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BRITISH COLUMBIA

Red alder management trials in the Vancouver Forest Region

by Paul J. Courtin, Kevin R. Brown, and George J. Harper[1]

1. INTRODUCTION

Alder research in the Vancouver Forest Region (VFR) dates back to 1935, when Forest Service staff initiated an alder growth and yield project at Cowichan Lake Research Station. In 1948, a series of alder thinning plots was established at the Station (Warrack 1949). More recently the Forest Service has worked with the Hardwood Silviculture Cooperative, based at Oregon State University, to establish a red alder stand management study. The objective of this report is to give an outline of this work and some results to date.

The Forest Service is one of 10 members of the Coop, which is made up of government agencies, industry and educational institutions from Washington, Oregon, and BC. Three Coop variable density installations (Type II) have been established in the Vancouver Forest Region (Figure 1). They are located in the Snowden Demonstration Forest near Campbell River (planted 1993), at French Creek near Coombs, and at Lucky Creek near Ucluelet (both planted 1994).

Installation locations are selected to fill the Coop matrix, which contrasts both US-based physiographic regions and site quality. For BC, the regions roughly coincide with the CDF zone, low elevation dry CWH subzones and low elevation wet CWH subzones. Site quality evaluation is based on Harrington and Curtis' site index (1986), with low, medium and high sites defined as 14-17 m,

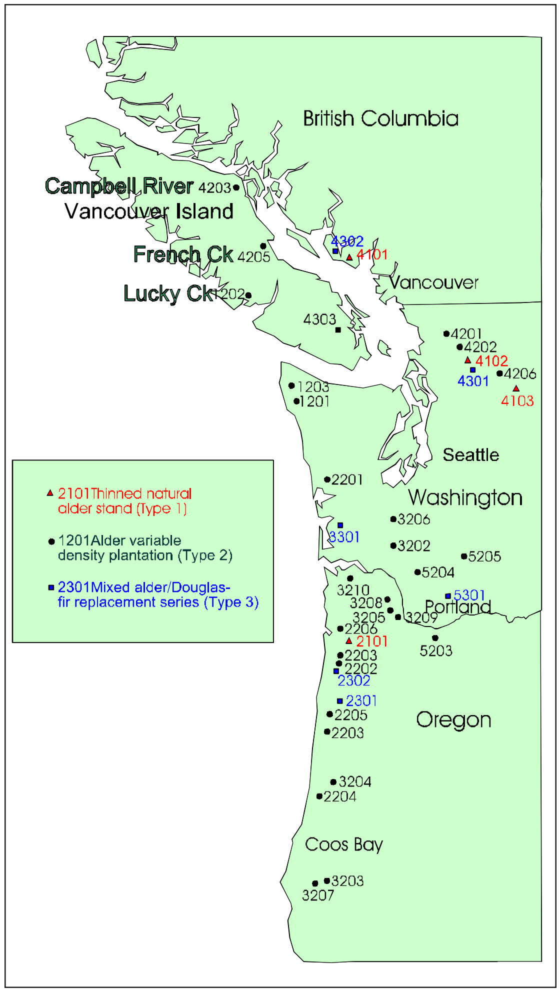

Figure 1. Location of Coop installations for the red alder stand management study.

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Table 1. Treatments at red alder stand management study trial installations.

Treatment	initial planting density (sph)	spacing (m)	at age or height to live crown	respace at this density (sph)	other activity
1	247	6.4			
2	568	4.2			
3	568	4.2			prune
4	1297	2.8	control		
5	1297	2.8	3-5 years	568	
6	1297	2.8	4.6-6.1 m	568	
7	1297	2.8	9.1-9.8 m	568	
8	2965	1.8	control		
9	2965	1.8	3-5 years	568	
10	2965	1.8	4.6-6.1 m	568	

18-20 m, and 21+ m (m@20 years), respectively.

Other installations associated with the Coop are a thinned natural alder stand near Sechelt (4101), and alder/Douglas-fir mixed species trials at East Wilson Creek near Sechelt (4302) and at Holt Creek near Duncan (4303) (Comeau et al. 1997).

Each Type II installation consists of 10 treatments with four different planting densities (from 247 to 2965 sph, based on US 100 to 1200 stems acre^{-1}), with entries for respacing or control and one plot for pruning (Table 1). Plots are respaced according to age or height to live crown. Each treatment plot is approximately 0.5 ha and encloses a 0.13 ha measurement plot where all trees are tagged and measured at periodic intervals. The main objective of the Coop is to monitor these installations and build a growth and yield database to guide alder management.

To date, thinnings have been carried out for all installations for treatments 5 and 9, and at Campbell River for treatment 10 (Figure 2). All installations have been pruned as per treatment 3 to a 6' (1.7 m) lift. Campbell River has had a second lift to 12' (3.4 m). A six-year summary of results is available from the Coop website at: http://www.cof.orst.edu/coops/hsc/.

2. RESULTS TO DATE

Seed collection and stock production

Earlier work by the Coop and Weyerhaeuser in Washington has provided guidance, but further work continues to be done. Alder shows variation with both latitude and elevation indicating local adaptation. Seeds zones have been delineated in the US (Hibbs and Ager 1989) and suggestions for seed transfer have been made in BC (Hamann et al. 2001). Since alder is susceptible to frost damage, careful consideration of elevation transfer should be made.

