer to date seen in flower as follows:-

1	16th April	5	15th June
2	4th May	6	2nd July
3	18th May	7	13th July
4	1st June	8	10th August
		9	31st August
		10	24th September

Column 11 refers to approximate abundance as described previously.

species	1	2	3	4	5	6	7	8	9	10	11	zones
<i>Abies lasiocarpa</i>											D	1b
<i>Larix occidentalis</i>											C	1a
<i>Picea engelmannii</i> }											A	1a 2 3 6 7
<i>glauca</i> }												
<i>Pinus contorta</i>												
var. <i>latifolia</i>											B	1d 6a 6b
<i>monticola</i>											C	1d 7
<i>Pseudotsuga menziesii</i>												6a 7
var. <i>glauca</i>											A	1a 1b 1d 2a
<i>Tsuga heterophylla</i>											A	1a 1b 1d 3
												6 7
<i>Taxus brevifolia</i>											B	1a 1b
<i>Acer glabrum</i>											C	1b 1c
var. <i>douglasii</i>												
<i>Cicuta douglasii</i>							x	x			A	2a 2c 3
<i>Herculeum spondylium</i>							x				C	1c
<i>Osmorhiza chilensis</i>						x	x				B	1b
<i>Sanicula marilandica</i>						x	x				D	2a
<i>Aralia nudicaule</i>					x						C	1b
<i>Asarum caudatum</i>											C	1b
<i>Achillea millefolium</i>											D	10
<i>Anaphalis margaritacea</i>								x	x	x	B	1b 1c 1d 10
<i>Antennaria microphylla</i>						x	x	x			C	1c
<i>neglecta</i>					x	x					C	1c
var. <i>howellii</i>												
<i>Arnica amplexicaulis</i>								x			D	2a
<i>cordifolia</i>								x			C	1b
<i>Aster borealis</i>							x	x	x	x	A	3 4b 7 8
<i>laevis</i>								x	x	x	B	1c 1d 10
<i>modestus</i>								x	x	x	B	1c 1d 2a 3
<i>Centaurea maculosa</i>										x	D	10
<i>Cichorium intybus</i>								x			C	10
<i>Cirsium arvense</i>								x			C	1d 10
<i>vulgare</i>								x			C	1d 10
<i>Conyza canadensis</i>											C	1b
<i>Erigeron philadelphicus</i>					x	x	x	x	x	x	B	2a
<i>Gnaphalium viscosum</i>								x	x		D	1d 10

species	1	2	3	4	5	6	7	8	9	10	11	zone
Hieracium albiflorum						x	x	x	x		B	1b 1c 1d
umbellatum								x			C	1b
Lactuca biennis								x			C	2a
canadensis								x			C	1d
Leucanthemum vulgare				x	x	x	x	x	x	x	A	1c 1d 10
Petasites palmatus				x							C	2 3 8
sagittatus	x	x									A	2 3 3
Senecio indecorus											B	2a
pauperculus							x				B	4 7
pseudaureus											C	2a
triangularis							x	x			B	2a
Solidago canadensis								x			B	1d 4b
Sonchus arvensis								x		x	C	10
Taraxicum officinale		x	x	x	x	x					B	1d 10
Tragopogon dubius					x		x				D	10
Mahonia aquifolia				x	x						C	1c 1d
Alnus incana											B	1b 1c 1d 2a
Betula glandulosa											A	2 3 6
var. glandulifera												
occidentalis											C	2a
papyrifera											B	1a 1b
Corylus cornuta											C	1c
Cardamine pennsylvanica					x	x					C	2a
Lobelia kalmii							x	x			A	3 4
Linnaea borealis					x	x	x				B	1a 1b 1c 6b 7
Lonicera involucrata				x	x						A	1b 1c 2a 3 6a 7
utahensis	x	x	x								C	1c 1d
Sambucus cerulea								x			C	1d
Viburnum edule						x					B	2a
Arenaria serpyllifolia				x	x						C	10
Cerastium fontanum					x	x	x				C	10
Stellaria longipes							x				C	2a
Stellaria longipes Paxistema myrsinites		x	x	x							A	1a 1b 1c 1d
Hypericum perforatum											C	1d
Cornus canadensis				x	x	x	x	x			B	1b 1c 1d 2a
sericea						x	x				B	1c 2a 7
Drosera anglica							x				A	4a 5a 5b
rotundifolia							x	x			A	3 4a 5a 5b
Emoetrum nigrum											B	6a 6b
Gaultheria hispidula											B	1a 1b 2a
ovatifolia											C	1b
Kalmia microphylla				x	x						C	6a 6b
Ledum glandulosum				x	x	x					A	2a 3 6a 6b 7
Mentzelia ferruginia					x	x					D	2a
Vaccinium Membranaceum											C	1b
myrtilloides				x	x						B	2a 6a 6b
oxycoccus					x	x	x				A	6a 6b 7

