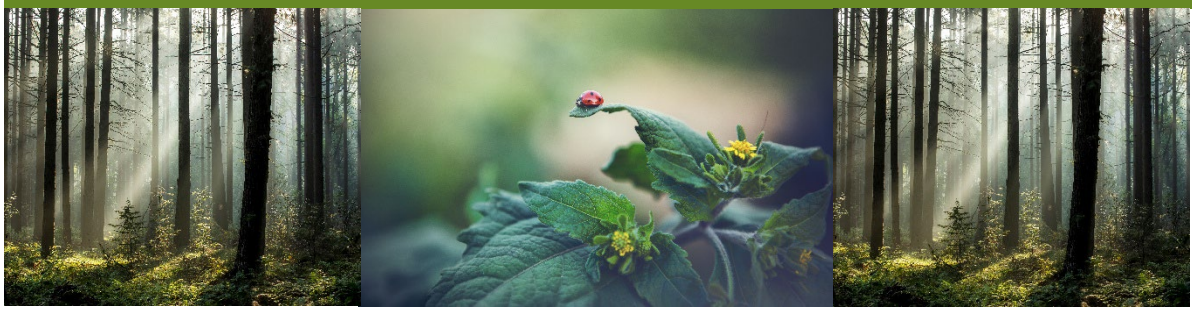
AREC FIELD PROCEDURES

Cariboo-Chilcotin Business Area



At Risk Ecological Communities (AREC) Field Assessment Procedures - Natural Disturbance Type 1 (NDT1)

1. Introduction / Preamble

These practical field assessment procedures have been developed for BC Timber Sales (BCTS) foresters and professional services contractors to follow when encountering a potential At Risk Ecological Community (AREC) during fieldwork. They provide step-by-step procedures for confirming an AREC location within Natural Disturbance Type 1 (NDT1). The distribution of NDT1 within BC is depicted in Figure 1. The spatial dataset for NDT1 is available from the BC Geographic Warehouse (BCGW), with the name WHSE_FOREST_VEGETATION.BEC_NATURAL_DISTURBANCE_SV.

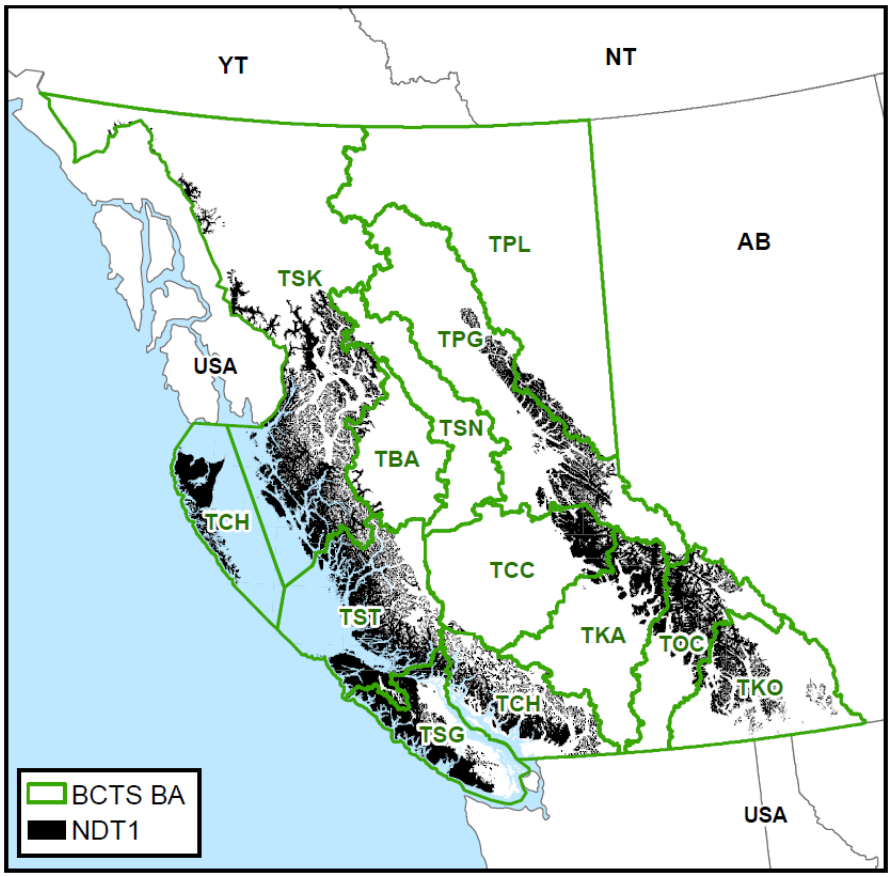


Figure 1: Distribution of NDT1 within BCTS Business Areas (BA)

All BCTS operations are certified under the Sustainable Forestry Initiative (SFI) Forest Management Standard. Indicator 4.2.2 states that certified organizations must have a program to locate and protect known sites of flora and fauna associated with viable occurrences of critically imperiled and imperiled species and ecological communities, defined as Forests with Exceptional Conservation Value.

In the BCTS context, an AREC is an ecological community that meets one or more of the following attributes:

- Red listed (Extirpated[1], Endangered, or Threatened) within the BC Conservation Data Centre (CDC) Species & Ecosystems Explorer database[2]– at greatest risk of being lost
- Blue listed (Special Concern) within the BC CDC Species & Ecosystems Explorer database
- Critically imperiled (G1/S1) or imperiled (G2/S2)[3]
- Red-listed or blue-listed on 'Schedules' of legislated Orders, including:
    - Great Bear Rainforest Order (GBRO) (replaced the Central and North Coast Land Use Order (LUO) & South Central Coast LUO in January 2016) – defined as plant communities
    - Haida Gwaii LUO – December 2010 (Amended April 2014 & September 2017)
- Identified Wildlife Management Strategy (IWMS) plant communities protected under the Forest and Range Practices Act (FRPA) Category of Species at Risk Government Actions Regulation (GAR) Orders:
    - Dates: May 6, 2004, June 5, 2006, & July 18, 2011

Note that some of the red- or blue-listed ecological/plant communities protected under legislation may not be listed, or may be listed under a different category within the BC CDC Species & Ecosystems Explorer database.

It is useful to understand the characteristics of NDT1 prior to undertaking fieldwork. The Biodiversity Guidebook (1995) defines NDT1 as "ecosystems with rare stand-initiating events." Prior to intensive logging practices, NDT1 ecosystems were characterized by uneven-aged or multi-storied even-aged stands. The disturbance type is dominated by gap phase dynamics – death of one to a few trees, with subsequent under and overstorey regeneration and infilling – nested within less frequent, larger disturbances, including wind, geomorphic events, and fires. Small disturbances from windthrow, fire, and landslides caused irregular openings in the landscape.

Average disturbance intervals were originally defined as 250 years for units of the Coastal Western Hemlock (CWH) and Interior Cedar Hemlock (ICH) Biogeoclimatic (BEC) zones, and 350 years for units of the Engelmann Spruce – Subalpine Fir (ESSF) and Mountain Hemlock (MH) BEC zones. On some exposed coastal areas, extreme ~100-year return interval windthrow events have occurred in the following BEC units: CWHvm1, CWHvm2, CWHvh1, and CWHvh2 (BC Ministry of Forests & BC Ministry of Environment, 1995). Refer to the AREC Field Assessment Procedures for NDT3 for fieldwork within those variants where ~100-year windthrow events are observed.

