

Best Management Practices for Managing Drought Prone Sites within the Thompson Okanagan Region

Reforestation on dry sites is extremely challenging. While this has always been the case, the challenge has been placed under greater focus now that harvesting has shifted away from Mountain Pine Beetle killed sites to harvesting in lower elevation Douglas-fir stands. This challenge is compounded by periodic years with decreased moisture such as drought years like 2017 and 2018. Periodic drought years should be expected more frequently as impacts from climate change increase.

This Best Management Practices document is intended to help silviculture practitioners identify and manage for the driving factors that cause significant drought mortality. This document is based on a review of licensee, BCTS, and ministry planting programs, and the broad suite of management practices they conducted on these sites. The reviews included field visits to more than 50 of their most drought prone sites. The majority of the recommendations found in this document are based on these observations of the successes and failures found on those sites.

For a more thorough discussion on the recommendations in this BMP a detailed companion report will be available fall 2020.

Identifying drought prone sites.

Sites within the Thompson Okanagan Region can be described in increasing amounts of moisture: extremely dry, very dry, dry, and not-dry but prone to dry situations. The biogeoclimatic zones rank in order of how they fall on the landscape in the Thompson Okanagan Region. These biogeoclimatic zones increase in elevation: Bunchgrass zone (BG) is the lowest in the Thompson Okanagan Region, Ponderosa Pine zone (PP) is located above the BG, Interior Douglas-fir zone (IDF) is located above the PP and Montane Spruce zone (MS) is located above the IDF.

In areas where Interior Cedar Hemlock zone (ICH) is present this zone is located above the IDF and below the Engelmann Spruce - Subalpine Fir zone (ESSF). Most ESSF and ICH sites should not be considered dry sites.

Drought risk key

The drought risk key below has been developed and discussed with local licensee silviculturists and adequately represents plantation mortality risk. The key is intended to be used by stratifying sites, identifying the key factors for each site and totaling the resulting value in the table below to come up with a number that reflects each site's drought risk. The numbers presented below are qualitative and represent trends in the risk of drought mortality. The intention is to then look up the recommended silviculture treatment regime identified for that drought risk. If the recommended silviculture treatment regime cannot be followed increase the total from the drought risk key to account for greater vegetation competition – this includes recalculating the value where a replant is necessary.

More experienced silviculturists can and should adjust the weighting to best match their observations of risk and mortality on their openings. Please recognize that there are vast differences between operating areas which effects sites differently.

Drought risk key:

Stratify sites based on the primary and secondary criteria below. Stratify sites as thoroughly as possible without lumping. Find the BGC subzone (primary stratification criteria) you are operating in and add or subtract points based on secondary site characteristics. Total the points up to identify the drought risk category and review and follow the resultant recommended treatment regime (below).	>15	Extremely dry sites
	10-15	Very dry site
	5-10	Dry site
	<5	Not a dry site

BEC	Soil Moisture Regime	Aspect	CF%	Overstory shade	Other factors
PP or BG 20	Very Xeric to Subxeric 5	SE-W 5	High 5	None 3	SE-W (>30%)* 3
IDFxh 15	Submesic 3				
IDFdk 10	Mesic 0	W-NW or E-SE 0	Moderate 3	Moderate 0	
MSxk or IDFmw 5	Subhygric -3				Flat with heavy
ESSF or ICH 0	Hygric-Subhydric -5	NW-E -3	Low 0	Significant -3	Compaction** 3

* Steep slopes on south facing slopes have increased risk.

** Flat ground when there is significant compaction can be difficult to achieve adequate disturbance from site preparation.

Best Management Practices on all sites where drought mortality is a consideration:

The following practices are Best Management Practices on all sites where drought mortality is considered likely. Specific details can be found in the Regime Based Silviculture section of this document.

Planning

- A silviculture forester should have input and signoff on all Site Plans in order to review openings for extremely dry sites and to help plan and prepare for reforestation of dry sites. Extremely dry areas such as south facing rock knobs or steep south facing pitches should be either removed from the block or separated out as separate Standards Units with increased retention and appropriate stocking standards.
- Silviculturists should review sites during post-harvest assessments through the lens of the drought risk key - separating areas with different values. Sites should be stratified as thoroughly as possible to identify regimes that will work for the different strata. The Land Management Handbook #23, A Guide to Site Identification and Interpretation in the Kamloops Forest Region February 1990 should be used to classify these sites.
- Track the drought risk rating value for each site using the table above. This will make it easier to quantify and summarize the area associated with increased risk.
- Create or use approved variations in the stocking standards to reduce minimum inter-tree distances to deal with situations where mechanical site preparation is not possible due to machine limitations and safety concerns.
- **Key concept.** All sowing, site preparation, and planting activities must be coordinated to minimize the time period between harvest start and planting.
- Create informal trials to test new ideas and increase learning opportunities.