species	1	2	3	4	5	6	7	8	9	10	11	Zone
Lathyrus ochroleucus				x	x						D	1c
Medicago lupulina				x	x	x		x	x		A	10
Melilotus alba								x	x		C	10
Trifolium pratense				x	x	x		x	x	x	B	10
repens				x	x	x		x	x	x	A	10
Gentianella propinqua						x	x				C	1c
Ribes hudsonianum				x	x						B	2a
lacustre				x	x						C	1a 1b
Myriophyllum spicatum						x					C	9a
subsp. exalbenscens												
Galeopsis tetrahit											D	1d
Lycopus uniflorus								x			C	4b
Prunella vulgaris						x	x	x	x		C	1c 4b
Schweya couquian												1a
Utricularia intermedia							x	x			A	4a 5a 5b
vulgaris									x		A	9a 9b
minor												
Menyanthes trifoliata				x	x	x					A	2b 3 4a 6 9b
Erilobum angustifolium							x	x	x		A	1c 1d 2a
ciliatum							x	x			B	2a 4a
minutum					x						D	10
palustre											C	6a
Parnassia fimbriata							x	x			B	3 4a 4b
Plantago lanceolata				x							C	10
major								x			C	10
Polygonum amphibium						x			x		D	2b
RUMEX acetosella						x					D	10
Lysimachia thyrsiflora						x	x				C	2a
Chimaphila umbellata								x			B	1a 1b 1c 3
Moneses uniflora							x				D	1a
Orthila secunda											D	1c
Pyrola asarifolia						x	x				C	1b 6a
chlorantha							x				B	1a 1b
Aquilegia formosa				x	x						C	1b 1c
Panunculus acris				x	x						C	10
uncinatus				x	x			x			B	2a
Rhamnus purshianus											C	2a 7
Amelanchior alnifolia				x	x						D	6b
Crataegus douglasii					x						D	1a 1c

species	1	2	3	4	5	6	7	8	9	10	11	zone
<i>Fragaria vesca</i>				x	x						C	1b 1c
<i>virginiana</i>			x	x	x						B	1b 1c 4b 10
<i>Geum macrophyllum</i>					x	x	x	x			B	2a
<i>rivale</i>					x	x					C	2a
<i>Physocarpus malvaceus</i>					x						D	1d
<i>Potentilla fruticosa</i>				x	x	x	x	x			C	4b 6a 7
<i>palustris</i>						x	x				B	9a 9b
<i>Rosa gymnocarpa</i>											D	1a
<i>nutkana</i>						x	x				B	1b 2a
<i>woodsii</i>						x					C	1c
<i>Rubus arcticus</i> subsp.				x			x				B	4b 6a 7
<i>acaulis</i>												
<i>idaeus</i>					x						D	1c 2a
<i>parviflorus</i>						x	x				C	1b 1c
<i>pubescens</i>				x	x						B	4b 6a 7
<i>Sorbus scopulina</i>					x						D	1a
<i>Spiraea betulifolia</i>											D	10
<i>Galium triflorum</i>						x	x	x			B	2a
<i>Populus balsamifera</i> subsp.											B	1a 1b 1c 1d
<i>trichocarpa</i>												
<i>tremuloides</i>											B	1c 1d
<i>Salix bebbiana</i>	x										A	1c 1d 2a 10
<i>candida</i>			x		x						B	2b 3 8
<i>mackenziana</i>					x						C	3 8
<i>pedicellaris</i>			x		x						B	3 8
<i>planifolia</i>											D	
<i>Mitella nuda</i>					x						C	1b
<i>Tiarella unifoliata</i>					x	x	x	x			A	1a 1b 1c 2a
<i>Castilleja miniata</i>						x	x	x			C	1c
<i>Collinsia parviflora</i>			x								D	10
<i>Mimulus guttatus</i>							x	x		x	B	2a 3 8
<i>Verbascum thapsus</i>								x			C	1d 10
<i>Veronica americana</i>					x	x	x	x			C	2a
<i>Viola nephrophylla</i>			x	x	x	x	x		x		B	4b 7 8
<i>orbiculata</i>			x	x							C	1c
<i>renifolia</i>			x	x	x						D	1c
<i>Lysichiton americanum</i>											A	2a
<i>Carex athrostachya</i>											D	1d 4
<i>buxbaumi</i>											A	4a 4b
<i>diandra</i>												
<i>disperma</i>											A	2a 3
<i>interior</i>												
<i>lasiocarpa</i>											B	4b
<i>limosa</i>											B	9b
<i>oederi</i>											C	9b
<i>rostrata</i>											A	2c 9b