Plug transplant seedlings (0.5+0.5) are preferred in BC whereas Weyerhaeuser in Washington generally plants 1+0 bareroot stock. A caliper of greater than 4 mm and height of greater than 60 cm is desirable. Seedlings should have buds along the lower part of the stem to prevent sunscalding. *Septoria* leaf spot disease is routinely controlled in the nursery. The occurrence of *Septoria* causing bark lesions in young alder plantations has been reported in the US but has not been found in BC.

Site selection

Poor growth of alder occurs when soils are either droughty or too wet. At a minimum, soil moisture regime should be fresh and nutrient regime should be medium. Alder is tolerant of nitrogen poor soils because of its ability to fix nitrogen. Growth varies with phosphorus (P) levels (Brown and Courtin 2002), and may increase with P fertilization (Brown 1999). Alder grows poorly on wet sites. A key soil indicator of medium to good growth is an aerated root zone to a depth of at least 30 cm. Aerated zones are indicated by the absence of mottled or low chroma soils (Figure 3). Table 2 lists site series where alder should achieve good and medium productivity.

Damaging agents

Some plantation failure has occurred due to frost or strong insolation. With good stock and carefully selected sites, excellent survival can be expected. Allen (1993) studied mature alder stands in southwestern B.C. for incidence of decay. He

Table 2. Good and medium productivity sites proposed for red alder.

	site series (edatopic classes) from Green and Klinka 1994	
biogeoclimatic unit	best sites – good productivity	medium productivity sites
CDFmm		05(6/C), 06(6/D-E), {07, 08}, [12, 13]
CWHxm & CWHdm	07, {08, 09}, [13, 14]	01(4/C), 05(4/D-E), 06(5-6/C)
CWHds1 & CWHds2	{08, 09}	07, 01(4/C), 05(4/D-E), 06(5-6/C)
CWHms1 & CWHms2		{07, 08}
CWHvm1	07, 08, {09, 10}	01(3-4/C), 05, 06(5-6/C)
CWHmm1	07, {08, 09}	01(3-4/C), 05, 06(5-6/C)
CWHvh1		04(4/C), 05, 06, 07, {08, 09}
CWHwh1	05, 06, {07, 08}	01(3-4/C) 03

{ } = alluvial floodplain site   [ ] = fluctuating water table site

Figure 2. Plot 7 at Campbell thinned from 2965 to 568 sph at age 9 when the height to live crown averaged 5 m. Few branches along the bole are due to natural crown lift under a full canopy.

found that compared with other hardwoods, red alder has very little decay. It is resistant to *Phellinus weirii* and only mildly attacked by *Armillaria*. Alder is rarely affected by *Phellinus igniarius* in the submaritime part of the coast. This condition seems to be related to cold outflow winds. Some insects affect alder but none seem to be growth limiting. The alder bark beetle *(Alniphagus aspericollis)* has been noticed in recent BC plantations, but the extent of damage has yet to be documented. No significant insect or disease outbreak has been recorded to date for alder plantations in Washington (Alex Dobkowski, Weyerhaeuser, pers.comm.). In future, as alder is grown more often in plantations, more damaging agents may be recorded.

Growth and yield and management regimes

The main objective of the Coop's research is to build a growth and yield database that will guide alder management. Monitoring the installations over time by periodically measuring trees for height, diameter, height to live crown, and condition will provide the data. Of the 26 Coop Type II installations, 14 will be 12 years old in 2002. This will allow a detailed investigation into growth versus treatment as laid out in Table 1. The TASS (Tree And Stand Simulator) model operated by the Stand Modelling Group, MoF Research Branch, is currently being calibrated for alder. TASS has access to all Coop data as well as permanent sample plots in BC, and will provide predictions in terms of varying management scenarios. This will also be the basis for an economic comparison of alder investment versus conifers.

Figure 3. A mottled soil. Only the first few cm are aerated and contain alder roots. The alder growing on this soil had a low site index.

To manage alder in the short term (e.g. 20-30 years) for sawlogs requires intensive management. Plantation versus natural seedling establishment is preferred due to faster initial growth and uniform stocking. A planting density of 1700 sph will rapidly occupy the site, control understory competition and promote early self pruning. However, two or more thinning entries will likely be required prior to harvest. A lower density of 1100-1300 sph may experience more competition and will be slower in terms of crown closure and self pruning, perhaps yielding less clear lumber, but planting costs are less and fewer entries will be required. TASS modeling will fine-tune predictions.

3. SUMMARY

The abundance of past research on alder has prompted one researcher to comment that it probably has the distinction of being the most thoroughly investigated species prior to its implementation in operational forestry (Tarrant et al. 1994). This is due to its ability to fix N and its role in ecosystem function. Over the past decade, however, the learning curve has proved to be steep in some respects. More work needs to be done. The contribution of the Hardwood Silviculture Cooperative has been to build a growth and yield database that will predict management outcomes for red alder.

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