Mechanical Site Preparation

- **Key concept.** MSP should be considered a required treatment on all sites. The only exception would be instances where disturbance is created from harvesting and planting occurs without an intervening growing season to allow pinegrass establishment. Target treatments for the fall prior to planting to minimize pinegrass ingress
- Administer MSP treatments with as much attention as planting programs including increased communication at the viewing, pre-work, and checking stages. Identify the level of disturbance required throughout the treatment area and indicate under what scenarios the area will need to be reworked until the acceptable level of treatment has been met throughout.

Planting prescription and stock specification

- **Key concept.** Choose species that are ecologically suited for the entire planned rotation – these are the species with the greatest drought tolerance following establishment and are usually the species in the pre-harvest stand. Do not make the species choice based on ease of establishment.
- Nursery. Use separate request keys for seedlings that are targeted for dry sites. This will make it easier to manage these seedlots through communication with the nursery.
- Seedling requests. When utilizing B class seed, select provenances that are drier than the target planting site.
- Seedling requests. As drought risk increases for a site, sow first and adjust the planting plans later. Planting must be initiated as quickly as possible. Identify when these openings are likely to be harvested and sow for these even if harvest completion is uncertain.
- Seedling requests. Order a number of dry site suitable species as a component of every planting prescription.
- **Key concept.** Seedling requests. Grow the appropriate size stock for the drought risk. Larger stock is appropriate where the drought risk is greater.
- Seedling requests. Do not use seedlots with less than 85% germination percentage to minimize transplant shock at the nursery.

Planting program implementation

- **Key concept.** It is extremely important to plant the driest sites first following the order of snow melt. Identify the work order prior to pre-work with planters. Control the thaw schedule so that planters follow the work order identified.
- Create an operational trial area on all sites. This will allow frequent excavation and increased learning opportunities. Root excavations should be incorporated into all stocking surveys for these units.
- There will be situations where mechanical site preparation does not adequately cover a site and there is one or two intervening growing seasons prior to planting. Reforestation to adequate levels may be very difficult or unachievable. In these situations it is recommended to include direction in all treatment regime planting prescriptions to obstacle plant for shading purposes to increase numbers. Expect very high mortality where MSP was not possible.

Brushing

- Vegetation control for woody species should be avoided on dry sites. Most species, with the exception of pinegrass will provide some level of shade protection which overrides most concerns related to competition for moisture.

Monitoring and reporting

- Track replants separate from initial planting. This will make it easier to manage sites that have increased challenges. Adopt the coding PL-RP for sites that have been previously planted and failed due to drought mortality. Add a comment in the re-plant activity “Drought”.
- Surveys. Identify a survey regime for at-risk sites. Extremely dry and very dry sites should have summer and fall walkthroughs to better track plantation progress. Surveys should be completed within one year of planting and resurvey frequency should be no longer than two years until establishment is secure.
- Surveys. Review the treatment regimes recommended for dry sites with survey crews. Outline the factors that surveyors need to address on dry sites. Surveyors should include comments about which microsites show increased mortality and survival. Informed surveyors will contribute to improving planting prescriptions and planting microsite selection.

Regime Based Silviculture.

This is regime based silviculture. All aspects of the identified regime need to be implemented to allow the regime to work as intended. These regimes are intended to limit the need for re-planting. If the first planting treatment is unsuccessful, the risk rating will need to be re-evaluated. Do not attempt a re-plant without a thorough review of the previous plantation failure. Identify what caused the failure and determine if the site preparation will remain adequate at the time of proposed re-planting.

Extremely dry site treatment regime (IDFxh and other BGC subzones that have secondary features indicating a very xeric site)

Extremely dry sites will likely require the greatest disturbance. An increased focus on shading is required for seedling survival.

- Increased harvest retention for shading, and to act as a seed source (clumped or dispersed).
- Increased advanced regeneration retention for stocking.
- MSP the fall prior to planting, providing minimal time for pinegrass to ingress on the prepared spots. MSP should be very aggressive, providing horizontal and vertical displacement from the anticipated pinegrass response. Vertical displacement allows for planting seedlings in shaded aspects of the site prep, as well as decompaction and further separation from the pinegrass. Examples of very aggressive MSP are: stumping with additional large and deep raised screefs, excavator raised screefs that are large and deep, and deep ripper plow furrows. All MSP treatments should ensure the required disturbance is met throughout the treatment area with strong focus on areas operationally not conducive for easy disturbance, such as increased coarse fragments, increased slope and flat, compacted soils. Recommended vertical displacement is a minimum of 20cm with a target of 30cm below the mineral soil horizon. Horizontal

displacement is not as critical as vertical displacement. Trees should be planted a minimum of 30cm from competing vegetation. The intended planting spot is halfway between the soil horizon and above the bottom of the cut, in a shaded location. Planting in the bottom of site prep where soil is compact should be avoided.

- Stock size recommendation: use medium sized stock where the regime can be implemented fully, use large sized stock when the regime cannot be fully implemented. Small stock is not recommended. (See stock size guideline below). This is extremely important particularly for Douglas-fir.

