

A STUDY OF THE AGES OF KEY BROWSE SPECIES OCCURRING ON MOOSE
WINTER RANGE AND OF THE AGES OF BROWSED TIPS ON CERTAIN OF THESE
SPECIES.....WELLS GRAY PARK...1958

Soos

I.

1. Green Mountain

Sample plots were taken near the Green Mtn trail approximately 0.3 miles from the road. The elevation is about 2,600'. The exposure is NE and the soil a light sandy loam.

History of the stand

The present stand (willow, aspen, birch, and scattered conifers) is regeneration after the fire of 1926. The original stand was a forest of mixed conifers and Douglas fir, red, cedar, Engelmann spruce, white spruce, and alpine fir were present. The stand was about 160 years old at the time of the fire. The composition of the present stand is quite variable. Willow, aspen, and birch grew up on dry sites following the fire. On wetter sites alder regenerated. Later conifers invaded both sites coming in after the deciduous trees.

Willow to 31 years old was found suggesting that it may have been present in the original stand. The oldest aspen were 29 to 30 years old and the oldest birch from 27 to 29 years. Lodgepole pine was probably the next invader - the oldest specimens examined were 23 years old. Next came Douglas fir with oldest specimens being from 20 to 22 years. Spruce, alpine fir, and cedar followed. Thus conifers invaded the Green Mtn burn about 7-8 years after the burn.

Height of present stand

The maximum heights of the present trees are: birch 50-55', aspen 55-60', D. fir 36-40', and willow 25-30'.

Species occurring on the sample plots were:

Populus tremuloides, *Betula papyrifera*, *Populus trichocarpa*, *Alnus tenuifolia*, *Alnus sinuata*, *Acer glabrum*, *Cornus stolonifera*, *Pinus contorta*, *Pseudotsuga menziesii*, *Thuja plicata*, *Picea engelmannii*, *Picea glauca*, *Abies lasiocarpa*, *Juniperus communis*, *Salix spp.*, *Pachystima myrsinites*, *Shepherdia canadensis*, *Amelanchier spp.*, *Rosa spp.*, *Lonicera involucrata*, *Mahonia aquifolium*, *Castilleja spp.*, *Rubus parviflorus*, *Fragaria spp.*, *Cornus canadensis*, *Linnaea borealis*.

Aging methods

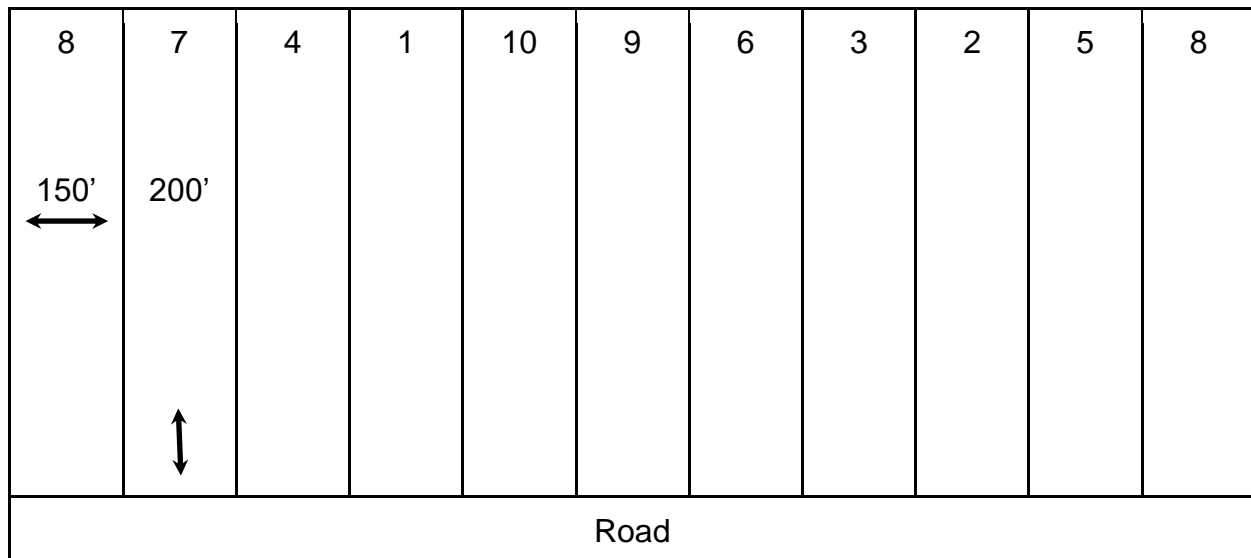
Willows were cut on several lines chosen indiscriminately along the trail in the area described above. The rings were counted on the spot or taken to the lab when this proved difficult. The ages were grouped in classes containing 5 years and their frequency plotted - Fig. 1.

