Oil Sands Vegetation Cooperative

In This Issue:

Targets (2017)

NAOS

Betula papyrifera 50 L
Populus tremuloides 80 L
Larix laricina 30 L
Alnus incana 30 L
Alnus viridis 70 L
Amelanchier alnifolia 70 L
Arctostaphylos uva-ursi 45 L
Cornus sericea 80 L
Corylus cornuta 20 L
Dasiphora fruticosa 10 L
Prunus virginiana 10 L
Rhododendron groenlandicum 10 L
Ribes species 75 L
Rosa acicularis 5 L
Rubus pubescens 2 L
Shepherdia canadensis 80 L
Symphoricarpos albus 2 L
Vaccinium myrtilloides 15 L
Vaccinium vitis-idaea 25 L
Viburnum edule 45 L
Total 754 L

SAOS —TBA

COLK—TBA

Species of Interest

Low-bush cranberry or *Viburnum edule*, a characteristic species of 'd' ecosites, has complicated germination and growth requirements. Rather than a simple cold stratification period, which is effective for many temperate species, *Viburnum edule* seeds require a lengthy warm stratification prior to an equally long cold period. After this complex treatment, germination is rarely greater than 50%. According to Dan McCurdy (Boreal Horticultural Services), germination often occurs in two stages. Following protrusion of the radicle, germination halts and a second cold treatment is needed to ensure shoot emergence. In a direct seeding trial, Smreciu and Gould (2015) reported field emergence to be significantly better if fruit, that had been stored frozen was direct seeded rather than sowing cleaned seeds.

Viburnum edule is known to thrive in shade and as such, most reclamation sites may be too exposed, leading to stress and failure. In field trials on three oil sands sites (Mildred Lake, Suncor Steep Bank and Aurora) a majority of seedlings survived five years after planting, however, plants were not robust and healthy under the sparse canopy. Although not quantified, plants that survived under a closed canopy were much larger and more vigourous after 5 years. To successfully incorporate this characteristic species, perhaps the time of placement needs to be adjusted; seedlings may need to be placed following or just prior to canopy closure.

Smreciu, A and K Gould. 2015. Field emergence of native boreal forest species on reclaimed sites in northeastern Alberta. Native Plants Journal 16(3): 205-226.

2017 Harvest Partners

NAOS: Canadian Natural Resources Ltd., Imperial Oil Ltd., Shell Albian Sands, Suncor Energy, Syncrude Canada Ltd.

SAOS: ConocoPhillips Co., Devon Energy, Husky Energy, MEG Energy, Nexen CNOOC Ltd., Statoil Canada, Suncor Energy

COLK: Canadian Natural Resources Ltd., Imperial Oil Ltd., Suncor Energy

Seed Banking

Banking or storing seeds is an ancient practice that began very early in the history of civilization. Storing seeds, for even a short period, allowed early societies to evolve from hunter/gatherers to an agrarian lifestyle. Growing similar crops from year to year required protecting seeds from all types of harm, the predominant being pests and moisture. Wet seed would tend to rot, so drying seed was probably one of the first treatments used to improve storage. Over the years, study of seeds has provided viability curves to determine optimal moisture content or relative humidity for individual species. Likewise, containers, that could keep out insects and other animals would be precursors for the hermetically sealed ones we use today.

In Canada, a couple of seed repositories were established in the late 1960s and early 1970s. A national effort to breed trees led to the National Tree Seed Centre, initially located at Chalk River, Ontario. From there, it moved to Fredericton, New Brunswick. Similarly, in the 1970s, Alberta Tree Improvement and Seed Centre was established at Smoky Lake, Alberta. There they have a bunker housing over 53 tonnes of seed, pre-dominantly tree species for reforestation. In 2009, the Oil Sands Vegetation Cooperative added shrub seed to their stores and number of species kept at Smoky Lake quickly doubled.

https://albertaep.wordpress.com/2013/08/19/clones-bunkers-and-banks-the-complex-science-behind-preserving-albertas-forests/

Seed Banks: Re-sowing Paradise

On Friday, December 16, 2016. CBC's radio program, IDEAS, featured *Seed Banks: Re-sowing Paradise*. They discussed a number of different banking facilities, including the Millennium Seed Bank (pictured) at Kew (Wakehurst, England), Svalbard Global Seed Vault (Norway) and the Heirloom Seed Sanctuary (Kingston, Ontario). If you are interested in listening to the show, it is available online.

http://cbc.ca/radio/ideas/seed-banks-re-sowing-paradise-1.3898130

To learn more about the OSVC, go to http://www.cosia.ca/oil-sands-vegetation-cooperative
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Seed Harvest and Handling

It is true that storage conditions have a large impact on seed longevity, but there are also aspects of harvest and extraction that can impact longevity. Specifically, seed harvested at peak ripeness will store longer and maintain higher viability than green seed. Also, damage, sometimes caused by extraction processes can negatively impact longevity. Fortunately, many shrub species have a relatively tough seed coat. This increases the length of time seed can be stored by preventing gas exchange and moisture absorption.

Diploendozoochory

Zoochory, the root of diploendozoochory, is the dispersal of seeds by animals. Some of this is incidental and external such as the attachment of seed pods (burs and others) to fur or feathers as animals move through the vegetation. Wider dispersion is often accomplished by endozoochory - animals feeding on vegetation, particularly fruits, and depositing seeds that have travelled through the guts much farther away from the original parent plants. In the boreal region, small mammals such as squirrels and muskrat scatter seeds within their limited geographical areas whereas larger mammals such as bears disseminate seeds farther afield. Birds, due to their flight and migration patterns are perhaps the vector by which seeds can be distributed most widely. The movement of seeds through the animal guts can also have a positive effect on seed germination. Seed with hard or tough outer coverings can be scoured in bird crops or by digestive acids and enzymes. A recent review article by University of Alberta authors, published in Ecosphere, discusses the role of carnivores in the dispersal of seeds. They describe **diploendozoochory** where an herbivore or omnivore has ingested plant material prior to being preyed upon by a carnivore. This results in seeds that are present in the gut of the first animal being transported though a second gut. One study they reviewed stated that 'a single raptor might disperse thousands of seeds annually based on the prey intake rate and the number of seeds in the guts of each prey item' and another, notes that cougars may broadcast as many as 5000 seeds per km^2 annually. The authors suggest that diploendozoochory may expand the area over which seeds can be distributed, improve seed germinability and increase the number of disseminated seeds. They also discuss the possible benefits for species as climates change and the detrimental effects as a vector for spreading of weedy and invasive species.

Hämäläinen, A, K Broadley, A Droghini, JA Haines, CT Lamb, S Boutin and S Gilbert. 2017. The ecological significance of secondary seed dispersal by carnivores. Ecosphere 8(2)
http://onlinelibrary.wiley.com/doi/10.1002/ecs2.1685/full

Oldest Viable Seed

Fruit of *Sllene stenophylla* (relative of campion) were recovered from a fossil squirrel burrow in northeastern Siberia. Carbon dated at over 30 000 years old, the immature seed wasn't germinated in the traditional way but grown from tissue culture, extracted from the embryo. The resulting plants grew to sexual maturity, producing flowers and seed of their own.

Yashina, S, S Gubin, S.Maksimovish, A Yashina, E Gakhova and D Gilichinsky. 2012. Regeneration of whole fertile plants from 30 000-y-old fruit tissue buried in Siberian permafrost. Proceedings of the National Academy of Science of the United States of America. 109(10): 4008-4013.

Photo courtesy PNAS, accompanying article.