Example stock size by species that are planted on dry sites. Source BCTS recommended seedling stock type selection. Interior/Spring

	Large	Medium	Small
Fdi	512A	412A	412B
Py	412A	410	310
Pli	412A	410	310

- Areas where it's not possible to achieve the most aggressive levels of disturbance should be reviewed and a new standards unit created. A new treatment plan will be necessary for these areas and will require solutions such as removal from NAR prior to harvest, adapting lower stocking standards (if the site can be classified differently), and planting with larger stock. Any planting proposed for these areas must be separated from the remainder of the opening and planted without intervening growing seasons between harvest and planting – trees will need to be moved or purchased to attempt reforesting these sites. Planting density will need to be elevated considerably – a minimum increase of 600 stems per hectare over target stocking is recommended
- Plant as early in the season as possible to provide the maximum time where soil moisture is adequate for root growth. Planting should startup immediately once the majority of site allows snow and frozen ground free conditions – undertake snow covered gullies at a later date.
- Plow roads where snow is affecting ability to access planting units which are snow or frozen ground free.
- Order PSI individually wrapped stock for the first units planned in the program. This allows planting to occur as soon as the site is substantially plantable without having to forecast two weeks in advance for a thaw request.
- Plant with a shade focused prescription. Shaded spots within site prep should be the focus of the planting prescription, working with planters to achieve this even where site prep orientation is not ideal (Example: plant south-facing mounds on the west side of the mound, adjacent to the cut, to provide some afternoon shade).

Very dry site treatment regime (Example: IDFDk and other BGC subzones that have secondary features indicating a very dry site)

Very dry sites will likely require a higher level of disturbance than normal dry sites. Additional shading is preferred but not required as in extremely dry sites. The regime for Extremely Dry sites should be followed, with the subsequent variations:

- MSP Examples of suitable site preparation are (in addition to those identified for extremely dry sites), double trenching, or single trenching where the treatment achieves the targeted level of disturbance. Recommended vertical displacement is a minimum of 15cm with a target of 20cm below the mineral soil horizon. Horizontal displacement is not as critical as vertical displacement. Trees should be planted a minimum of 20cm from competing vegetation. The target planting spot is 5cm below the hinge. Planting in the bottom of site prep where soil is compacted should be avoided.
- Plant as early in the season as possible to provide the maximum time where soil moisture is adequate for root growth. These sites do not require planting immediately after snow and frost free conditions but early planting is recommended. Planting startup is recommended within two weeks of the site being substantially free of snow and frozen ground.
- Plant with a shade focused planting prescription.

Dry site treatment regime (Example: MSxk and other BGC subzones that have secondary features indicating a dry site)

Dry sites will likely require a modest level of disturbance to provide protection from pinegrass. Additional shading is preferred but not as critical as protection from cattle. The regime for Extremely Dry sites should be followed with the subsequent changes:

- Examples of suitable MSP (in addition to those identified for extremely dry sites and very dry sites) are single trenching where the treatment achieves the targeted level of disturbance. Recommended vertical displacement is a minimum of 10cm with a target of 20cm below the mineral soil horizon. Trees should be planted a minimum of 25cm from competing vegetation (this is wider than recommended for extremely dry or very dry sites. The target planting spot is 5cm below the hinge. Plant with a microsite and cattle focused planting prescription. Planting in the bottom of trenches should be avoided to reduce cattle trampling and compacted soil.

Stumping treatment regime (for areas where stumping has been prescribed due to root disease incidence)

- Stumping should wait until fall prior to planting, providing no time for pinegrass to ingress on prepared spots. Stumping in conjunction with harvesting should be avoided for this reason.
- Stumping on all dry site categories requires additional raised screefs between stump holes to ensure adequate number of prepared spots.
- Planting position within prepared spots should maximize shading.

Raw planting regime (all site categories)

Situations and areas exist where it's not possible to provide adequate mechanical site preparation. These areas should be identified pre harvest or at the post-harvest assessment so an appropriate prescription can be applied.

- Accelerate the plan to reforest these sites. It will likely be required to plant these prior to mechanical site preparation activities. Transfer or purchase suitable seedlings for these sites and plant them with no intervening growing season to allow seedlings to establish where pinegrass influence is minimized.
- Plant with large stock. This may require regularly sowing large stock types on spec in order to get seedlings to problem sites as quickly as possible.
- Focus planting around obstacles for shade. Woody species should be used to provide shade where available. Maximize shaded obstacles by using minimum inter-tree distance.

There are situations where the harvest disturbance may be a suitable alternative to mechanical site preparation. Harvesting should be considered a weak site preparation treatment - this varies considerably due to season, slope, harvest method, soil texture and individual operators. If harvesting activities occur in a manner which prevents intervening growing seasons for pinegrass and creates enough disturbance to damage previously occupying pinegrass, raw planting may be successful. This regime carries considerable risk due to rapid encroachment of pinegrass.