

Research Note

WOOD CHIPS AS MULCH FOR NORTHERN WHITE CEDAR

by Luc C. Duchesne and Lisa M. Clark

An overmature stand of *Thuja occidentalis* of aesthetic and ecological value is found at "Le lieu National de Fort Témiscamingue," the site of an important trading post in the 17th century on the south shore of Lake Témiscamingue, Quebec (47.21° N 79.26° W). This forest, locally known as the Enchanted Forest, is unique because most of its trees are gnarled and show various adventitious branches at breast height, possibly caused by a widespread disturbance agent that damaged apical buds at the sapling stage in the late 19th century. From an ecological stand point, the Enchanted Forest represents the relatively rare occurrence of *T. occidentalis* stands on dry sites in northern Quebec. This even-aged stand, originating from a local disturbance 150 years ago, was tended by the Oblate Brothers and by Parks Canada for approximately 35 years, starting in the mid-1950s. Tending included the removal of woody and leaf litter from the site.

However, *T. occidentalis* regeneration of the Enchanted Forest is failing. Today, there are fewer than 50 seedlings per hectare, creating an important management problem for Parks Canada managers in their attempts to preserve the site. Indeed, the values of the site may be in jeopardy if recruitment does not soon replace dying older trees (D. Veillette, pers. comm.).

The objective of our investigation was to explain the paucity of *T. occidentalis* regeneration at Fort Témiscamingue. Here we report the use of soil monoliths, a technique that may be of use to other forest and park managers.

Materials and Methods

Because the surrounding *T. occidentalis* forest, also subjected to trampling by visitors, regenerates well we hypothesized that previous tending in the Enchanted forest led to improper conditions for

seedling establishment. To test this hypothesis 10 soil monoliths (soil slabs) were collected from the forest floor of the *T. occidentalis* stand at Fort Témiscamingue: five from the Enchanted Forest where there is insufficient regeneration, and five from the adjoining *T. occidentalis* forest where *T. occidentalis* regeneration is abundant.

For collecting soil monoliths, a wooden board measuring 18 cm by 30 cm and 2 cm deep was placed on the litter surface while the monolith was outlined with 30 cm serrated knives to avoid disturbing the surface litter. Each monolith was approximately 10 cm thick including the organic horizon, the Ae horizon, and a variable portion of the B horizon. After the monoliths were transported to the Petawawa National Forestry Institute (PNFI) they were allowed to dry.

To investigate the effect of a wood chip mulch on seed germination, half of each monolith received a 3 cm layer of *T. occidentalis* wood chips (3 cm x 2 cm x 0.5 cm made from partially decomposed *T. occidentalis* logs collected at the Petawawa National Forestry Institute). Two hundred *T. occidentalis* seeds (PNFI seedlot No. 9230095, viability tested at 88.8% in 1993) were placed on each soil monolith: 100 seeds directly over the wood chips, and 100 seeds on the undisturbed forest soil (Fig. 1).

The monoliths were then incubated for 6 weeks in a greenhouse at PNFI and each monolith was watered daily following a watering schedule equivalent to the average daily June rainfall at Fort Témiscamingue. This converted to 0.22 mL of deionized water for every 1 cm² of surface area. Ambient air temperatures during the 6-week germination period was 24°C ± 2.5. All monoliths were examined daily for germinating seeds. In this experiment a germinating seed was one with a radicle longer than 1 cm. The percent germinating