The resulting graph shows that most of the willows are in age classes over 15 years. Expressed in percent it is 69%. Only 31% are younger than 15 years. Typically these old willow stands send out few new shoots from the roots. Only 1% of the willow stems are in the 1-5 year age group. Reproduction is suppressed by competition from overshadowing conifers and deciduous growth as well as by the fact that the willows are very old and lacking in vigor. The area studied has a history of being excellent moose winter range. The lack of reproduction of willow in these stands will ultimately mean that few or no moose can be wintered here.

It is recommended that work be commenced immediately to alter succession to favor young deciduous growth particularly willow and birch.

The Green Mountain winter range is about 5 miles long varying in width from 1/2 mile to 5 miles and totals approximately 20 square miles. The whole area should not be treated at once even if sufficient money were available for this. Esthetic values and erosion problems must be considered. Available money and labor force are also primary factors. The following points should be adhered to where possible:

1. No trees should be cut with 200' of the road to preserve esthetic values.
2. 150' strips should be cut parallel to each other straight up the slope. This would allow the cut wood to be skidded directly downhill.
3. Cutting should be done in early winter or late fall. This would supply an immediate food source to the moose in the form of tops of willow, aspen, and birch. The trees could be limbed and skidded in late winter or early spring.
4. The strips should be cut on a ten year rotation in the following manner:



The advantage of course is the resulting diversity of ages in the strips cut. The rotation period can be shortened if necessary to bring a large area into production in a short time.

2. Pyramid

The second area studied was the Pyramid burn. The topography is relatively flat and stands at about 2,700' elevation. The soil is a light sandy loam with relatively dry surface conditions. Willow and birch thrive in this area. Commonly occurring plants of the area include: *Betula papyrifera*, *Salix spp.*, *Populus tremuloides*, *Populus trichocarpa*, *Alnus tenuifolia*, *Alnus sinuata*, *Pinus contorta*, *Pseudotsuga menziesii*, *Picea engelmannii*, *Thuja plicata*, *Pachystima myrsinites*, *Shepherdia canadensis*, *Cornus canadensis*, *Cornus stolonifera*, *Acer glabrum*, *Amelanchier spp.*, *Epilobium angustifolium*, *Linnaea borealis*, *Mahonia aquifolium*, *Lonicera involucrata*, *Vaccinium membranaceum*, *Fragaria spp.*, and *Rubus parviflorus*.

Samples were taken in the same method as on Green Mountain. The present stand is the result of a reburn of unknown age. The average height of the willows is from 5-6' and for birch 6-7'. If the height and age of the willows are compared (Fig. 2), we can conclude that the area has been heavily browsed. The line graph for willow shows that this is a very good condition for the stand. It contains an even distribution of age groups. There are only 6% of the willows over 15 years old. The graph shows that most willows are in the 6-10 year age groups. Natural reproduction is very good (from 1 to 5 years make up 20% of the age groups). The willows are in very good health and very few dead willows are seen.