Recent work has redefined average disturbance intervals for some BEC units on the coast and in northeastern BC, as summarized in Appendix 3 of the Interim Assessment Protocol for Forest Biodiversity in British Columbia – Standards for Assessing the Condition of Forest Biodiversity under British Columbia's Cumulative Effects Framework – Version 1.0 (Provincial Forest Biodiversity Technical Working Group, 2020). Table 1 provides a summary of average disturbance intervals from this most recent work, as well as intervals that still apply from the original Biodiversity Guidebook (1995). In northeastern BC, BEC units were

[1] No extirpated AREC were extracted from BC Species & Ecosystems Explorer when developing the BCTS Business Area focus lists.
[2] The Glossary for Species & Ecosystems At Risk may be accessed here: https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/glossary-for-species-ecosystems-at-risk
[3] The Conservation Status Categories are defined here: https://explorer.natureserve.org/AboutTheData/DataTypes/ConservationStatusCategories

categorized into Natural Disturbance Units and Sub-Units for better alignment with unique characteristics defined for each category (DeLong C. , 2011; Provincial Forest Biodiversity Technical Working Group, 2020).

Table 1: Summary of average disturbance intervals for various BEC units within NDT1 (Provincial Forest Biodiversity Technical Working Group, 2020; BC Ministry of Forests & BC Ministry of Environment, 1995)

BEC Unit(s)*	**Average disturbance/return interval (years)**	**Natural Disturbance (Sub)Unit (Northeastern BC) – if applicable**
ESSFwc3	150	Boreal Foothills – Mountain
ICHwk1	150	Moist Trench – Valley
ESSFwk1	200	Moist Interior-Mountain
ICHvc, vk1, vk2, wk4	250**	
ESSFwc2	300	Moist Trench – Mountain
ESSFvc, wc4, wcw, wh1, wm2, wmw, wv	350**	
ESSFwk1	400	Cariboo Mountain Foothills
ICHwk2, wk3	600	Wet Trench – Valley
ESSFwc3, wk1	800	Wet Trench – Mountain
ESSFwc3	900	Wet Mountain
CWHvm1, vm2, wm	2,000	
CWHwh1, wh2, MHmm1, mm2, wh, wh1	3,000	
CHWvh1, vh2, vh3	10,000	

* BEC units listed here are in alignment with the Version 12 BCGW BEC spatial dataset

** From original Biodiversity Guidebook (1995)

2. Scope

These NDT1 AREC Field Assessment Procedures apply to all BCTS Business Areas with operating areas within this disturbance type (see Figure 1).

Primary resources needed to complete the fieldwork associated with identifying AREC within NDT1 are the appropriate Land Management Handbook (LMH) for the BEC unit, these procedures, the associated quick reference field card, and the appropriate BCTS Business Area AREC Focus Lists. Table 2 provides a summary of the appropriate LMH to use when working in the various BEC units, as well as the applicable BCTS Business Areas. Table 2 was derived from a GIS analysis that overlayed the BCTS Business Areas with the September 2nd, 2021 BEC and NDT dataset (WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY – Version 12), which was then cross-referenced with each LMH. As BEC units and LMHs are updated, Table 2 should be updated to reflect the changes.

The BCTS Business Area AREC Focus Lists provide references of key AREC to be aware of during fieldwork. These AREC were risk ranked highest due to parameters specified in the risk ranking process used to score all AREC downloaded from the BC Species & Ecosystems Explorer.

It should be noted that limited confirmed AREC have been mapped by the CDC within BC, and some red and blue listed ecological communities could be found outside their known range within BEC units that may not

be listed in the focus lists[4]. More information about confirmed AREC locations may be found within the BC CDC webpage and tools (BC Species & Ecosystems Explorer and CDC iMap). There are provincial standards for mapping and modelling ecosystems at risk, including utilizing Sensitive Ecosystems Inventory (SEI), Terrestrial Ecosystem Mapping (TEM), Predictive Ecosystem Mapping (PEM), or Broad Ecosystem Inventory (BEI) (Ministry of Environment, 2006).

Table 2: BEC units, LMHs, and BCTS Business Areas included in NDT1

BEC Unit	LMH Number(s)[5]	BCTS Business Area
CWHvh1	28	Chinook (TCH), Seaward/tlasta (TST), Strait of Georgia (TSG)
CWHvh2	26, 28	TCH, TST, Skeena (TSK)
CWHvh3	68	TCH, TSK
CWHvm1	26, 28	TCH, TST, TSK, TSG
CWHvm2	26, 28	TCH, TST, TSK, TSG
CWHwh1	28, 68	TCH
CWHwh2	28, 68	TCH
CWHwm	26	TSK
ESSFvc	20, 23*	Kamloops (TKA), Kootenay (TKO), Okanagan - Columbia (TOC)
ESSFwc2	20, 23*	TKA, TOC, Prince George (TPG)
ESSFwc3	29, 39	Cariboo - Cilcotin (TCC), TKA, Peace - Liard (TPL), TPG
ESSFwc4	20, 70	TKO, TOC
ESSFwcw	70	TCC, TKA, TKO, TOC, TPG
ESSFwh1	70	TKO, TOC
ESSFwk1	39, 51	TCC, TKA, TPG
ESSFwk2	29	TPL, TPG
ESSFwm2	70	TKO
ESSFwmw	70	TKO
ESSFwv	26	Babine (TBA), TSK, Stuart - Nechako (TSN)
ESSFwvw	26	TBA, TSK, TSN
ICHvc	26	TSK
ICHvk1	15, 20, 23*	TKA, TKO, TOC
ICHvk2	51	TPG
ICHwk1	20, 23*	TCC, TKA, TKO, TCO, TPG
ICHwk2	39	TCC, TKA
ICHwk3	15	TPG
ICHwk4	39	TCC, TPG
MHmm1	26, 28	TCH, TST, TSK, TSG
MHmm2	26, 28, 39	TBA, TCC, TCH, TKA, TSK, TSG, TST
MHwh	26, 28, 68	TCH
MHwh1	26	TST, TSK

* LMH 23 is expected to be replaced by LMH 76 (once the final version is released) for relevant geographic areas.

[4] Personal communication with Jason Straka, MSc, RPBio, Program Ecologist for the BC CDC.

[5] References for each LMH are as follows: LMH 15 (Meidinger, McLeod, MacKinnon, DeLong, & Hope, 1988), LMH 20 (Braumandl & Curran, 1992), LMH 23 (Lloyd, Angove, Hope, & Thompson, 1990), LMH 26 (Banner A. , MacKenzie, Thomson, Pojar, & Trowbridge, 1993), LMH 28 (Green & Klinka, 1994), LMH 29 (DeLong, Tanner, & Jull, 1994) LMH 39 (Steen & Coupé, 1997), LMH51 (DeLong C. , 2003) LMH 68 (Banner A. , et al., 2014), and LMH 70 (MacKillop & Ehman, 2016).

3. Experience Considerations

To effectively identify potential AREC in the field, it is beneficial for the assessor to have the following experience:

- Knowledge of local indicator plants, and ability to identify them in the field
- Familiarity using BEC field guides (LMHs)
- Experience in field identification and confirmation of BEC site series within the local geographic location
- Proficiency collecting and preparing ecological data for cutblock Site Plans (Registered Professional Forester (RPF) OR an experienced professional field ecologist (Registered Professional Biologist (RPBio))

If the assessor does not meet the competency requirements listed above, they should work under the direct supervision of an assessor who does meet them (Site Plan Forester or Ecologist).

