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Effects of Bigleaf Maple (*Acer macrophyllum* Pursh) on Growth of Understorey Conifers and the Effects of Coppice Spacing on the Growth of Maple (MOF EP 1121.02)

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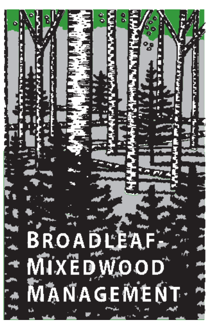

Why Manage Bigleaf Maple?

Bigleaf maple is a desirable ecosystem component that adds to the structural and species diversity of British Columbia's coastal forests. The presence of bigleaf maple may accelerate nutrient cycling, improve site productivity, and contribute to long-term sustainability. Bigleaf maple can be planted on sites infected with laminated root rot for site rehabilitation and amelioration. Maple is also potentially valuable as a commercial tree species; the wood is used for high-value furniture, flooring, and face veneers.

Where Does Bigleaf Maple Grow?

The bigleaf maple range extends north to Port Hardy (lat 51°N) on Vancouver Island and to Sullivan Bay on the mainland. Maple is found on a wide range of sites, with best growth occurring on the rich, moist soils of river terraces, floodplains, and seepage sites (Haeussler et al. 1990; Minore and Zasada 1990). It is moderately shade-tolerant and can survive in the understorey of mature forests.

Maple most often grows in mixture with conifers, and is a common component of Douglas-fir forests in the Coastal Western Hemlock (CWH) zone of British Columbia. Regeneration is from either seed or resprouting (coppicing) after disturbance of the stand. Maple usually re-sprouts vigorously after cutting of young or mature trees, producing up to 60 shoots per stump. The shoots can grow more than two metres a year, and it is not unusual for maple coppices to attain crown diameters of five metres in as little as two years.

Interactions Between Maple and Conifers

Bigleaf maple coppices are considered to be strong competitors with Douglas-fir (Haeussler et al. 1990) and quickly overtop conifers. Light levels beneath maple coppices can be less than 1% of full sunlight in midsummer, resulting in reduced growth and increased mortality of conifers. Maple shoots also cause substantial physical damage when they come in contact with branches or leaders of the conifers. The heavy leaf litterfall can also smother small conifers. Information on the effects of spacing of maple coppices on understorey light and conifer growth is required as a basis for successful management of maple in mixedwood stands.

A study was initiated in 1995 to document: 1) the effects of spacing treatments on understorey light, conifer performance, and growth of remaining coppices; and 2) the effects of thinning individual coppices on re-sprouting, growth of remaining stems, and coppice crown characteristics over time.

Study Area

The study was conducted at a site near Port Alberni, British Columbia, in the xeric maritime coastal western hemlock (cwhxm2) subzone. The area was logged in 1988 and planted with Douglas-fir (*Pseudotsuga menziesii* ssp. *menziesii*) and grand fir (*Abies grandis*) in 1989. Prior to logging, there were approximately 400 bigleaf maple coppices/ha on the site. These maples re-sprouted after logging and averaged 10 m tall by winter 1995. This study is comprised of two experiments and was established in 1995/1996.

Experiment 1: Maple Density

The purpose of this experiment was to examine the effects of spacing treatments on understorey light, conifer performance, and growth of remaining coppices. Ten coppice densities (0–400 maple coppices/ha) were randomly assigned to 30 × 30 m treatment plots (Figure 1). The treatments were applied in March 1996; chainsaws were used to fell selected coppices.

Height, diameter at breast height (dbh), and the crown radius of remaining coppices and all conifers were recorded immediately following treatment. The maple coppices had an average initial height of 10 m, crown diameter of 5.25 m, and density of 17 stems/coppice. The Douglas-fir ranged in height from 95 to 215 cm with a height/diameter ratio of 61–87. In each treatment plot, a grid of 25 sample points was established, spaced six metres apart.

The leaf area index (lai) was measured with a li-cor (1992) lai-2000 plant canopy analyzer (pca) during the summer of 1996 (Figure 2). lai is defined as the amount of leaf area over a given area of ground, and is usually expressed as m^2m^{-2}. lai measurements were made in four directions (n, s, e, w) at each grid point, using a 90° view-angle restrictor over the pca lens, and then averaged.

Diffuse non-interceptance (difn) was calculated from these measurements. difn is defined as the amount

figure 2 *Plant canopy analyzer (LAI-2000) used to record light measurements next to a quantum sensor.*

of light passing through the overstorey canopy, and is expressed as a fraction of open-sky light. Ten quantum sensors (photodiodes) were placed in six treatment plots (Plots 3, 6, 7, 8, 9, 10) to measure understorey light conditions. Light measurements were recorded at 30-minute intervals from April to October 1996 (Figure 3).

Hemispherical (fish-eye) canopy photographs (Figure 4) were taken at five points in each plot during July 1996 and July 1997. The photographs were digitized and a gap light index (gli) calculated. gli is a useful index that estimates the percentage of incident light at any particular point in the understorey over the course of a growing season (Canham 1988). The amount of light reaching the understorey (difn) decreases with increasing basal area of maple coppices (Figure 5). It is interesting to note that, theoretically, difn should be 1 when basal area (m^2/ha) is 0. However, due to the influence of trees in adjacent plots, difn is significantly less than 1 ($p<0.01$). Results of Experiment 1 are summarized in Table 1. Preliminary findings suggest that spacing treatments have caused substantial increases in understorey light.