species	1	2	3	4	5	6	7	8	9	10	11	zone
<i>Eleocharis elliptica</i>											A	4a 4b
<i>Eriophorum angustifolium</i>											C	6a 6b
<i>viridicarinatum</i>											B	6a 6b
<i>Rhynchospora alba</i>											B	4a
<i>Scirpus lacustris</i>											A	4a 4a 8
<i>Trichophorum alpinum</i>											C	4a 4b
<i>caespitosum</i>											A	4a 4b
<i>Juncus bufonius</i>											C	10
<i>ensifolius</i>											B	9b
<i>nodosus</i>											C	4a
<i>tenuis</i>											C	9b
<i>Luzula parviflora</i>											D	4b
<i>Triglochin maritimum</i>				x	x						A	4a 4b
<i>Clintonia uniflora</i>					x	x					B	1b
<i>Smilacina racemosa</i>				x	x	x					C	1b
<i>stellata</i>				x	x						B	7
<i>Zigadenus elegans</i>						x	x				B	4b 6a 6b 8
<i>Calypso bulbosa</i>				x	x						C	1b
<i>Corallorhiza maculata</i>								x			D	1a
<i>Cypripedium calceolus</i>					x	x					B	6a 6b 7 8
<i>passerinum</i>						x					D	2a
<i>Epipactis gigantea</i>						x	x	x			B	3 4b 6a 6b
<i>Goodyera oblongifolia</i>							x	x			B	1a 1b
<i>Liparis loeselii</i>					x	x	x				B	4a
<i>Listera convallerioides</i>					x		x				C	2a 4a
<i>Platanthera dilatata</i>						x	x	x			B	2a 3 6a
<i>hyperborea</i>					x	x		x			C	1b 2a 4b 3
<i>obtusata</i>					x	x	x				B	1a
<i>stricta</i>					x	x					B	1b 2a
<i>unalascensis</i>								x			D	1d
<i>Spiranthes romanzoffiana</i>								x			B	4a 4b
<i>Agropyron nauciflorum</i> var.											D	1c
<i>novae-anglicae</i>											C	10
<i>renens</i>											B	1d 9b
<i>Agrostis stolonifera</i> var.											C	1b 1d 1c
<i>stolonifera</i>											D	10
<i>Apera interrupta</i>											C	1b 1c
<i>Bromus carinatus</i>											C	10
<i>Calamagrostis canadensis</i>											C	1b 1c
<i>stricta</i> var.											C	
<i>stricta</i>											C	10
<i>Dactylis glomerata</i>											C	1c 10
<i>Danthonia spicata</i>											B	2a 4b
<i>Elymus glaucus</i>											C	3 4b
<i>Glyceria striata</i>											C	2a 9b 10
<i>Muhlenbergia racemosa</i>											C	10
<i>Phalaris arundinacea</i>											C	
<i>Phleum pratense</i>											C	

species	1	2	3	4	5	6	7	8	9	10	11	zone
<i>Phragmites australis</i>											C	8
<i>Poa palustris</i>											B	2a
<i>Potamogeton gramineus</i>					x	x					B	9a 9b
<i>Sparganium minimum</i>						x	x	x			C	9a 9b
<i>Typha latifolia</i>							x				B	2a 7 9b

Of particular note on the list above is *Rhynchospora alba* which provides the first substantiated find for this sedge relative in the interior of this Province. It is unfortunate that as many sedges again as are listed were found after collection not to be at the optimum stage for determination and remained unnamed. This section of the flora should be repeated another year.