4. Field Procedures

These field procedures have been developed based on the Biodiversity Guidebook (1995), the Field Manual for Describing Terrestrial Ecosystems – 2nd Edition (2010), and the guidance provided within the Guidelines to support implementation of the Great Bear Rainforest Order with respect to Old Forest and Listed Plant Communities - LMH 72 (Banner, Meidinger, Green, & Saunders, 2019). Although LMH 72 was developed specifically for assessing plant communities on the coast, it provides the best practical field assessment advice for this type of work in BC. A simplified, practical approach is used in these field procedures.

These field procedures help assessors determine whether a potential AREC meets the description of a red or blue listed ecological community, as per the following steps:

4.1 Office Prework;
4.2 Potential AREC & Site Series Observations (STEP 1);
4.3 Tree/Plant Species Identification, AREC Description Confirmation, Area, and Stand Age (STEP 2);
4.4 Stand Maturity Assessment (STEP 3);
4.5 Biodiversity Attributes Assessment (STEP 4); and
4.6 Field Form & Operability Observations (STEP 5).

Fieldwork Timing Considerations

Fieldwork should take place during the growing season, in the absence of snow. In spring, assessments may be undertaken several weeks after snowmelt, when deciduous understorey shrubs and herbs have started to appear, leaf out, and bloom. In the absence of drought, summer provides the best season for observing the full range of vegetation growing under the forest canopy, and therefore the best conditions for assessing potential AREC. Assessments should be completed prior to fall dieback of understorey vegetation. Seasonality of fieldwork will vary depending on BEC zone and location. Example windows for fieldwork along southern BC's low elevation coast are from May to October, whereas the northern interior window may be limited from June/July to August/September, depending on snowmelt and early season dieback.

4.1 Office Prework

Prior to beginning fieldwork, office prework should be completed to gain valuable information about the development area/area of interest (AOI):

- ☐ Review the following spatial data within the AOI, using iMap, Geographic Information Systems (GIS), or a similar mapping program:
  - ☐ NDT[6] (to ensure the correct field assessment procedure is used) – WHSE_FOREST_VEGETATION.BEC_NATURAL_DISTURBANCE_SV from BCGW.
  - ☐ BEC unit (zone / subzone / variant / phase) – WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY from BCGW.
  - ☐ Optional: TEM (common for coastal BC) or PEM (more common in BC's interior) – check Terrestrial Ecosystems Data & Information (TEI) project index maps online (Province of BC, 2023) and/or search for data from the BCGW. TEM or PEM data may be used to gain an idea of site series locations, but site series must be field confirmed.
  - ☐ Known red or blue listed ecological community locations – WHSE_TERRESTRIAL_ECOLOGY.BIOT_OCCR_NON_SENS_AREA_SVW from BCGW for publicly available occurrences. Other datasets for masked, sensitive occurrences are available from BCGW as well.
- ☐ Review the AREC Focus List for the relevant BCTS Business Area:
  - ☐ Note AREC names for the BEC unit(s) within the AOI (the AREC Focus List spreadsheet is easily filtered). If working within the GBRO (2016) areas, refer to Appendix A to ensure all AREC within the BEC unit are noted. Some GBRO (2016) blue-listed plant communities within NDT1 are not included in the focus lists, and/or the BC Species & Ecosystems Explorer.
  - ☐ Review AREC descriptions on the BC Species & Ecosystems Explorer (if available[7]) and ensure ability to identify the occurrence in the field. For example, Sitka spruce / salmonberry Very Wet Maritime may occur within the CWHvm1/09. By clicking on the scientific name link in a BC Species & Ecosystems Explorer search, a list of reports and references appears, including the BC Community Summary.
  - ☐ Review the relevant LMH to gain additional information about the AREC. Refer to the written descriptions and vegetation prominence tables within for the site series and geographic area.
  - ☐ Note AREC key characteristics, such as tree canopy species, shrub/herb/moss layer species and relative cover, soil textures, soil moisture regime (SMR), soil nutrient regime (SNR), forest productivity, and any other identifying qualities. This is extremely important to be aware of prior to fieldwork, so potential AREC may be easily identified.
  - ☐ The assessor should develop their own library of AREC descriptions specific to their BEC unit working areas to ensure due diligence.

[6] NDT is also included as an attribute within the BEC spatial data from the BCGW.
[7] Limited Ecological Community Summaries are available from the CDC. Where unavailable, refer to the relevant LMH.

- ☐ Gather an idea of stand age prior to fieldwork. Refer to Vegetation Resource Inventory (VRI), from BCGW and speak with field personnel who already know or can estimate stand age.

4.2 Potential AREC & Site Series Observations (STEP 1)

Potential AREC observations are usually completed as part of Site Plan field data collection, but could be observed during any fieldwork[8]. Assessors should carry a copy of their office prework notes, applicable LMH, and NDT1 field reference card. During fieldwork, a Site Plan Plot Card may be used to gather initial reconnaissance data where tree and plant species observations match AREC names from the BCTS business area focus list or GBRO (2016) schedules. Where a potential AREC is observed in the field, it is important that the tree and plant species relative abundance and percentages are in alignment with the AREC descriptions and vegetation tables gathered during the office prework stage. The observed site series does not need to match the AREC Focus List spreadsheet, because the downloaded CDC data might not include all BEC units/site series the AREC is found in. The CDC data is limited to the current known range for each AREC. However, where observed site series match the AREC focus list in addition to AREC descriptions and vegetation tables, more evidence can be applied towards confirming the AREC.

Potential AREC site series may be observed as per the following two definitions:

> 1) **a discrete observation** – a single site series, or almost entirely a single site series which supports a BCTS focus list or GBRO (2016) AREC; or,
> 2) **a complex observation** - a mosaic of two or more site series (unable to be mapped separately due to spatial complexity[9]) which supports one or more BCTS focus list or GBRO (2016) ARECs.

If a discrete or complex potential AREC observation is encountered during fieldwork, apply the appropriate field decision-making procedures as outlined in STEP 1 below. Work through the steps in the order they appear. If a statement does not apply, or there is no direction to skip to a specified step, proceed directly to the next statement. For example, if 1.1 does not apply, proceed to 1.2, and so forth for all field procedures steps.

> **STEP 1**: A discrete or complex potential AREC observation is encountered during fieldwork. Apply location-specific procedures:
>
> 1.1 The potential AREC observation is located within the GBRO Central/North Coast Area or GBRO South Central Coast Area AND matches the information listed in Appendix A (Table 4 and/or Table 5), as collated from the red-listed and blue-listed GBRO (2016) schedules N and O for NDT1. → Follow the decision-making process in LMH 72 and refer to the GBRO Field Reference Card. Do not apply these BCTS field procedures.
>
> 1.2 The potential AREC observation is not listed in Appendix A and the GBRO (2016) schedules N and O. → Proceed to STEP 2.

[8] Proficiency with ecological Site Plan field data collection is required. Methodology is beyond the scope of this document.
[9] Definitions established based on listed community definitions within LMH 72 (Banner, Meidinger, Green, & Saunders, 2019).

