CENTRE FOR BOREAL RESEARCH
TECHNICAL NOTE #28
FOREST RECLAMATION AND BOREAL REFORESTATION - APRIL 2019

Hitchhiker Planting in Reclamation: Protocols for Developing Nursery Stock of Woody and Herbaceous Species

INTRODUCTION

The 2010 reclamation criteria for forested lands requires the establishment of both native woody and herbaceous species, while controlling undesirable and noxious weed species, to reclaim industrially disturbed sites to functional forest ecosystems.

Hitchhiker planting in reclamation is a new technique pilot tested by NAIT's Centre for Boreal Research to simultaneously grow and establish native woody and herbaceous species. This technical note outlines planting protocols for overstory woody species (e.g. trees) grown with herbaceous understory species (e.g. forbs) or woody understory species (e.g. shrubs) in the nursery.

Figure 1. White spruce (*Picea glauca*) and Showy aster (*Eurybia conspicua*) growing together in the greenhouse

MAIN CHALLENGES TO ESTABLISH TARGET UNDERSTORY SPECIES

Planting of target tree seedlings is the most common revegetation method used on disturbed sites. Understory species (e.g. forbs and shrubs) are typically not reintroduced in reclamation planning and are left to regenerate naturally on site, which does not guarantee target plant densities or species composition. Similarly, establishment of herbaceous and woody understory species through direct seeding is often ineffective because of (1) a lack of commercially available seed sources, (2) low germination percentage and/or seedling survival (due to adverse site conditions, weed competition, seed predation, and pests), (3) high inter-annual variability in site conditions, and (4) high costs associated with the large quantity of seeds required.

HITCHHIKER PLANTING: CONCEPT + BENEFITS

Hitchhiker planting is a form of companion planting or polyculture that includes simultaneously growing multiple species in the same space. It involves planting species of different growth forms (e.g. erect and creeping) and forest canopy layers (overstory and understory) within the same nursery stock container (Figures 2-3) which are then outplanted together in the field (Figure 5).

Figure 2. White spruce (*Picea glauca*) growing with dogbane (*Apocynum cannabinum*) in the same nursery stock container.

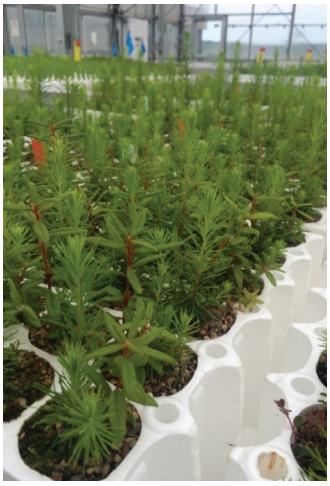


Figure 3. Tamarack (*Larix laricina*) growing with labrador tea (*Ledum groenlandicum*) in the same nursery stock container.

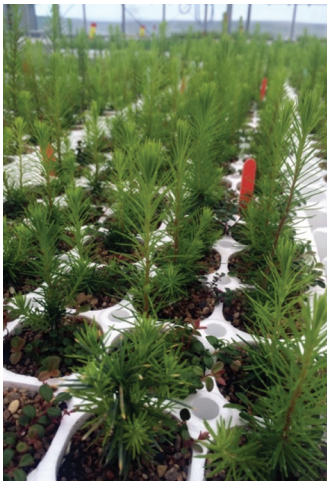


Figure 4. Tamarack growing with bog cranberry (*Vaccinium vitis-idaea*) in the same nursery stock container.

Figure 5. White spruce with fireweed (*Chamerion angustifolium*) in first growing season after outplanting.