Thanks are due to Dr.T.C.Brayshaw for identification or confirmation on many of the sedges and to Mr.L.Pavlick, both of the Provincial Museum, for doing similarly on grasses.

Chama globularis var. *globularis*

Mosses

Apart from the two sphagnum species which were identified by Dr.W.B.Schofield, -the collection of mosses and liverworts taken at Mara Meadows has not been examined or confirmed by any expert in this field. As an indication of habitat each species listed is shown under a simplified version of the plant community scheme used for vascular plants.

species	1a	1b	1c	1d	2a	4	6
<i>Aulacomnium palustre</i>							x
<i>Barbula vinealis</i>					x		
<i>Brachythecium albicans</i>					x		
<i>velutinum</i>	x	x					
<i>Bryum caespiticum</i>		x					
<i>capillare</i>	x						
<i>pseudotriquetrum</i>	x						
<i>uliginosum</i>		x					
<i>weigeli</i>		x					
<i>Calliergon cordifolium</i>		x					
<i>Camoyllium hispidulum</i> var. <i>sommerfeldtum</i>					x		
<i>polygamum</i>					x		
<i>stellatum</i>						x	
<i>Ceratodon purpureus</i>					x		
<i>Cinclidium stygium</i> <i>Rhizomnium magnafolium</i>					x	x	
<i>Climacium dendroides</i>	x						
<i>Dicranella palustris</i>							x
<i>Dicranum fuscescens</i>	x						
<i>montanum</i>	x				x		
<i>polysetum</i>		x				x	

species	zone								
	1	2	1a	1b	1c	1d	2a	4	6
Dicranum scoparium					x				
tauricum					x				
undulatum								x	
Drepanocladus uncinatus			x						
Grimmia torquata						x			
Heterocladium dimorphum				x					
Homalothecium megaptilum						x			
Hylocomium splendens			x		x				
Hypnum callichorum					x				
Leptobryum pyriforme				x					
Lentodictyum trichopodium				x					
Plagiomnium cuspidatum				x					
insigne				x					
Mnium thomsonii			x						
Plagiomnium venustum				x					
Orthotrichum consimile Barbula convoluta						x			
Pleurozium schreberi			x	x	x				
Pohlia nutans						x			
Polytrichum formosum						x			
juniperinum						x		x	
Ptilidium crista-castrensis			x						
Rhacomitrium varium canescens					x				
Rhytidiadelphus triquetrus			x						
Scorpidium scorpioides								x	
Sphagnum fuscum									x
warnsdorffii									x
Tomenthypnum nitens									x
Weissia controversa Dichodontium pellucidum				x					
Blenharostoma arachnoideum				x					
Cephalozia lunulifolia				x					
catenula				x					
Lophocolea heterophylla				x					
Jungermannia exsertifolia				x					
Lepidozia reptans				x					
Plagiochila asplenoides				x					
Ptilidium pulcherrimum				x					

Lichens

Lichen distribution was not studied in all types of community and the indications in the table below represent where a particular species was collected and not necessarily all the habitats it might be found. None of the specimens has been examined by an expert in this field.