4.3 Tree/Plant Species Identification, AREC Description Confirmation, Area, and Stand Age (STEP 2)

STEP 2-A applies diagnostic questions to confirm the potential AREC meets descriptions and classification parameters available from the office prework and relevant LMH. The AREC name sometimes represents the dominant tree and understorey species present. For example, as per LMH 28, observations for Sitka spruce / salmonberry Very Wet Maritime (CWHvm1/09) would include Sitka spruce as the dominant tree species, and salmonberry as one of the dominant shrub species. Other understorey species should be present as per the vegetation summary from BC Species & Ecosystems Explorer, and the Vegetation Table from LMH 28. Not all vegetation from the summaries and tables must be present for an occurrence to be considered as a potential AREC.

The AREC description confirmation requires professional judgement and due diligence.

STEP 2-A: Ask the following questions, and record supportive data:

2-A.1 Is the potential AREC observation located within a forested[10] ecosystem? → If **YES**, proceed to STEP 2-A.2 → If **NO**, proceed to STEP 2-A.3.

2-A.2 Is the site series able to support an AREC at mature and old stages of forest development?
The stand should be exhibiting signs of mid to late successional status[11] with a structural stage of 6 - mature or 7 - old[12]. See Appendix B for complete definitions. → Take notes and photos to support your answer. If **YES**, proceed to STEP 2-A.3. → If **NO**, the observation is not an AREC. Assessment complete.

2-A.3 Is the vegetation summary from BC Species & Ecosystems Explorer (if available) and the description/vegetation table from the relevant LMH in alignment with the tree/plant species observations for the potential AREC? If there is no vegetation summary available from BC Species & Ecosystem Explorer, refer only to the description/vegetation table from the relevant LMH when answering this question. → Take notes to support your answer of **YES** or **NO**. → If **NO**, AND within a non-forested ecosystem, the observation is not an AREC. Assessment complete. → Otherwise, proceed to STEP 2-B.

STEP 2-B involves determining the area occupied by the potential AREC, estimating stand age, and estimating veteran tree count. If the ecosystem is non-forested, stand age and veteran tree count is not required. These determinations may be completed concurrently during a walk-through mapping exercise.

[10] Forested ecosystems are defined as having ≥ 10% average cover of trees ≥ 10 m tall. If there is continuous tree cover of trees < 10 m tall, these sites are also considered to be forested (e.g., bog woodlands) (MacKenzie, 2012).
[11] Mid-successional stands usually have two cohorts with one dominant overstorey layer and one younger regenerating layer (BC Ministry of Forests and Range & BC Ministry of Environment, 2010). Later successional stands will eventually mature into old climax characteristics, with well-developed vertical structure, dead wood (standing and on the forest floor), canopy gaps, and well-developed plant communities.
[12] Definitions for structural stages of mature and old are in alignment with mid to late successional stages. Refer to the Site Description section of LMH 25 for complete definitions (BC Ministry of Forests and Range & BC Ministry of Environment, 2010).

Mapping the area occupied by the potential AREC will indicate whether the observation is large enough to qualify as a confirmed AREC.

Stand age estimations are used to support determination of successional (seral or developmental) forest stages, e.g. mid/mature or late/old succession/structure. Table 3 (following page) summarizes stand age categories for BEC zones within NDT1 (Biodiversity Guidebook, 1995; Landscape Unit Planning Guide, 1999).

Veteran trees are living remnants that survived a previous stand-replacing disturbance (e.g. wildfire, windthrow, disease, or logging), and are much older than the rest of the stand (Banner, Meidinger, Green, & Saunders, 2019; BC Ministry of Forests, 2022). They are usually recognized as being much larger in diameter and height than other trees in the stand. For the purposes of these BCTS AREC field procedures, and in accordance with LMH 72, veteran trees are categorized as ≥ 200 years old.

Table 3: Seral Stage Stand Ages for BEC Zones within NDT1

BEC Zone	Mature	Old
CWH	> 80 yrs	> 250 yrs
ICH	> 100 yrs	
ESSF & MH	> 120 yrs	

STEP 2-B: Map the potential AREC location using GPS or accurate iPad tracks/mapping. Stand age and veteran tree count (stems per hectare(sph)) may be estimated at the same time. If the ecosystem is non-forested, stand age and veteran tree count is not required.

If the forest is not obviously old (> 250 years), collect age cores at breast height (1.3 m from high side ground) from at least 5 of the largest diameter, living trees in the main canopy (excluding veteran trees). Estimate ages by counting the rings and adding estimated age to breast height age based on the following (BC Ministry of Forests, 2022):

- Fd, Lw, Pl, Pw, Py → add 10 years
- Hw, Cw, Se, Sx, Ss, Bl, Ba, Bg → add 15 years

If the pith was not obtained from coring, apply Best Practices for Coring and Aging Trees to Determine Stand Age in older forests - available from Appendix 4 of Field Verification of Priority Old Forest Deferral Areas: Technical Guidance (2022). Determine the average stand age based on the 5 estimated tree ages. If the forest is obviously old, recommend coring at least one tree to confirm it is > 250 years old.

If the stand is < 250 years old, and veteran trees are present, recommend coring one or two veteran trees to confirm the veteran trees are ≥ 200 years old. During mapping, establish whether veteran tree count is ≥ 20 sph, 10-20 sph, or < 10 sph. Calculate average veteran tree density based on a few fixed radius (25 m) plots/ha[13]. Even if the potential AREC observation is less than 1 ha, ensure to calculate veteran density over at least 1 ha to avoid introducing bias.

2-B.1 The **discrete observation** covers **≥ 0.25 ha** OR the **complex observation** covers **≥ 2.0 ha**[14] → Proceed to STEP 2B-3.

[13] Based on LMH 72 (Banner, Meidinger, Green, & Saunders, 2019).
[14] Size criteria based on GBRO listed plant community requirements (Schedules N & O).

2-B.2 The discrete observation covers < 0.25 ha OR the complex observation covers < 2.0 ha → The observation is not large enough to be an AREC. Assessment complete.

2-B.3 The observation is within a non-forested ecosystem → **Observation is a confirmed AREC**. Proceed to STEP 5.

2-B.4 The stand age is obviously old at > 250 years → **Observation is a confirmed AREC**. Proceed to STEP 5.

2-B.5 The stand age is ≤ 250 years AND the answer from STEP 2-A.3 is **YES** → Proceed to STEP 3.

2-B.6 The stand age is ≤ 250 years AND the answer from STEP 2-A.3 is **NO** → The observation is not old enough, nor has the right species composition to be an AREC. Assessment complete.

4.4 Stand Maturity Assessment (STEP 3)

The stand maturity assessment is applied after stand age and veteran tree count estimations (STEP 2-B). This step applies a decision-making key to determine potential AREC confirmation where the stand is not obviously old, but has old forest characteristics. The key is based on mature stand age for the BEC zone (Table 3), and veteran trees present with ages ≥ 200 years. Veteran tree thresholds of ≥ 20 sph, indicating old forest characteristics, were established based on Field Verification of Priority Old Forest Deferral Areas: Technical Guidance (2022).

STEP 3: Work through the following decision-making key:

3.1 BEC zone is CWH, stand age is > 80 years, and contains ≥ 20 sph of veteran trees. → AREC has old forest characteristics. **Observation is a confirmed AREC.** Proceed to STEP 5.

3.2 BEC zone is ICH, stand age is > 100 years, and contains ≥ 20 sph of veteran trees. → AREC has old forest characteristics. **Observation is a confirmed AREC.** Proceed to STEP 5.