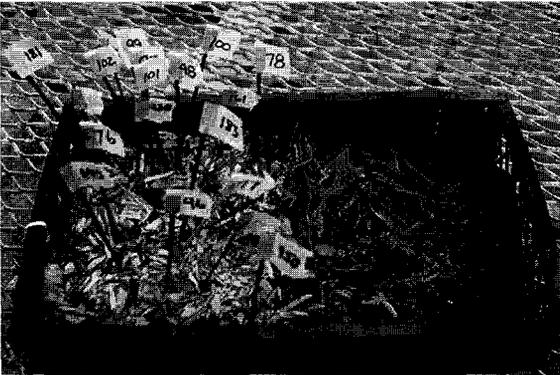


Figure 1. Germination of *Thuja occidentalis* seeds on a soil monolith from the non-regenerating area of the Enchanted Forest of Fort Témiscamingue. Germinating seedlings are marked with a flag. The left section of the monolith was treated with a 3 cm layer of wood chips whereas the right section of the monolith was untreated. Both sections were seeded with 100 *T.occidentalis* seeds.

seeds for each monolith was determined after six weeks incubation and the results averaged for each treatment.

Results and Discussion

Seed germination was five times greater on the monoliths of the adjoining regenerating forest as compared to the Enchanted Forest (Table 1). The data from the adjoining forest provides an estimate of the regeneration potential of *T. occidentalis* in undisturbed conditions. Germination was increased 19 times by wood chips on the monoliths from the Enchanted Forest whereas germination was increased 2.5 times by wood chips on the monoliths from the adjoining forests.

In general, lack of regeneration of *T. occidentalis* is associated with: 1) insufficient seed rain (1), 2) low seed viability (3,5), 3) improper conditions for

seed germination (1), 4) improper conditions for seedling establishment (1,2); 5) browsing by animals (5), and 6) trampling by human visitors (4). The results from this investigation suggest that the lack of regeneration of the Enchanted Forest is associated with poor microsite conditions for *T. occidentalis* seed germination. This is evidenced by the observation that seed germination was 5.5 times greater on monoliths from the adjacent forest as compared to the Enchanted Forest. Moreover, germination of seeds collected in the Enchanted forest is 73% (data not shown). Therefore, we recommend either of two prescriptions: 1) place a layer of *T.occidentalis* wood chips in the locations where regeneration is desirable, or 2) spread partly-decomposed *T.occidentalis* logs throughout the site. Obviously, this choice should be guided by aesthetic considerations along with the availability of partly-decomposed *T.occidentalis* logs.

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Literature Cited

1. Bartlett, R.M., R.J. Reader and D.W. Larson. 1991. *Multiple controls of cliff-edge distribution patterns of Thuja occidentalis and Acer saccharum at the stage of seedling recruitment.* J. Ecol. 79:183-197.
2. Curtis, J.D. 1946. *Preliminary observations on northern white cedar in Maine.* Ecology 27:23-36.
3. Frank, R.M. and L.O. Safford. 1970. *Lack of viable seeds in the forest floor after clearcutting.* J. For. 68:776-778.
4. Larson, D.W. 1990. *Effects of disturbance on old-growth Thuja occidentalis at cliff edges.* Can. J. Bot. 68:1147-1155.
5. Nelson, T.C. 1951. *A reproduction study of northern white cedar.* Michigan Dep. Conserv., Game Div. East Lansing, MI.

Canadian Forestry Service
 Petawawa National Forestry Institute
 P.O. Box 2000
 Chalk River, Ontario K0J 1J0, Canada

Zusammenfassung. Um die Regeneration von *Thuja occidentalis* im Forst zu untersuchen, wurde Rindenmulch in Bodenbereichen aufgetragen. Es wurde dann Boden aus diesen Bereichen entnommen und im Triebhaus unter kontrollierten Bedingungen eingesät und zum Keimen gebracht. Die Auflauftrate von *T. occidentalis*-Samen war 19 mal höher in mit Rindenmulch behandelten Böden als in unbehandelten Vergleichsböden.

Table 1. Germination of *Thuja occidentalis* seeds on soil monoliths with or without chips from Fort Témiscamingue.

	with chips	without chips
Enchanted Forest	14.8%±7.3*	0.8%±0.8
Adjoining forest	11.0%±1.9	4.4%±2.8

* average of 5 replicates ± standard deviation