



Mixed Species Options for Forests For Tomorrow

Encouraging conifer mixtures

Scope

This guidance is to encourage conifer mixtures through the silviculture activities of *Forests For Tomorrow* (FFT) to meet reforestation species diversity objectives and as an adaptation management measure to foster forest and ecosystem resilience.*

Maximizing diversity on every site may result in stands and landscapes that are difficult to manage now and in the future, therefore, planning for biological diversity is often best done at the landscape level¹. The desired tree species and stand structure for a specific site should reflect these landscape level objectives.

While FFT does encourage the use of ecologically appropriate species including broadleaf species in all its reforestation efforts, this guidance does not specifically deal with conifer/broadleaf mixtures but the general principles still apply in those situations. Specific information on broadleaf/conifer mixtures can be found in the [Chief Forester's memo](#) and in [other related documents](#).

1- Introduction

One of the main objectives of the *Forests for Tomorrow* (FFT) program is to improve the long-term timber supply through the establishment of new forests on areas impacted by the mountain pine beetle (MPB) and catastrophic fires outside licensee and BC Timber Sales basic reforestation obligations². FFT-funded silviculture operations contribute to achieving diverse mixes of desirable tree species within FFT treatment units, subject to

* This guidance is consistent with the goals and objectives outlined in the MFLNRO, Forest Stewardship Action Plan for Climate Change Adaptation, 2012-2017

applicable site management objectives, site limitations, and considerations of economic return¹.

2- Purpose and Objectives

As stated under [FFT Policy No.1](#)³: species mixtures must be planted where appropriate, and on sites with more than one preferred species, more than one preferred species, or all of the preferred species, should be planted. The following guidelines will help forest managers increase the number of areas established with conifer mixtures.

This guidance is not intended to address nor discourage the use of broadleaves when attempting to increase diversity or meet management and product objectives. For more information on the establishment of broadleaves or broadleaf conifer mixtures please refer to the [Chief Forester memo on incorporating mixedwoods and broadleaves into stocking standards](#). The purpose of this guidance is to assist in increasing mixtures when establishing conifer dominated forest stands.

3- General Guidance

It is important to select a mix of species that is ecologically suited to the area when proposing the species composition for the silviculture prescription. The species selection process should be particularly careful where a mix of species was present before the timber was denuded or if sufficient evidence-based knowledge, policy guidance, data and information (e.g. scientifically sound and peer-reviewed climate change model projections) indicates the possibility of a shift in species composition. It is understood that in some ecosystems single species plantations may still represent the most suitable silviculture treatment and species management option.

Reasons for fostering the increased use of conifer tree species mixtures include ⁴:

- maintenance of historical species profiles in the landscape,
- improving stand resilience to biotic and abiotic disturbance factors and/or events such as the incidence of forest health pests, pathogens or damaging agents (e.g., red cedar or western larch in root rot infected areas), wildfire, and climate change,
- increased future stand value,

- enhancing biodiversity,
- increasing biological and ecological benefits, and
- accounting for cultural value.

It is important to support changes in ecosystem, species, and population distributions based on knowledge of responses of species and populations to climate, as well as on knowledge of interspecific interactions (such as inter-species competition, plant community/ ecological and genetic interactions)⁵. Ecosystem and tree species vulnerability assessments coupled with frequent monitoring of forest health conditions and productivity can help inform species compatibility considerations in stand-level species selection decisions.

Factors affecting species compatibility include⁶:

- the rate and level of natural ingress of all species on the specific site
- the relative growth rates of all species on the specific site
- the relative protection requirements and shade tolerance of the species
- the spatial requirements and branching habit of the crowns for the species
- the nutritional effects of the species or combination of species on the soil and each other
- the pathological and biological (morphological) rotation age of each species
- forest health concerns (contact local forest health specialists and refer to the various forest health information).

The integration of these factors determines how a species will perform in pure or mixed-species stands. Irrespective of tree species, a forest stand can be visualized as one of three general structure types:

- even-aged, non-stratified canopy stand structures
- even-aged, stratified canopy stand structures
- uneven-aged, multi-storey stand structures.

While the [FFT Species Management and Density Targets](#), recommends specific mixture targets the determination of an appropriate species mix is, however, unique to each site

and should include landscape level considerations such as species distribution and the percentage of required species mix within the treated areas.

Choosing a species – It is essential to select tree species and stocking levels based on sound ecological and ecosystem-specific information because trees are well adapted to specific environmental conditions⁷. As indicated by the [FFT Assisted Migration Guidance](#), it is possible to minimize the impacts of climate change by facilitating the ‘assisted migration’ of tree species. This can also be achieved by managing for a greater species diversity which increases the resiliency to biotic and abiotic factors⁸.