3.3 BEC zone is ESSF or MH, stand age is > 120 years, and contains ≥ 20 sph of veteran trees. → AREC has old forest characteristics. **Observation is a confirmed AREC.** Proceed to STEP 5.

3.4 BEC zone is CWH, stand age is > 80 years, and contains < 20 sph of veteran trees. → Proceed to STEP 4.

3.5 BEC zone is ICH, stand age is > 100 years, and contains < 20 sph of veteran trees. → Proceed to STEP 4.

3.6 BEC zone is ESSF or MH, stand age is > 120 years, and contains < 20 sph of veteran trees. → Proceed to STEP 4.

3.7 BEC zone is CWH and stand age is ≤ 80 years **OR** BEC zone is ICH, and stand age is ≤ 100 years **OR** BEC zone is ESSF or MH, and stand age is ≤ 120 years. → The stand is not old enough to be an AREC. Assessment complete.

4.5 Biodiversity Attributes Assessment (STEP 4)

Based on the Biodiversity Guidebook (1995) and LMH 72, there are several important stand attributes that contribute to higher biodiversity levels in mature stands. Where the potential AREC observation was classified as mature (see Table 3 for age categories based on BEC unit), with < 20 sph veteran trees in STEP 3, they may be further assessed in STEP 4. If all suggested biodiversity attributes listed in the STEP 4 criteria are met, the AREC observation should be confirmed.

STEP 4 requires professional judgement and due diligence. Where not all STEP 4 criteria are met, and the assessor believes the AREC observation should be confirmed, they should make a case to the BCTS Business Area contact outlining why they believe the observation is a confirmed AREC.

STEP 4: Does the AREC observation, assessed as mature in age, meet the following criteria?

- ☐ 10-20 sph veteran trees (≥ 200 years old)
- ☐ > 14 sph dead trees
- ☐ Common pieces of large downed woody debris
- ☐ Significant vertical structure – a variety of canopy layers > 2 cohorts
- ☐ 10-30% crown closure
- ☐ Patchy to well-developed understorey shrub and herb cover
- ☐ Previous disturbance history was natural (fire or wind) or selective harvest

If **NO,** the observation does not have enough biodiversity attributes to qualify as a confirmed AREC.

If **YES**, **observation is a confirmed AREC.** → Proceed to STEP 5.

4.6 Field Form & Operability Observations (STEP 5)

STEP 5: Complete the BCTS Species At Risk (SAR) Field Observation form (or similar), and take representative photos. Suggested plot size is 10 m x 10 m. Minimize edge effects by establishing the plot at least one tree length into the stand from any edges. At minimum, record the following information:

- Observer Details: Observer's Name, Date Observed, Location Information
- AREC Observations: AREC Name, BEC unit (zone / subzone / variant / phase), site series, SMR, SNR, Area/size of AREC, List of vegetation and percent coverage (tree species, shrubs, herbs, mosses/lichens [see examples of foliage estimates for individual plants in Figure 2, and of vegetation stratums in Figure 3 - total percent coverages by layer/stratum may not exceed 100%, but percent coverages by individual species within a stratum could exceed 100% when there are vegetation overlaps]), Answers to the questions in 2-A, Comments to support assessment (e.g., assessment completed within NDT1, which steps were completed to confirm the AREC, etc.).
- Supportive information (forested ecosystems only): Record stand age and how age was estimated. Include tree core data (species, ring count, etc.), where applicable. If the stand is younger than 250 years, record estimated veteran tree age, and sph.

- Photos: Take photos in each of the cardinal directions, of the representative vegetation, and of the tree crown.

Operability Observations

Take notes about the confirmed AREC location. Is the AREC located in an operable area? Is the area harvestable or not? Is the AREC already located within a reserve? Is the AREC located near established protected areas? Is the AREC location impeding access to current or future development? Are there any safety issues?

Field assessment is complete. Ensure all data are collected, and consider the next steps when back in the office (see Section 5).

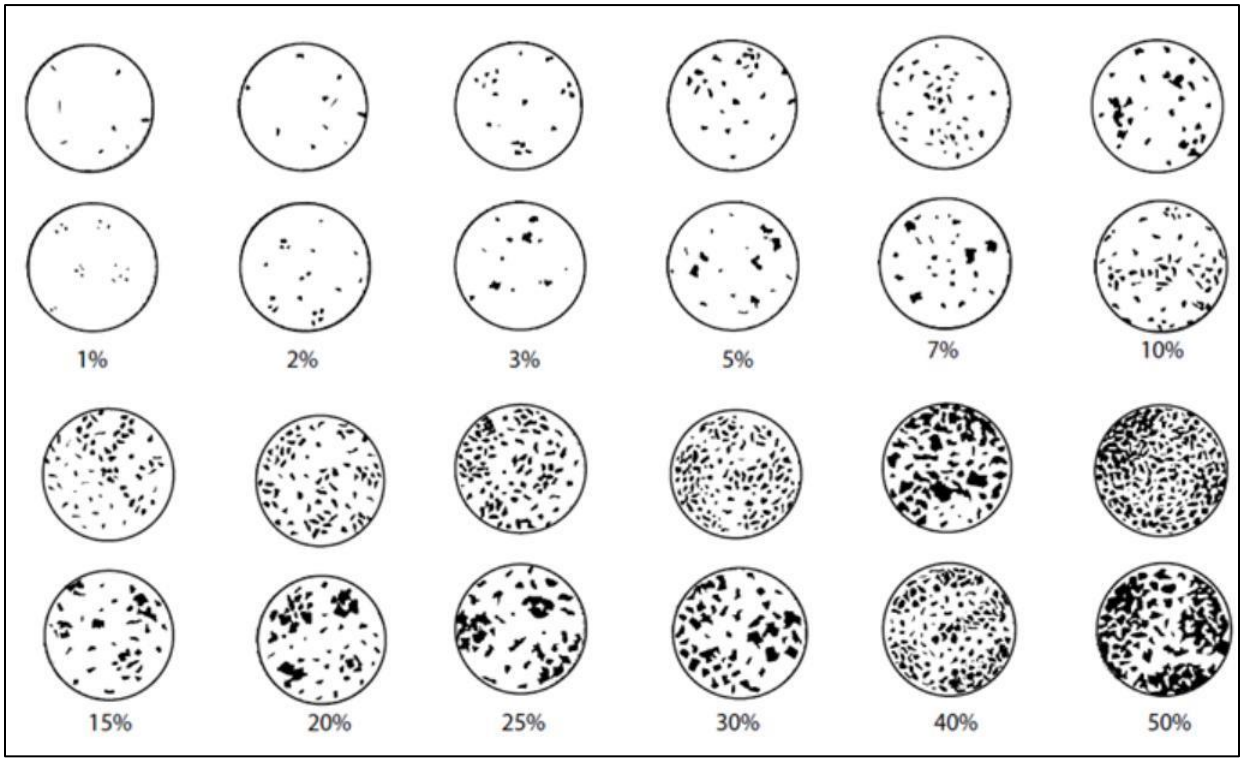


Figure 2: Visual representations of foliage percent estimates – from LMH 25 (BC Ministry of Forests and Range & BC Ministry of Environment, 2010)