Because birch was also heavily browsed in this area, a frequency curve was constructed for this species also (Fig. 2). If we compare the curve of birch with that of willow we see birch contains more of the older age classes. 74% of the birch stand is over 15 years old. However reproduction is quite good with 12% of the stems being under 5 years old. Birch is also longer lived than willow. This area is one of the best winter ranges as the willow and birch become shrub-like after browsing and have thus produced more available shoots. The importance of birch on this area can be judged in that this species is more closely cropped than willow. Birch had definite advantages over willow:

1. It is longer lived.
2. It regenerates better after browsing.
3. The crown is denser after browsing.
4. Older shoots are browsed more frequently than in other species.

These stands of willow and birch are being endangered by lodgepole pine which is invading the area. The oldest pines are twelve years old and already producing seed

and reproducing. If the willow and birch stands are to be protected the pines must be cut at ground level.

3. Study Area "C"

This area lies across the Murtle River from Pyramid Mountain at an elevation of about 2,800'. The area is relatively flat but transected by a few low ridges. Blackwater Creek bisects the region on a north-south line. The burn comprises about three square miles. The soil is a dry sandy loam laid over volcanic stone. Commonly occurring plants are: *Salix spp.*, *Pseudotsuga menziesii*, *Pinus contorta*, *Picea engelmannii*, *Populus tremuloides*, *Populus trichocarpa*, *Pachystima myrsinites*, *Shepherdia canadensis*, *Epilobium angustifolium*, *Cornus canadensis*, *Antennaria spp.*, *Trifolium spp.*

The sampling method was the same as at the other two areas. The present willow stand is the result of a reburn of unknown age. Browsing is intermediate between Green Mountain and Pyramid. The maximum height of the willow stand is 18' with the average around 12'. Fig. 3 and Table 3 show that the age distribution of the willow stand is favourable with 70% of the stems being from 1 to 15 years old. Only 5% are over 20 years old. Reproduction is good as 31% are between one and five years old.

Browsing on the area was much heavier two or three years previous with lighter browsing in more recent winters.

Age of Twigs browsed by Moose

(1) Green Mountain

Willow is the favourite food of moose but they also use many other species. There are two possible reasons for the use of these other species. The first is that there is not enough willow available for moose to exist entirely on it. The second is that they may wish to vary their diet. On Green Mountain the following trees and shrubs are browsed: *Salix spp.*, *Betula papyrifera*, *Cornus stolonifera*, *Acer glabrum*, *Pachystima myrsinites*, *Populus tremuloides*, *Populus trichocarpa*, *Amelanchier spp.*, *Thuja plicata*, *Abies lasiocarpa*, and *Pseudotsuga menziesii*.

Originally it was planned to examine only the age of browsed willow but later it was decided to examine *Cornus stolonifera*, *Acer glabrum*, and *Betula papyrifera*.

Samples were taken indiscriminately along the length of the Green Mountain trail. Several samples were taken from each willow tree. Each twig was aged immediately adjacent to where the moose had browsed it. In the case of all twigs over one year old it is probable that the moose ate a one year old twig as well as the older one. However only the remaining portion could be aged and so tallied. The same system was applied to other sample plots at Pyramid, Study Area "C" and Deer Creek. Results for Green Mountain are given in Figure 4 and Table 4.

We can conclude from the table and figure that willow twigs one, two, and three year old are most important for the moose. Four year old twigs are rarely browsed. *Cornus stolonifera* and *Acer glabrum* twigs are browsed in a similar fashion but older twigs are more frequently browsed in the case of *Betula papyrifera* and assume more importance. Four year old twigs make up 14% of the aged stubs and stubs to 7, 8, and 9 years old were browsed. Possibly older twigs are browsed in the case of shade grown birch for they arise from the main stems. This may produce twigs which do not turn woody so quickly as open grown birch. The peak of browsed twigs occurs in the second year in birch instead of in the first year as in the other species studied. Probably first year twigs are too small or thin to be easily chewed by moose and thus second year twigs are eaten.

