

Potential Management Options to Enhance Ecosystem Resilience 2011 FRPA Policy Assessment Workshops

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#	Potential Management Option
PLANNING	
1	Retain or restore areas that can likely tolerate anticipated climate change to retain plants and animals that could provide propagules
2	Develop landscape structures that enable species and genotype flow northward and upslope.
3	Develop In situ and ex situ conservation strategies(including but not limited to natural reserves) to maintain biological legacies for future climate (not necessarily FRPA)
4	Establish genetic outposts (small plantations of seed sources that are adapted to predicted future climates in remote locations) to hasten the adaptation of forests in unmanaged areas
5	Measure and plan for variability and diversity at the forest scale: Accept considerable variability at lower scales that result in diversity and complexity at the systems scale (the forest)
6	Plan for and manage within the context of an uncertain future: include experimentation, learning and adapting to deal with uncertain ecological and management interactions, shifts in disturbance regimes, and ecological community reorganization

	HARVESTING
1	Manage age classes to enable continual recruitment of biological legacies
2	Focus management on currently productive sites and those likely to remain more productive under future clim
3	Harvest vulnerable and poorly adapted stands first, including and species most susceptible to pests.
4	Develop forest harvest patterns and regeneration regimes that generate a diversity of stand ages and compositions over landscapes
5	Manage age classes - not just for the first 20 years, but all the way through the rotation.
6	Vary the size and shape of clearcuts, and leave patches or stream buffers
7	Broadly implement alternative partial harvest systems and various silviculture techniques to generate micro-environment suitable for survival of migrated species
8	Use harvesting as a forest health tool for stand replacement. Replace with better adapted species/genotype. Strategically determine where harvesting occurs. Cut the forest profile. Address FH issues
9	Account for changes in future site conditions in management decisions (e.g., anticipate where moisture may become limiting)
10	Manage species for shorter rotations to minimize losses to the current inventory from climate change-induced disturbances
11	Where economic conditions allow, use intensively managed plantations dedicated to wood supply to focus efforts on a smaller more productive forest estate which could be managed to reduce the impacts of climate change. Aim for carbon conservation benefits on other areas.
12	Use silvicultural systems that maintain or enhance genetic diversity

	STAND TENDING
1	Undertake sanitation cutting in stands already infected
2	Control root disease by removing infected stumps where feasible
3	Implement measures to reduce hazard and/or risk of loss to forest health agents.
4	Use prescribed burning to reduce fire risks and forest vulnerability to insect outbreaks
5	Prevent the introduction or spread of invasive species, and remove or control undesirable invasive species
6	Modify management of the current generation of trees such that the risks of species mal-adaptation are taken into account : e.g. Fertilize high value stands to bring them to rotation before climate change-induced mortality; e.g. Thin stands on drought-prone sites to reduce water use where it will not increase susceptibility to wind throw or disease

	REFORESTATION
1	Introduce fire into ecosystems where historical fire cycles have been disrupted by past fire exclusion
2	Plant species mixes based on novel assemblages identified through scenario-based climate modeling
3	Assist migration (potentially of seed, seedlings, pollen etc)
4	Avoid practices that generate uniform post-disturbance stands that may be highly vulnerable to future disturbance (OK in a small percentage of stands (5%?) but not across the landscape. There are trade-offs between yield and protection.)
5	Plant resistant genotypes—use resistant (and/or pest and disease tolerant) planting stock to help; consider companion planting /tree species mgmt (certain species grow well together, spread/re-direct harmful pests/pathogens to other hosts/understory shrub and vegetative community ¹²
6	Increase genetic variation at multiple scales (e.g. use a range of seed sources at the stand and landscape level) to reduce cum. impacts from over-planting the same source(s) /seedlot(s) in an area or MU
7	Plant a broader range and new mixes of tree species over landscapes –e.g. hardwood/conifer mix and seedlings from a range of seed sources, particularly from more southern or lower-elevation populations.
8	Emphasize species or populations that have the genetic ability to tolerate a wide range of environmental conditions
9	Develop genetic resource mgmt /seed strategies to assess what seed sources may no longer be appropriate for BC, or will no longer be appropriate within several decades; manage seed inventory accordingly.
10	Plant and monitor species and provenance over a broader range of climatic and edaphic conditions to hedge against the risk of losing management investments.
11	Plant drought-resistant species in areas that are prone to increased drought
12	Prompt reforestation of all harvested and disturbed forests with a suitable variety of species and provenances adapted to both today's and predicted future climates (e.g. assisted migration); this could include planting species that have historically occurred south of the BC border. (A time frame of 30 years out may be as far as we can reliably forecast for climate based seed deployment).
13	Bank surplus seed – broader use of non-local seed sources may require the procurement and banking of many different seedlots.