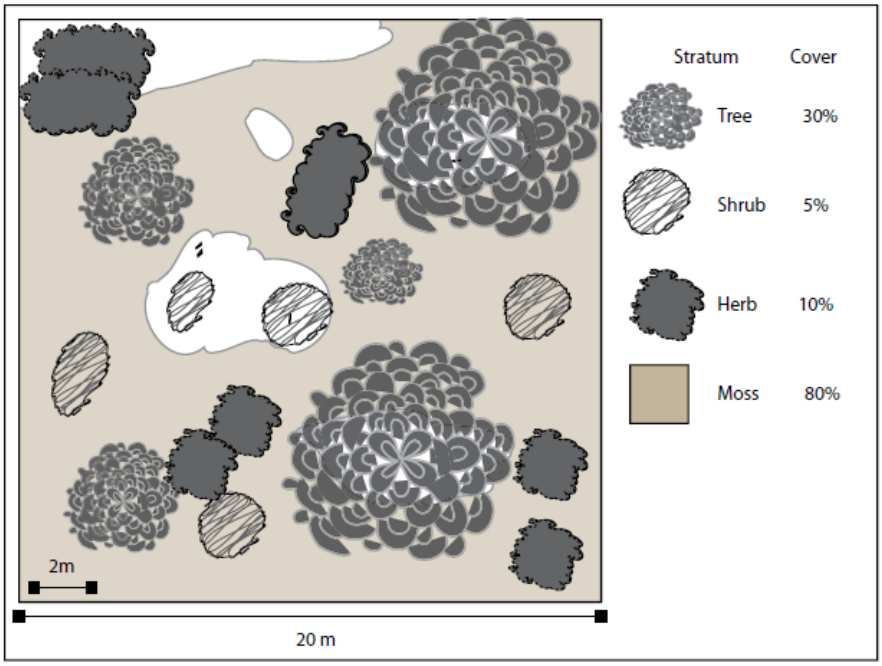


Figure 3: Bird's eye view of example vegetation stratums in a plot – from LMH 25 (BC Ministry of Forests and Range & BC Ministry of Environment, 2010)

5. Next Steps

Report the confirmed AREC observation to the appropriate BCTS contact. Provide all field data, including GPS or iPad tracks, plot data, photos, SAR Field Observation Form (or similar), and additional notes. Consult with any existing AREC management guidelines within the Business Area and Ministry region, such as local BMPs or SOPs, to develop a stand level management option. If necessary consult with a qualified registered professional. BCTS will submit details of the confirmed AREC to the BC Conservation Data Centre using the Incidental Observations submission process, where applicable.

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Appendix A

Table 4: GBRO (2016) Red-Listed Plant Communities within NDT1

GBRO Area	BEC unit	English Name
Central/North Coast	CWHvh2 CWHvm1 CWHwm	dune wildrye - beach pea
Central/North Coast	CWHvh2/Wf51 CWHvm1/Wf51 CWHvm2/Wf51 CWHwm/Wf51 MHmm1/Wf51	Sitka sedge / peat-mosses
Central/North Coast	CWHvh2/Wf52 CWHwm/Wf52	sweet gale / Sitka sedge
Central/North Coast South Central Coast	CWHvh2/08	Sitka spruce / false lily-of-the-valley Wet Hypermaritime 1
Central/North Coast South Central Coast	CWHvh2/09	Sitka spruce / tall trisetum
Central/North Coast South Central Coast	CWHvm1/09	Sitka spruce / salmonberry Very Wet Maritime
Central/North Coast South Central Coast	MHmm1/00	pearly everlasting - leafy aster
Central/North Coast South Central Coast	MHmm1/00	spreading phlox - Wallace's selaginella
South Central Coast	CWHmm1/03	western hemlock - western redcedar / salal Moist Maritime 1
South Central Coast	CWHmm1/05	amabilis fir - western redcedar / three-leaved foamflower Moist Maritime 1
South Central Coast	CWHmm1/06 CWHmm2/06	western hemlock - amabilis fir / deer fern Moist Maritime
South Central Coast	CWHmm1/07	amabilis fir - western redcedar / salmonberry Moist Maritime 1
South Central Coast	CWHmm1/Wf52 CWHmm2/Wf52 CWHvh2/Wf52	sweet gale / Sitka sedge
South Central Coast	CWHmm1/Wf53 CWHmm2/Wf53	slender sedge - white beak-rush
South Central Coast	CWHmm1/Wm51	three-way sedge
South Central Coast	CWHvh1	dune bluegrass Herbaceous Vegetation
South Central Coast	CWHvh1 CWHvh2 CWHvm1	dune wildrye - beach pea
South Central Coast	CWHvh1/00	large-headed sedge Herbaceous Vegetation
South Central Coast	CWHvh1/08	Sitka spruce / false lily-of-the-valley Very Wet Hypermaritime1
South Central Coast	CWHvh1/09	Sitka spruce / tall trisetum
South Central Coast	CWHvh2/Wf51 CWHvm1/Wf51 CWHvm2/Wf51 MHmm1/Wf51	Sitka sedge / peat-mosses

Table 5: GBRO (2016) Blue-Listed Plant Communities within NDT1

GBRO Area	BEC unit	English Name
Central/North Coast South Central Coast	CWHvh1/04	western hemlock - Sitka spruce / lanky moss
Central/North Coast South Central Coast	CWHvh1/06	western redcedar - Sitka spruce / three-leaved foamflower*
Central/North Coast South Central Coast	CWHvh1/07	western redcedar - Sitka spruce / devil's club Very Wet Hypermaritime
Central/North Coast South Central Coast	CWHvh1/10	red alder / salmonberry / common horsetail
Central/North Coast South Central Coast	CWHvm1/04 CWHvm2/04	western redcedar - western hemlock / sword fern
Central/North Coast South Central Coast	CWHvm2/Ws54	western redcedar - western hemlock - skunk cabbage**
South Central Coast	CWHmm1/01 CWHmm2/01	western hemlock – amabilis fir / pipecleaner moss
South Central Coast	CWHmm1/02 CWHmm2/02	Douglas-fir – western hemlock / salal Moist Maritime
South Central Coast	CWHmm1/11	lodgepole pine / peat-mosses
South Central Coast	CWHmm1/12	western redcedar – Sitka spruce / skunk cabbage
South Central Coast	CWHmm1/20 CWHvh1/20	western redcedar – bluffs**
South Central Coast	CWHmm2/03	western hemlock - western redcedar / salal Moist Maritime 2

* Not currently in the BCTS focus lists. Is on the BC Species & Ecosystems Explorer as Yellow listed, GNR.
** Not currently in the BCTS focus lists, nor the BC Species & Ecosystems Explorer

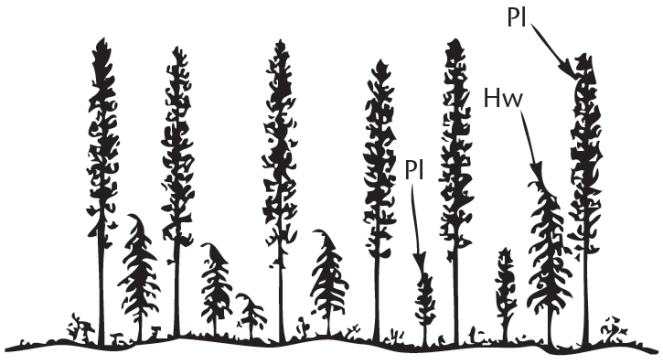
Appendix B

A summary of definitions referred to in STEP 2-A.2. The following definitions, examples and diagrams have been quoted from the Field Manual for Describing Terrestrial Ecosystems 2nd Edition (2010). Examples are not always characteristic of NDT1.

