



# EMEND

## Ecosystem Management Emulating Natural Disturbance



### Three factors impacting natural regeneration of white spruce (*Picea glauca*) on disturbed sites

Quickly establishing vegetation and achieving reclamation certification are shared objectives of oil and gas industry operators.

While tree planting is clearly advantageous in the predictability of regeneration, natural regeneration is still widely relied on as a reclamation approach. If natural regeneration is to be used as a reclamation prescription, it should be carefully planned and managed purposefully rather than relying on the assumption that nature will take care of itself.

#### Key Messages

EMEND research shows that successful natural regeneration of white spruce (*Picea glauca*) on a disturbed site is challenging. At least three key conditions are necessary:

- Exposed mineral soil serves as a microsite for seeds.
- Mature white spruce seed trees are within 60 m of each exposed microsite.
- There is alignment with a mast year in which a large volume of seed is produced (every 2–6 years).

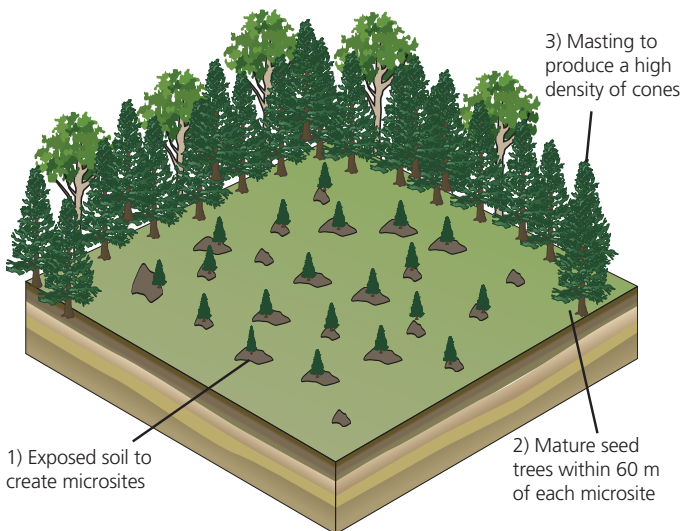
#### Microsites are critical for white spruce establishment

There is strong evidence that exposed patches of mineral soil are crucial for white spruce seeds to germinate successfully. Favorable conditions, including warm soil and adequate soil moisture, allow for high germination success of the seeds that come in direct contact with these mineral patches.

The presence of exposed mineral soil patches is greatly reduced when minimal disturbance techniques are used during oil and gas operations, thus diminishing natural regeneration potential after operations are terminated. The success of natural regeneration is likely to be much higher if minor disturbances like scuffing of heavy moss layers occur during the reclamation of a site. This suggestion is not to negate the importance of soil conservation techniques but to state the importance of creating microsites if natural regeneration is the reclamation approach.

#### Seed trees must be present in high enough quantities around a site

Mature seed-bearing trees must be in close proximity to exposed microsites to ensure sufficient seed availability for successful



#### About EMEND

Ecosystem Management Emulating Natural Disturbance (EMEND) is a collaborative research project that aims to understand what recovery in the boreal forest looks like following a range of forest harvesting, fire, and silvicultural treatments. As EMEND is grounded in forest ecology science, there are many lessons to be shared with the oil and gas industry to aid in reclamation. This series aims to apply EMEND knowledge to the oil and gas industry.

natural regeneration of white spruce. EMEND studies have found this natural regeneration of white spruce is most successful when a minimum of 30 seed trees are within 60 m of each microsite. Although this number of seed trees may be high, the more mature white spruce trees that are within 60 m of exposed microsites, the higher the rate of successful recruitment.

Ensuring that a site is surrounded by a conifer-dominated or a mixedwood stand type with sufficient quantities of mature white spruce seed trees is a key factor that should contribute to natural regeneration success following reclamation after oil and gas operations.

**Natural regeneration of white spruce is unpredictable and must be carefully planned as success is not guaranteed. Reclamation advisors should be prepared with a plan B if natural regeneration is insufficient.**



## Yearly variation in seed production and microclimate are key factors in success

Seed production from mature white spruce trees is highly variable from year to year and may complicate the likelihood

of successful natural regeneration of white spruce. In some years—called “mast” years—cone production can be 3–16 times higher than in other years. In addition, years in which large quantities of seed are produced are often followed by years with very low seed production.

Predicting when a mast year will occur is difficult. Studies have linked year-to-year climate variability to masting events, but even this is not a reliable predictor of mast years. The unpredictability of white spruce seed production reduces the reliability of natural regeneration on a reclaimed site. **In addition, a lack of sufficient seed supply in the year following reclamation could compromise goals because competing vegetation may quickly occupy the available microsites.**

In the context of oil and gas reclamation, understanding how disturbance activities align with masting years, such as knowing whether a masting event occurred the year before a disturbance, could help estimate the feasibility and reliability of natural regeneration as a reclamation practice. It is not an ideal solution but it may be the best option available.

## Bibliography

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