The [Tree Species Selection Tool](#) provides useful information on species selection at the stand (ecologically suitable species lists) and landscape-level (species overviews) by BEC subzone and variants⁹; information on environmental factors that may pose risk to the ecological suitability of a species, management trade-offs, and links to information for developing climate change adaptation strategies.

4- Site Level Considerations

When prescribing a silviculture treatment for managing tree species mixtures it is recommended that the prescribing forest manager or practitioner:

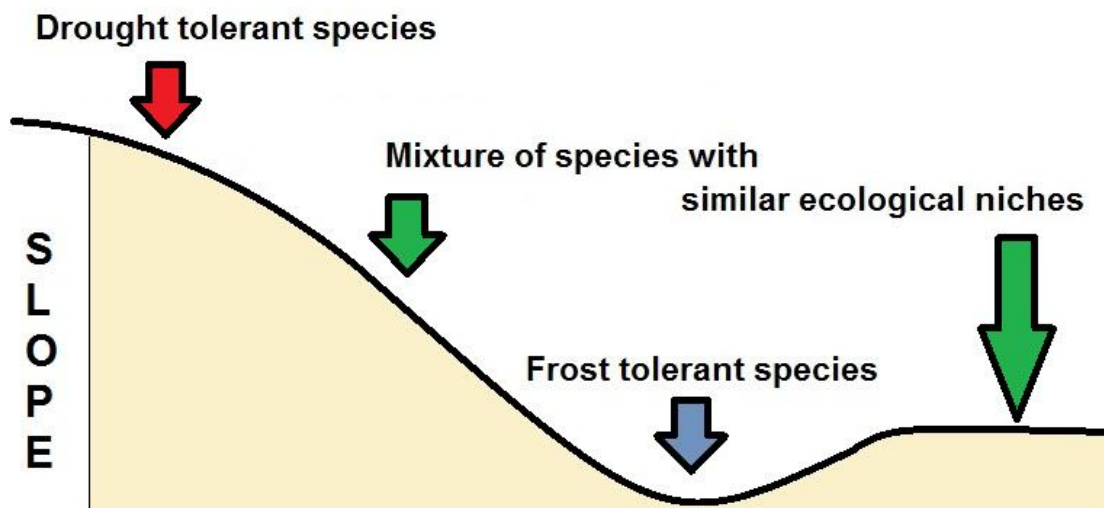
1. Identify and plant small micro-sites within the larger unit with a different micro-site specific species (e.g. small wet/moist pockets, disease pockets, etc.)
2. Take advantage of permanently shaded sites to increase the concentration of shade tolerant species
3. When inter-mixing species consider future products ranges, rotation ages, and future access
4. As indicated by the [Establishment to Free Growing Guidebook](#) there are four key elements in selecting the tree species for a new stand:
 - i. identifying desired stand goals throughout the rotation (e.g., stand structure, intermediate product removal)
 - ii. identifying ecological site attributes
 - iii. knowing and using the inherent silvical characteristics of all species suited to the site

iv. carefully matching these elements to produce a prescription that meets management objectives.

5. Where possible, include a component of tree species currently, or historically, associated with a minor component of the species profile or those that associated with species at risk (e.g. whitebark pine interactions with Clark's nutcracker).

5- Example conifer mixture strategy

The following figure is a diagrammatic representation of potential mixture strategies at the site level. In this example, slope and drainage are key elements contributing to the selection, ecological suitability and management of tree species. Silviculture prescriptions should take into consideration which species (or mix of species) are best suited for each planting area within the management unit, and should also facilitate those species anticipated to enhance stocking through natural regeneration.



6- Reference List

¹ Mah, S. et. al. 2012, Landscape –level Species Strategy for Forest Management in British Columbia.Prov. B.C. Victoria, B.C. Tech. Rpt. 067 [Click here](#)

² Forest for Tomorrow Program Management Plan, June 15, 2005. [Click Here](#)

³ FFT Policy N°1 – Management of Tree Species Composition, May 18, 2006. [Click Here](#)

⁴ Comeau, P.G. 1996. Why mixedwoods? In “Silviculture of temperate and boreal broadleaf-conifer mixtures”. Edited by P.G. Comeau and K.D. Thomas. BC ministry of forests, Victoria. Land and Management Handbook no.36. pp.1-7. [Click Here](#)

⁵ USDA Forest Service, Genetic Resource Management and Climate Change: Genetic Options for Adapting Forests to Climate Change, March 2012 [Click Here](#)

⁶ Establishment to Free Growing Guidebooks October, 2007. [Click here](#)

⁷ The Establishment to Free Growing Guidebook, May, 2000. [Click Here](#)

⁸ FFT Assisted Migration Guidance, June 25, 2009. [Click Here](#)

⁹ The Tree Species Selection Tool. [Click Here](#)