species	zone			
	1a/1b	1c	1d	6(lignicolous)
<i>Alectoria sarmentosa</i>	x			
<i>Bryoria capillaris</i>				x
<i>fuscescens</i>	x			x
<i>Cetraria merrillii</i>				x
<i>pinastri</i>	x			x
<i>Cladina mitis</i>		x		
<i>rangiferina</i>				x (ground)
<i>Cladonia cariosa</i>		x	x	
<i>cenota</i>			x	
<i>chlorophaea</i>		x	x	x
<i>coccifera</i>		x		
<i>conocraea</i>	x		x	
<i>cornuta</i>		x		
<i>crispata</i>		x		
<i>ecmoeyna</i>		x		
<i>furcata</i>		x		
<i>gracilis</i>	x			
<i>phyllophora</i>	x			
<i>pleurota</i>	x			
<i>squamosa</i>	x			
<i>Evernia prunastri</i>				x
<i>Hypogymnia imshaugii</i>	x			
<i>physodes</i>	x			
<i>Letharia vulpina</i>				bog
<i>Lobaria pulmonaria</i>	x			
<i>Nephroma parile</i>	x			
<i>resupinatum</i>	x			
<i>Parmelia sulcata</i>				x
<i>subaurifera</i>				x
<i>Parmeliopsis ambigua</i>	x			
<i>hyperoptera</i>	x			
<i>Peltigera aphthosa</i>	x			
<i>canina</i>		x		
<i>polydactyla</i>		x		
<i>venosa</i>	x			
<i>phaeophyscia hispidula</i>				x
<i>Platismatia glauca</i>	x			
<i>herrei</i>	x	x		
<i>Stereocaulon rivulorum</i>		x		
<i>tormentosum</i>		x		
<i>Usnea hirta</i>				x
<i>fulvoreagens</i>				x
<i>Xanthoria candelaria</i>				x

Fungi

1984 was drier than average and as such was not a productive year for fungi. Soon after the first fall rain in September early frost occurred, curtailing the season. Even so, of those shown below at least as many more were not identified and the list must, therefore, be regarded as cursory.

Cooler fall weather brought forth five species among moss of the Northern Islands. One appeared to be *Galerina paludosa* and another of greyish-lilac colour was similar to descriptions of *Cantharellus umbonatus* which grows on mosses in the east and could be a western relative. In the whole meadow area only one fungus was found and this, a small unremarkable specimen of *Marasmius* character growing on decomposing bog vegetation, was not identified. All others below were found in forested areas.

<i>Lactarius tomentosus</i>	<i>Discina perlata</i>
<i>Russula brevipes</i>	<i>Dacromyces palmatus</i>
<i>xerampelina</i> (?)	<i>Pseudoplectania nigrella</i>
<i>Clitocybe dilata</i>	<i>Gyromitra esculenta</i>
<i>Hygrophoropsis aurantiaca</i>	<i>Leotia lubrica</i>
<i>Lentinus ursinus</i>	<i>Phlogiotis helvelloides</i>
<i>Lepista irina</i>	<i>Auricularia auricula</i>
<i>Marasmius rotorula</i>	<i>Clavaria vermicularis</i>
<i>Mycena alcalina</i>	<i> fusiformis</i>
<i> amatilissima</i>	<i>Ramaria botryoides</i>
<i> murina</i>	<i>Clavariadelphus ligula</i>
<i>Omphalina ericetorum</i>	<i>Fomes pini</i>
<i>Xeromphalina campanella</i>	<i> pinicola</i>
<i>Agrocybe praecox</i>	<i> fomentarius</i>
<i>Cortinarius armillatus</i> (?)	<i>Gloeophyllum saebiarum</i>
<i> dilutis</i> (?)	<i>Pycnoporus cinnabarinus</i>
<i> griseoluridus</i> (?)	<i> Suillus albidipes</i> (?)
<i> pinetorum</i> (?)	<i> Lycomerdon perlatum</i>
<i>Crepidotus applanatus</i>	<i> umbrinum</i>
<i>Galerina palustre</i> (?)	<i>Cantharellus infundibuliformis</i> (?)
<i>Gomphidius glutinosus</i>	<i> Stereum hirsutum</i>
<i>Cantharellus infundibuliformis</i> (?)	<i> Yellow slime fungus</i>

Birds

Despite its other claims to fame one boast Mara Meadows cannot make is for a rich bird population. It might be supposed that an area of varied wetland would prove attractive to a range of waders and marsh inhabitants, yet half of the few that were recorded were spring transients and presumably found elsewhere more to their requirements. Both mallards and American wigeon used the pond early in the season and although one mallard female was flushed in the forest no nest was found and no young seen of either species nor adults after 1st. June. Willdeers, too, were present only prior to the breeding season and no heron appeared at all even though

an active heronry is situated about 25km (15 mls.) south

The reason for this sparsity of waterfowl has to be a direct reflection of the low volume of available insect food which, in turn, appears to be controlled by alkalinity of the water. It is most noticeable and pleasant that mosquitoes are almost completely absent from the bog meadow breeding only of the forested areas, in fact, insects of all types are conspicuously absent in the greater part of the meadow. Only waters of the drainage ditch and to a lesser extent the pond and natural drainage channel appear to be in any way plentifully supplied.