On Green Mountain birch isn't so important as a browse species as it has grown out of reach and is largely unavailable to moose. Moose did not reach the area in numbers before the crowns had grown out of reach. If the area were cut back, birch would probably assume more importance as moose browse.

(2) Pyramid

For a general description of this area see Section I page 4. The sample was taken in the same manner as on Green Mountain and the species aged were *Salix spp.*, *Betula papyrifera*, and *Populus tremuloides*. The results (Table 5) show that willow is browsed most heavily in the first year making up 47% of the total. It is almost as heavy in the second year with 41% and is still significant in the third year with 11%. In the fourth year browsed willow is negligible with only 1%. The shape of the browsing curve for willow is the same as that of Green Mountain-Fibs. 4 & 5.

The browsing curve for birch is similar on Green Mountain and Pyramid with the exception that on Green Mountain twigs are browsed to nine years and on the Pyramid area to six years. Probably the open grown twigs of the Pyramid area become woody earlier than they shade grown twigs of Green Mountain.

The browsing curve for aspen is similar to that for birch except that twigs older than four years are not browsed.

3. Study area "C"

For a general description of this area see Section I page 5. The area is largely willow and is moderately browsed. The results are given in Fig. 6 and Table 6. It is interesting that 4th year twigs make up 3% of the browsed ends even though the area is but moderately browsed.

4. Deer Creek Burn

This area is on the trail between the Lean cabin at Deer Creek and the mature timber north of Ray Farm. The elevation is about 3,000'. The area is gently rolling topography

at the foot of Kilpil Mountain. The soil is sandy loam lying atop igneous rock. The present willow stand came after a burn. The original stand was an old stand of mixed conifers mostly D. fir, cedar, and spruce. The oldest willow stems are 20 years old, with the age of most of the younger stems being 10 years. The average height is about 10'. Commonly occurring plants of the area are: *Pseudotsuga menziesii*, *Picea glauca*, *Picea engelmannii*, *Abies lasiocarpa*, *populus trichocarpa*, *Pachystima myrsinites*, *Shepherdia canadensis*, *Cornus canadensis*, *Rubus parviflorus*, *Epilobium angustifolium*, *Castilleja spp.*, *Spiraea lucida*, *Antennaria spp.*, and *Fragaria spp.*

The data shows that the peak of browsing occurs in the second year (Fig. 7, Table 7). However the difference is not too significant. The data from the third and fourth years are similar to that from the other area. This area is only slightly browsed. We can conclude from this that the browsing curve is independent of the degree of browsing.

The results for willow from the various areas were integrated to give a general browsing curve for the species Fig. 8. The curve is the average of data from the four areas studied.

About 600 browsed ends were examined in different areas showing heavy, moderate, and light browsing to obtain the following conclusions:

1. The browsing curve is independent of the degree of browsing.
2. The browsing curve is independent of the age of willow stands.
3. Browsing is heaviest in the first year.

III

A Study of the Age Distribution of *Pachystima Myrsinites**

*Common names-false box, mountain lover, Myrtle box leaf, and Oregon boxwood.)

Geographic range

From Canada to northern U.S. in the Cascade, Siskiyou, Blue, and Rocky Mountains. In B.C. it is found from sea level to timberline except in the dry regions of the interior.

Local range

It is widely distributed throughout the park to about 5,500' in favourable locations such as near the Azure Lookout and on Mt Huntley. It is generally found in mixed stands of *Pseudotsuga menziesii*, *Picea engelmannii*, and *Pinus contorta*. It is found in all regenerations of this type after it has been burnt and is associated with the regrowth of aspen and willow. *Pachystima* is a very valuable indicator of previous stands on burned over land. *Pachystima* requires a fair amount of soil moisture but is not found in bogs.

The coverage is less in closed coniferous stands than in deciduous or not quite closed coniferous types.