Mid Successional Status - includes ***Maturing Seral***, ***Overmature Seral***, and ***Young Climax*** stands, as per the following:

"***Maturing Seral:***
Community of early-successional tree species that have generally gone through an initial natural thinning due to species interactions such as within-stand competition for light or root-growing space, or a community where mid-successional species dominate. Very open stands may not go through a stem exclusion phase but could have a succession of understorey plant species occurring.

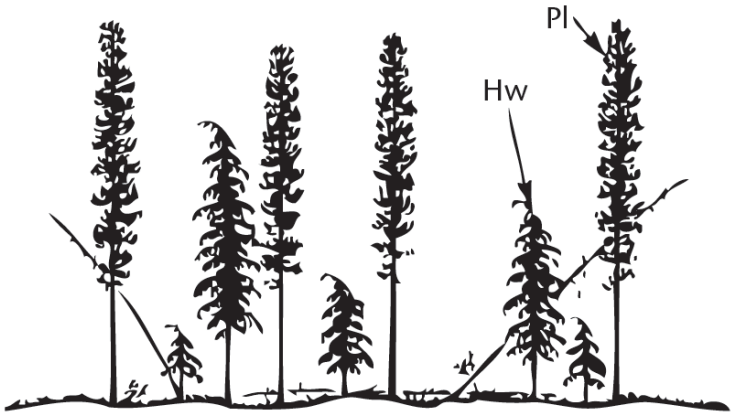
- Trees of mature age (generally 60–140 years old).
- Generally two cohorts: one in the overstorey and a younger one in the regeneration layer, usually of species with greater shade tolerance, but may include a component of species that are the same as the overstorey (e.g., fluvial cottonwood stands).
- Includes stands subject to frequent stand-replacing disturbances where regeneration to another cohort may be limited or absent, but where the stand has matured through natural thinning and development of the community, and the expected regeneration for the climate and ecosystem is to another, more shade-tolerant species.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.



Maturing seral stand

Overmature Seral:
Community where the seral overstorey species of the main upper canopy are dying.

- Usually > 140 years old.
- Typically with a secondary tree canopy consisting of more shade-tolerant species, or some of the same species as those dying; some individuals belonging to the secondary cohort may have entered the main canopy.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.

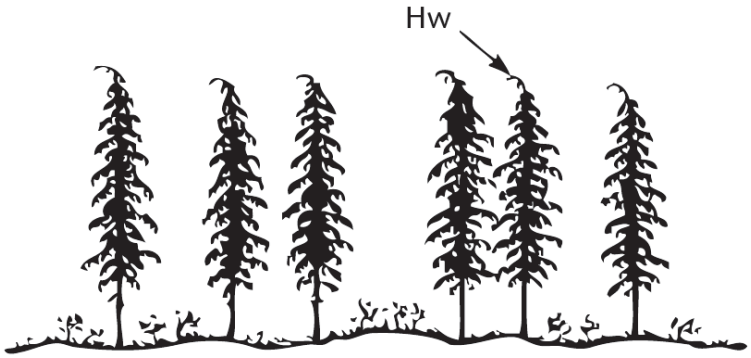


Overmature seral stand

Young Climax:

Community contains tree species typical of the climax expected for the site, but the proportional composition and structure expected at later climax stages has not developed; understorey seral species are usually still evident. This stage may follow the development and death of a stand of seral species or may develop from climax species regeneration on a recently disturbed site.

- In cases where climax tree species are the initial cohort, stands can be young (<30 years); this often occurs in wetter climates where stand-replacing fires are infrequent.
- Includes previously recognized Young Climatic Climax and Young Edaphic Climax stages.
- Examples: young subalpine fir – Engelmann spruce stand in a wet subalpine climate; young ponderosa pine stand in a dry climate where it would be the fire-maintained climax species; 50-60 year old hybrid white spruce stand 'released' from canopy of 100 year old lodgepole pine killed by mountain pine beetle."

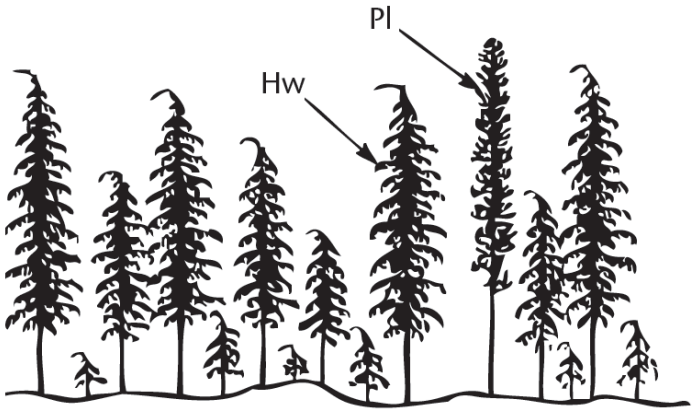


Young climax stand

Late Successional Status - includes ***Maturing Climax***, and ***Old Climax*** stands, as per the following:

"***Maturing Climax:***
Community composed of species in proportions more or less typical of late succession for the site; the stand has undergone natural thinning, and vertical structure has developed, but lacks the complex structure typical of old forests.

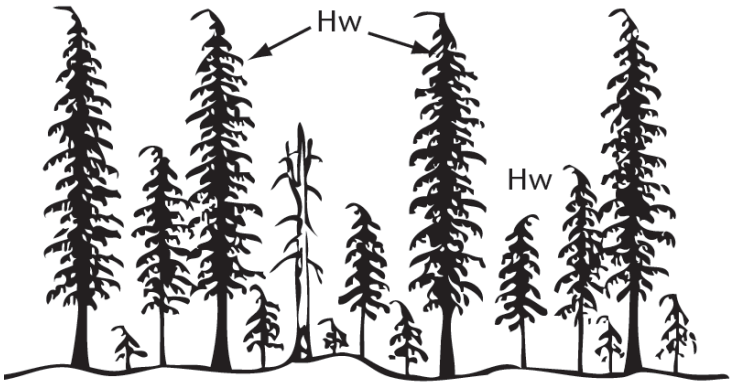
- Differs from [Young Climax] in having a typical mature forest understorey herb and shrub community; stands are developing continuous diameter and height class distributions of climax tree species; seral species may still exist.
- Stands are at least 80–120 years old, but usually older.
- Includes previously recognized Maturing Climatic Climax and Maturing Edaphic Climax stages.
- Examples: mature western redcedar – western hemlock forest with component of Douglas-fir in canopy; mature hybrid white spruce on high-bench floodplain with a developing understorey of multiple cohorts of spruce regeneration.



Maturing climax stand

Old Climax:
The plant community is composed of species expected to be present in the climax stand; vertical structure is well developed; live-tree decay is evident and tree death has led to canopy gaps and large woody debris on the forest floor; often with well developed and distinct epiphytic communities.

- Occasionally, very long-lived seral species (e.g., Douglas-fir) are present, as a minor component of stand, but their removal would not cause a significant change in the growth or establishment of the climax trees.
- Differs from MC in having better-developed vertical and horizontal structure and a more or less continuous age and height class distribution of climax tree species.
- Stands are at least 250 years old, but often much older.
- Examples: very old coastal forests, including subalpine mountain hemlock – amabilis fir or hypermaritime western hemlock – western redcedar – yellow-cedar – shore pine; western redcedar – Devil's club forest with epiphytic stubble-lichens in interior rainforest climate.