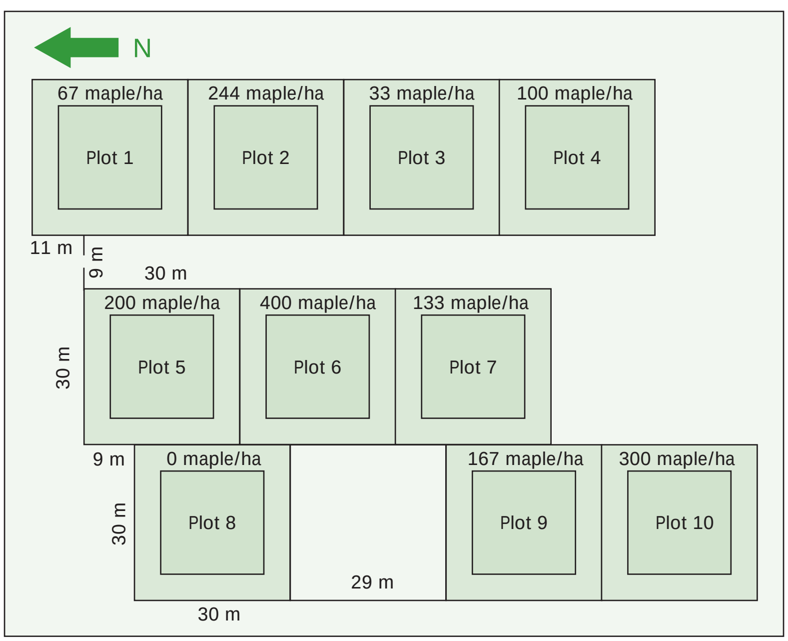

figure 1 *Plot layout for coppice density study (Experiment 1).*

figure 3 *Quantum sensor positioned on top of a two metre wooden stake.*

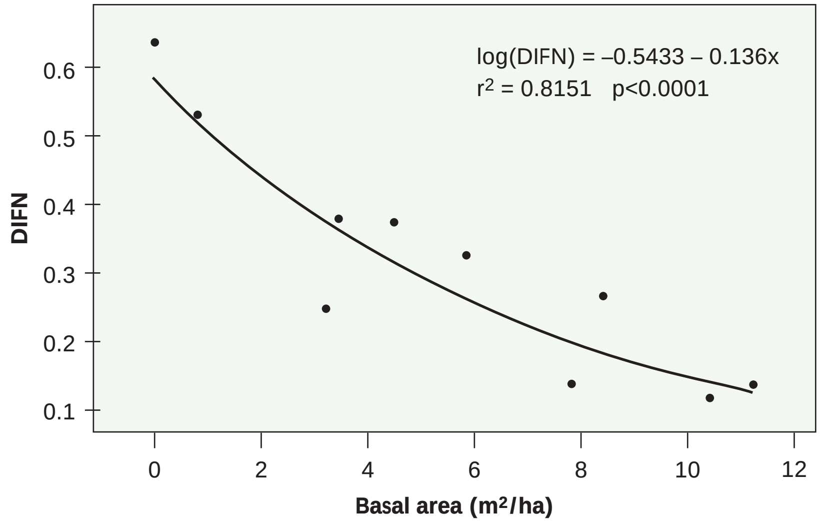

figure 5 *Relationship between the percentage of light passing through the overstorey (DIFN) and basal area (m^2/ha) of maple coppices in Experiment 1.*

Experiment 2: Coppice Thinning

The purpose of this experiment was to examine the effects of thinning individual coppices on re-sprouting, growth of remaining stems, and coppice crown characteristics over time. The experiment was established in a 0.13 ha area adjacent to Experiment 1. Three treatments (untreated control, space to 30 cm between shoots, space to 60 cm between shoots) were randomly assigned to 10 maple coppices. The shoots with the best form were selected as leave-stems and tagged. The remaining stems were cut with pruning saws. Immediately after thinning, the initial dbh and height of each leave-stem was measured (Table 2). Additional data will be collected during re-measurement: number and average height of re-sprouts, and leaf density of each coppice (measured in midsummer).

Future Plans

Work on these studies is continuing. Maple in both studies and conifers will be re-measured in 1998, 2000, and then at 5-year intervals.

table 1 *A summary of leaf area index (LAI), diffuse non-interceptance (DIFN), and gap light index (GLI) for the 10 treatments in Experiment 1*

Treatment	Plot	Density (coppices/ha)	LAI (m^2 m^{-2})	DIFN	GLI
1	8	0	1.195	0.6371	72.9
2	3	33	1.287	0.5305	67.2
3	1	67	2.308	0.3782	46.9
4	4	100	2.735	0.2471	31.8
5	7	133	1.920	0.3732	42.0
6	9	167	2.134	0.3250	42.3
7	5	200	3.891	0.1179	15.7
8	2	244	3.440	0.1387	25.0
9	10	300	2.553	0.2647	32.1
Control	6	400	3.495	0.1376	16.1

figure 4 *Camera set-up for hemispherical (fish-eye) photography.*

table 2 *A summary of initial mean (standard deviation) height, dbh, crown diameter of maple coppices, and number of stems per coppice in Experiment 2*

Spacing	Height (m)	dbh (cm)	Crown diameter (m)	Stems/coppice
Control	7.3 (0.8)	55.2 (8.4)	1.2 (0.3)	3
30 cm	8.0 (1.3)	60.3 (16.4)	1.1 (0.4)	7
60 cm	6.7 (2.0)	48.3 (16.5)	1.1 (0.5)	16

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