Description

Pachystima is an evergreen shrub from 12"-30" high. The leaves are opposite, coriaceous, leaves from 1/4 to 1' long. The stems are squarish. Flowers are small, yellow or reddish; solitary or in few flowered axillary clusters. They flower around the first part of May in Wells Gray Park with some variation according to elevation. The seeds are 1-2 black, shiny, enclosed in a deeply fringed aril. the wood is very hard and brittle.

Reproduction is by layering. Twigs bend down touching the soil surface, roots are sent out, then new shoot are grown. No reproduction by seed was found in the study. A large network of roots is sent out by the main plant.

Stomach samples show *Pachystima* to be an important browse species for deer, moose, and caribou and has been found in mountain goat stomachs. *Pachystima* is pawed in winter and dies in spring possibly as a result of freezing.

Table VI Age of Browsed Willow Twigs at Study Area "C"

Age in years	Frequency of occurrence	Frequency %
1	76	48
2	53	33%
3	26	16%
4	5	3%
Total	160	100%

Table VII Age of Browsed Willow Twigs at Deer Creek Burn

Age in years	Frequency of occurrence	Frequency %
1	34	42%
2	38	47%
3	8	10%
4	1	1%
Total	81	100%

Table VIII Age of *Pachystima myrsinites* at Green Mtn.

Sample Plot #1

Age in years	Frequency of occurrence	Frequency %
2	4	4%
3	8	8%
4	7	7%
5	7	7%
6	7	7%
7	9	8%
8	7	7%
9	6	5%
10	9	8%
11	11	11%
12	8	8%
13	7	6%
14	5	5%
15	4	4%
16	2	2%
17	2	2%
18	1	1%
Total	104	100%

Table IX Age of *Pachystima myrsinites* at Green Mtn.

Sample Plot #2

Age in years	Frequency of occurrence	Frequency %
2	2	1%
3	8	5%
4	12	8%
5	16	11%
6	18	12%
7	17	11%
8	19	13%
9	9	6%
10	10	6%
11	11	7%
12	8	8%
13	5	3%
14	5	3%
15	3	2%
16	3	2%
17	2	1%
18	1	1%
Total	149	100%

Table X Age of *Pachystima myrsinites* at Green Mtn.

Sample Plot #3

Age in years	Frequency of occurrence	Frequency %
2	1	1%

Age in years	Frequency of occurrence	Frequency %
3	5	6%
4	7	8%
5	10	11%
6	12	14%
7	8	9%
8	7	8%
9	8	9%
10	11	13%
11	7	8%
12	5	6%
13	3	3%
14	2	2%
15	2	2%
Total	88	100%

The general description of the area sampled for *Pachystima* is the same as that for the willow sample plots at Green Mountain. The plots were 1 meter x 1 meter and all *Pachystima* stems on the plot were cut at ground level. After treating with sulphuric acid the age could be determined very closely. The results are given in Figure 9 and Tables 8, 9, and 10. The frequency curve from the data led to the following conclusions:

1. All ages from 2 to 18 years were found. (no 1 yr. olds were found because the sample was taken in early spring).
2. The peak of the curve is between 6 and 9 years.
3. The curve is a positively skewed bell shaped curve.

Table I Age of Willow Stand at Green Mountain, 1958

Age in years	Frequency of occurrence	Frequency by 5 year age groups	Frequency in % by age groups
1			
2			
3			
4	1		
5	1	2	2%
6	3		
7	1		
8	3		
9	1		
10	5	13	16%
11	2		
12	3		
13	1		
14	1		
15	4	11	13%
16	4		
17	2		
18	3		
19	4		
20	8	21	25%
21	3		
22	3		
23	4		
24	4		

Age in years	Frequency of occurrence	Frequency by 5 year age groups	Frequency in % by age groups
25	3	17	20%
26	3		
27	5		
28	4		
29	2		
30	4	18	22%
31	1		
32	1		
Total	84	84	100%