Common snipe , alone among waders, were represented on practically every visit. Judging from spring display activity the number of breeding pairs is not great. Perhaps the most interesting summer residents were a pair of greater sandhill crane which continued the tradition of recent years of one pair being present. No attempt was made to find their nest but displacement behavior and shadowing strongly point to one at the north end of the Main Meadow. In late summer two birds were seen near the Archipelago when later crane calls were heard from the north end. This may have been a third bird or young of the year but none was actually seen so successful breeding cannot be confirmed.

Although long-billed curlew was listed as having been present from May into July those seen were always overhead and not once on the ground. These may represent regular flights from valley nesting sites below.

Drier and more open conditions along West Bench attracts a few unexpected species - American falcon, savanna sparrow and, in migration, white-crowned sparrow - and as forest recovers this area this will probably be shown to have been a temporary phenomenon. Of the swallows that hawked over the meadows only barn swallows continued their appearances into summer, and this again suggested a limited feeding potential.

Two observations of rusty blackbird, a single bird on the first occasion and a pair on the second, occurred by the time they should have been on breeding territory. Certainly the marshy habitat would be to their liking but hitherto none has been reported as breeding in the north Okanagan and no young were seen this year.

species	1	2	3	4	5	6	7	8	9	10
Mallard	x	x	x	x						
American wigeon	x									
American falcon								x		
Greater sandhill crane				x	x	x	x			
Killdeer	x	x								

species	1	2	3	4	5	6	7	8	9	10	nest
Common snipe	x	x	x	x	x				x		
Long-billed curlew		x	x	x	x	x					
Common nighthawk					x	x	x	x			
Vaux swift		x	x	x					x		
Rufous hummingbird				x	x						
(hummingbird undetermined)						x	x				
Common (northern) flicker	x					x	x		x		
Pileated woodpecker										x	
Yellow-bellied sapsucker		x	x			x	x				x
Hairy woodpecker	x	x	x				x				
Downy woodpecker	x					x					
Three-toed woodpecker	x		x								
Western wood pewee				x		x	x				
Olive-sided flycatcher				x	x	x	x				
Violet-green swallow		x	x	x							
Tree swallow			x	x							
Rough-winged swallow		x									
Barn swallow				x		x	x				
Gray jay (March previous year)											
Steller's jay	x	x			x		x	x	x		
Common raven				x	x	x					
Black-capped chickadee				x		x		x	x		
Boreal chickadee		x									
Chestnut-backed chickadee	x										
Red-breasted nuthatch	x	x	x	x	x						
Pygmy nuthatch						x					
House wren	x	x		x	x	x					
American robin	x	x	x	x	x	x	x				
Varied thrush	x	x	x		x		x		x		
Swainson's thrush							x				x
Mountain bluebird			x	x							
Golden-crowned kinglet						x					
Cedar waxwing						x			x		
Red-eyed vireo					x	x	x				
Warbling vireo				x	x						
Orange-crowned warbler		x									
Yellow-rumped warbler		x	x				x				
Townsend's warbler				x							
Rusty blackbird		x		x							
Pine siskin	x	x									
Red-winged blackbird	x										
Savanna sparrow		x									
Dark-eyed junco	x	x		x	x	x	x	x	x	x	x
Chipping sparrow				x							
White-crowned sparrow										x	
Lincoln's sparrow					x						
Song sparrow		x	x	x	x	x	x		x		x

Mammals

Actual sightings during visits were not frequent and indications of mammal presence were mostly from tracks or scat. Deer tracks showed on forest trails whenever soft ground allowed and seemed to enter the open bog only to cut corners. Numbers were not large but were regular and well scattered. Bear, too, appeared present through the season and twice fresh scat and abruptly reversed tracks indicated close encounters narrowly averted, once on the North Trail and the other under wet going in sedge woods.

Local residents say that on occasion moose are unwise enough to venture down from the hills but do not survive long.

Indications of coyotes could be found in all but the most thickly forested areas, even out in the midst of the bog meadow where a pair was watched for some time investigating clumps of vegetation to the obvious consternation of the sandhill cranes. Protection of the bog to snipe and other ground-nesting birds would seem therefore to be only partial.