Potential benefits of hitchhiker planting to simultaneously reintroduce herbaceous and woody species on disturbed sites include:

- Rapid site occupancy of target species
- Reduced ingress of undesirable species
- Reduced herbicide usage
- Shelter for shade-tolerant woody species
- Reduced planting costs by combining growing and outplanting of two target species

HITCHHIKER SPECIES COMBINATIONS

The selection of suitable species combinations is critical. Understanding the growth strategy of the species to be paired and timing the sowing so that both species have opportunity to grow (i.e. one does not excessively suppress the other) is essential when selecting species combinations for nursery hitchhiker planting. Groupings that have generally worked well are pairings of a determinate, slower growing species (such as white spruce) with a faster growing, herbaceous species or two slower growing species such as black spruce (*Picea mariana*) and bog cranberry. It is much more difficult (though still possible but additional research is required) to pair two fast growing, light- and space-demanding species such as green alder (*Alnus viridis*) and fireweed.

The Centre for Boreal Research tested, with some degree of success, the following hitchhiker planting combinations using 615A (340 mL) or 512A (220 mL) Styroblock™ containers:

- Fireweed (*Chamerion angustifolium*) and white spruce (*Picea glauca*)
- Fireweed (*Chamerion angustifolium*) Bebb's willow (*Salix bebbiana*)
- Fireweed (*Chamerion angustifolium*) and paper birch (*Betula papyrifera*)
- Fireweed (*Chamerion angustifolium*) and green alder (*Alnus viridis*)
- Goldenrod (*Solidago canadensis*) and white spruce (*Picea glauca*)
- Dogbane (*Apocynum cannabinum*) and white spruce (*Picea glauca*)
- Showy aster (*Eurybia conspicua*) and white spruce (*Picea glauca*)
- Bog cranberry (*Vaccinium vitis-idaea*) and black spruce (*Picea mariana*)
- Bog cranberry (*Vaccinium vitis-idaea*) and tamarack (*Larix laricina*)
- Labrador tea (*Ledum groenlandicum*) and tamarack (*Larix laricina*)
- Labrador tea (*Ledum groenlandicum*) and black spruce (*Picea mariana*)

The hitchhiker planting protocol below has been developed to display fundamentals of co-planting for the aforementioned species to maintain a viable co-plantation stock. Table 1 indicates the suggested sow dates for each species combination tested and the mean height of the woody plant at the time of sowing the second species in with the first. The steps below illustrate the process for a generic pair of species (labelled A and B).

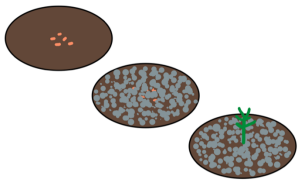
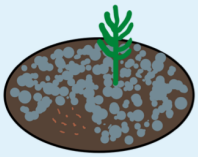
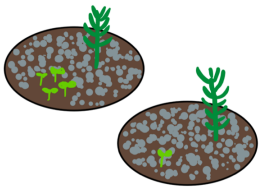
STEPS	IMAGES
1. Sow species A into prefilled styroblock containers and cover with grit. Thin to a single seedling 2-3 weeks following germination.	
2. At the appropriate time following sowing of species A, expose a small area on the plug surface and sow species B seeds. Depending on seed size, immediately cover with grit (if seeds are large) or leave exposed area uncovered to allow germination.	
3. Depending on the tolerance level of species B, regular fertilization may need to be postponed until true leaves begin to form on young germinants. 4. 2-3 weeks after species B has germinated, thin species B seedlings to 1-2 seedlings per plug and recover the grit to reduce moss growth.	
5. It is important to note that fertilization and watering requirements will be greater with two species sharing a container. During the growing phase once leaf area has developed, this stock type may require daily watering and fertilization up to 3 times per week.	

Table 1. Suggested sow dates for forbs after sowing woody overstory species for hitchhiker planting.

Hitchhiker planting combinations (Woody species + forb)	Suggested sow date for understory species (forb)	Mean height (cm ± standard deviation) of overstory woody plant at time of forb sowing	Image
White spruce + fireweed	10-12 weeks	5.5 ± 1.5	
White spruce + goldenrod	12-14 weeks	6.6 ± 1.1	
White spruce + dogbane	10-12 weeks	5.5 ± 1.5	
White spruce + showy aster	10-12 weeks	5.5 ± 1.5	

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ISSN 2371-462X

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