Table II Age of Willow and Birch Stand, Pyramid Area 1958

Willow

Age in years	Frequency of occurrence	Frequency by 5 year age groups	Frequency in % by age groups
1	1		
2	3		
3	10		
4	3		
5	3	20	26%
6	6		
7	5		
8	6		
9	6		
10	5	28	37%

Age in years	Frequency of occurrence	Frequency by 5 year age groups	Frequency in % by age groups
11	8		
12	3		
13	3		
14	4		
15	4	22	29%
16	3		
17	1		
18	1		
19	1		
20	1	7	8%
Total	77	77	100%

Birch

Age in years	Frequency of occurrence	Frequency by 5 year age groups	Frequency in % by age groups
1			
2	1		
3	2		
4	2		
5	3	8	12%
6	2		
7	2		
8	1		
9	3		
10	1	9	14%

Age in years	Frequency of occurrence	Frequency by 5 year age groups	Frequency in % by age groups
11	3		
12	3		
13	4		
14	6		
15	9	25	38%
16	4		
17	5		
18	6		
19	4		
20	3	22	33%
21	2	2	3%
Total	66	66	100%

Table III Age of Willow Plants Study Area "C"

Age in years	Frequency of occurrence	Frequency by 5 year age groups	Frequency in % by age groups
1	1		
2	13		
3	9		
4	12		
5	6	41	31%
6	5		
7	6		
8	8		
9	5		

Age in years	Frequency of occurrence	Frequency by 5 year age groups	Frequency in % by age groups
10	2	26	20%
11	3		
12	5		
13	7		
14	7		
15	3		
16	4		
17	4		
18	11		
19	8		
20	6	33	25%
21	6	6	5%
Total	131	131	100%

Table IV Age of Browsed Twigs, Green Mountain

Willow

Age in years	Frequency of occurrence	Frequency %
1	106	50%
2	75	35%
3	25	12%
4	6	3%
5	1	-
Total	213	100%

Betula papyrifera

Age in years	Frequency of occurrence	Frequency %
1	55	25%
2	76	26%
3	55	25%
4	16	7%
5	10	5%
6	1	0.5%
7	1	0.5%
8	1	0.5%
9	1	0.5%
Total	216	100.0%

Cornus stolonifera

Age in years	Frequency of occurrence	Frequency %
1	109	54%
2	56	28%
3	27	13%
4	7	4%
5	2	1%
Total	201	100%

Acer glabrum

Age in years	Frequency of occurrence	Frequency %
1	31	37%
2	29	35%
3	18	21%

Age in years	Frequency of occurrence	Frequency %
4	6	7%
Total	84	100%

Table V Age of Browsed Willow Trigs, Pyramid Area

Willow

Age in years	Frequency of occurrence	Frequency %
1	67	47%
2	58	41%
3	16	11%
4	2	1%
Total	143	100%

Aspen

Age in years	Frequency of occurrence	Frequency %
1	30	29%
2	45	43%
3	23	22%
4	6	6%
Total	104	100%

Birch

Age in years	Frequency of occurrence	Frequency %
1	37	24/%
2	67	45%
3	34	23%

Age in years	Frequency of occurrence	Frequency %
4	9	6%
5	1	1%
6	2	1%
Total	150	100%

Addendum

The following recommendations are offered for consideration in any cutting plan arising from the foregoing report:

1. Clear cutting to be done in blocks rather than in strips so as to minimize conifer reproduction from adjacent seed sources.
2. All coniferous slash to be piled and burned to kill seed; deciduous slash to be loosely piled for cover from small seed-eating rodents. Rabbits would also benefit from this cover. Field observations and a small scale experiment have indicated that rabbits may materially retard succession.
3. Cut areas should be adjacent to the road where possible. Rapid regeneration of deciduous growth will minimize any damage to aesthetic values. With cut areas next to the road the touring public would be aware of our efforts to increase wildlife populations through habitat improvement. Feeding areas would also be more accessible to observers during winter.
4. Cutting should be done in the dormant period or early growing season. Recovery by deciduous species is not so rapid after having been cut in mid or late growing season.