Distance and the impossibility of making repeat visits prevented small mammal traps being set. One heard vigorously splashing but not seen in the thickness of forested bog may have been a navigator shrew. Soon after snow cover left the meadows small patches around its edge gave every indication of runs and burrows in the wet moss layer, soon to be eliminated as water level rose. It was not clear whether these had been caused by small mammals or were of some other nature.

Red squirrel	
Varying hare	scat
Deer sp.	scat, tracks
Northern pocket gopher	mounds and runs (West Bench)
Black bear	scat, tracks
Coyote	

Herpetiles

Relating again to apparent low food availability was the surprisingly small number of amphibians in the waters of the bog meadow. Apart from one Pacific tree frog during May none seemed to use its large open area and no larvae were seen. Spotted frogs were regular in the drainage ditch but only at its southernmost where tall cover was close and water was deeper. Heating of the shallow bog waters may be a factor too as this frog was found also in the spring-fed waters of the pond. The wood frog sighting occurred in Forested Bog.

Common garter snake

Thamnophis sirtalis

Pacific treefrog

Hyla regilla

Spotted frog

Rana pretiosa

Wood frog

Rana sylvatica

Arachnida

Of arthropods only spiders were examined. As befits an area of unique physical and floral character, the spider fauna also proved to be of considerable interest. Over 20 of those listed below and identified by Mr. J. H. Redner of Biosystematics Laboratory, Ottawa, (whose courtesy is greatly appreciated) do not appear to have been previously reported from the Okanagan. Furthermore six of these were new records for British Columbia and these now reside with a measure of obscure glory in the National Collection in Ottawa. As is usually the case a large number of juveniles were included in the collection which can only be determined to generic level.

species	New record for Okanagan B.C.	
Theridiidae ...		
Theridion bimaculatum (L)		
differens Em		
Linyphiidae ...		
Pityohyphantes sp.		
Nerine radiata (Walck)		
Frontinella pyramitela (Walk)		
Centromerus longibulbus (Em)	x	x
Oreonetides rotundus (Em)	x	x
Bathypantes pallidus (Banks)	x	
brevipes (Em)	x	
Leptohyphantes sp.		
Erigonidae ...		
Walckenaeria communis (Em)	x	x
Ceraticelus atriceps (Pick-Cam)	x	
Symmigma minimum (Em)		
Oedothorax trilobatus (Banks)	x	
Grammonota gigas Banks	x	x
Pocadicnemis americana Mill	x	
Araneidae ...		
Hypsosinga pygmaea (Sund)	x	
Cyclosa conica (Pallas)		
Araneus marmoreus Clerk		

species	Okanagan	B.C.
Araneus trifolium (Hentz)	x	
nordmani (Thor)		
Nuctenea patagiata (Clerk)		
cornuta (Clerk)	x	
Tetragnathidae ...		
Tetragnatha sp.		
Agelenidae ...		
Cryphoea peckhami Simon	x	
Cybaeus morosus Simon	x	
Hahniidae ...		
Anistea brunnea (Em)	x	
Pisauridae ...		
Dolomedes triton (Walck)		
Lycosidae ...		
Pardosa dorsuncata L & Don		
mackenziana (Keys)		
moesta Banks	x	
Trochosa terricola Thor		
Arctosa raptor (Ful)	x	x
rubicunda (Keys)	x	
alpigena (Dole)	x	
Pirata canadensis Don & Red	x	x
insularis Em	x	
Alopecosa sp.		
Thomisidae ...		
Xysticus punctatus Keys	x	
Misumena vatia (Clerk)		
Philodromidae ...		
Thanatus formicinus (Clerk)	x	
Tibellus maritimus (Menge)	x	
Philodromus sp.		
Salticidae ...		
Tutelina similis (Banks)		
Metaphidippus protervus (Walck)		
Eris marginata (Em)		

Conclusion

In attempting a broad-ranging examination such as that of the past summer only a fairly superficial treatment of individual subjects can result especially if expertise in each field is

not available. The data collected, though, does provide a base upon which more detailed work can be built and the 1984 study has confirmed Mara Meadows as a particularly valuable feature in British Columbia's Ecological Reserve system and the International Biological Programme, one on which advanced studies would be fully justified.

At present the reserve is not in serious jeopardy from any particular source. Land for sale in the general vicinity suggests that rural homesite development is increasing, however, local population use of and interest in the reserve ~~at~~ through most of the year is not high and perhaps the greatest danger would be if the open areas of the Bog Meadow became popular for snowmobiling. Not all the bog necessarily freezes in winter and soft terrain under thin snow cover could easily be damaged by these vehicles. Additionally, shrub cover around the fringe is liable to be over-ridden and broken. It may be that a notice should be set up explaining the fragile nature of the surface and asking snowmobile riders to stay out.

Comment has been made about the use of the area by cross-country skiers and the apparently unauthorized brush cutting and construction by their organization. As suggested earlier, it would be wise to establish control over these activities by contacting this organization.

The other regular user at the present time is a local small sawmill operator who crosses to reach cutting licenses east of the reserve. Undesirable though this may be it does not currently have a detrimental effect. It does mean that South Trail cannot be shut by gate to prevent access by other vehicles. A single logging truck making a single trip each working day may be one thing; a fleet of logging trucks operating continuously would be another. I do not know whether approval to use the road is given annually but some means should be devised to exercise control over the perhaps unlikely event of a major increase in trucking operations.

The condition of the bog itself appears to be stable. Hopefully an effort can be made to monitor water depth and vegetation change in the future. With most water inflow coming from springs and seeps it is the condition of forests on surrounding hills that holds ultimate control over this factor and an attempt should be made to watch for unusual activities. The one essential on the Mara Meadows drainage system is the cedar log dam where the ditch reaches South Trail. It is imperative that it should be kept in good condition and fully operative.



Malcolm E. Martin
March 1985

MASSACHUSETTS GEOLOGICAL SURVEY # 1-35
REVISION AND CORRECTIONS TO REPORT OF 1934 SURVEY

1. In the introduction to the 1934 report it was stated that no climate so similar to Kara Bendam was known in N.C. This rash statement overlooked Beaver Dam on the Beaver River north of Morris Town about where springs issuing from an underlying limestone formation support a flora reminiscent of that at Kara Bendam though, in comparison, no exact temperature due to greater altitude and less varied conditions.

2. A comment was also made that no species of the genus *Brachycephalus* appeared to be present in the bog, the only species found being *B. hachinatus*, an inhabitant of dry forest. This, too, must be revised because of the presence of *B. revolvens* var. *intermedia* in wet places (zones 4, and 5) although in no better numbers than the predominant dry forest.

3. *Desmarestia carinata* - All three species are listed in the 1934 report but a lesser amount of *D. carinata* is mentioned in report and will be added. This appears to have led to hybridization as a species was collected which corresponds to Taylor and Macbride's *D. x villosa*.

4. *Oreohelia curvica subsp. nuda* - This was found in zone 4 and in the description referred to as "subsp. nuda" (zone 4) and in addition to the earlier list.

5. *Desmarestia carinata* - The variety of this dry land form found in zone 4, *Desmarestia carinata* var. *carinata* is specific cluster as *D. carinata* var. *carinata* is added to the list of species with the former variety.

6. *Desmarestia carinata* - The variety identified in zone 4, *Desmarestia carinata* (zone 4) is now *D. carinata* var. *carinata* and *D. carinata*.

7. *Desmarestia carinata* - In the 1934 report -
 Locs 1 and 2 - *Desmarestia carinata* var. *carinata*
 Locs 3 and 4 - *Desmarestia carinata* var. *carinata*
 Locs 5 and 6 - *Desmarestia carinata* var. *carinata*
 Locs 7 and 8 - *Desmarestia carinata* var. *carinata*
 Locs 9 and 10 - *Desmarestia carinata* var. *carinata*
 Locs 11 and 12 - *Desmarestia carinata* var. *carinata*
 Locs 13 and 14 - *Desmarestia carinata* var. *carinata*
 Locs 15 and 16 - *Desmarestia carinata* var. *carinata*

8. *Desmarestia carinata* -
 Locs 1, 2, and 3 - reference to "subsp. nuda" should be to *D. carinata*.

9. *Desmarestia carinata* - Locs 15 and 16 are now as follows:

1 1