Old climax stand

Structural Stage 6: Mature Forest - Understorey reinitiation stage:
"Trees established after the last stand-replacing disturbance have matured; a second cycle of shade-tolerant trees may have become established; shrub and herb understories become well developed as the canopy opens up; time since disturbance is generally 80–140 years for BGCs with NDT 3 and 80–250 years for NDT 1, 2 & 4."

Structural Stage 7: Old Forest - Old-growth stages:
"Stands of old age with complex structure; patchy shrub and herb understories are typical; regeneration is usually of shade-tolerant species with composition similar to the overstorey; long-lived seral species may be present in some ecosystem types or on edaphic sites. Old growth structural attributes will differ across biogeoclimatic units and ecosystems."

Structural Stage 7a: Old Forest
"Stands with moderately to well developed structural complexity; stands comprised mainly of shade-tolerant tree species in canopy and regeneration layers, although older seral trees from a disturbance such as fire may still dominate the upper canopy; fire-maintained stands may have a 'single-storied' appearance; time since stand-replacing disturbance is generally 140 – 250 years for biogeoclimatic units with NDT 3 and > 250 years for NDT 1, 2 & 4."

Structural Stage 7b: Very Old Forest
"Very old stands having complex structure with abundant large-sized trees, snags and coarse woody debris (size is relative to the specific ecosystem); snags and CWD occur in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species with well-established canopy gaps; time since stand-replacing disturbance generally > 250 years for BGCs with NDT 3 and > 400 years for NDT 1, 2 & 4."

At Risk Ecological Communities (AREC) NDT1 Field Reference Card p.1

STEP 1 – Potential AREC & Site Series Observations

Discrete or complex potential AREC observed & site series identified

1.1 Located within GBRO Central/North Coast Area or South Central Coast Area & listed on GBRO schedules N or O

Follow decision-making process in LMH 72. Refer to GBRO Field Reference Card

1.2 Not listed on GBRO schedules N or O

STEP 2 - Tree/Plant Species Identification, AREC Description Confirmation, Area, and Stand Age

A

2-A.1 Is the potential AREC observation located within a forested ecosystem (≥ 10% tree cover ≥ 10 m tall or continuous tree cover < 10 m tall)?

No

Yes

2-A.2 Is the site series able to support an AREC at mature and old stages of forest development?

No → No further action

Yes → Mid to late successional status Structural stage 6 or 7

2-A.3 Note whether prework AREC summaries* & BEC descriptions/ vegetation table are in alignment with field observations – **Yes** or **No**

If NO AND within a non-forested ecosystem. No further action.

Go to 2-B.1 if in a forested ecosystem, or if YES AND within a non-forested ecosystem.

B

2-B.1 Meets area requirements for discrete (≥ 0.25 ha) or complex (≥ 2.0 ha) observation?

No → **2-B.2** No further action

Yes → **2-B.3** Site is Non-forested **2-B.4** Stand Age > 250 years → AREC Confirmed → **STEP 5**

2-B.5 Stand Age ≤ 250 years & 2-A.3 is **Yes**

2-B.6 Stand Age ≤ 250 years & 2-A.3 is **No** → No further action

**If no AREC summary available from BC Ecosystems & Explorer, refer only to the BEC guides.*

STEP 3 – Stand Maturity Assessment

3.1 or 3.4 Stand Age >80 years & CWH

3.2 or 3.5 Stand Age >100 years & ICH

3.3 or 3.6 Stand Age >120 years & ESSF or MH

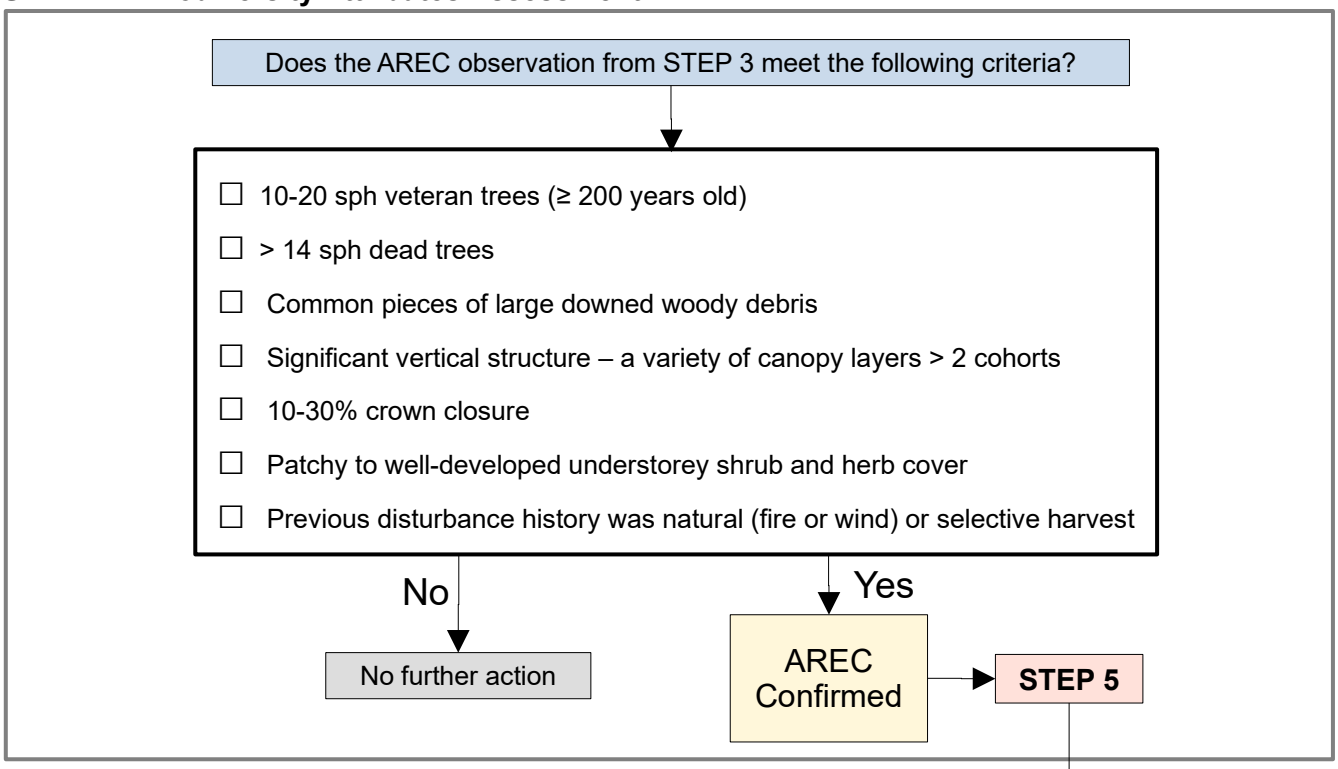
3.1, 3.2, or 3.3 → Veteran trees ≥ 20 sph → AREC Confirmed → **STEP 5**

3.4, 3.5, or 3.6 → Veteran trees < 20 sph → **STEP 4**

3.7 Stand Age ≤ 80 years & CWH OR Stand Age ≤ 100 years & ICH OR Stand Age ≤ 120 years & ESSF or MH → No further action

At Risk Ecological Communities (AREC) NDT1 Field Reference Card p.2

STEP 4 – Biodiversity Attributes Assessment

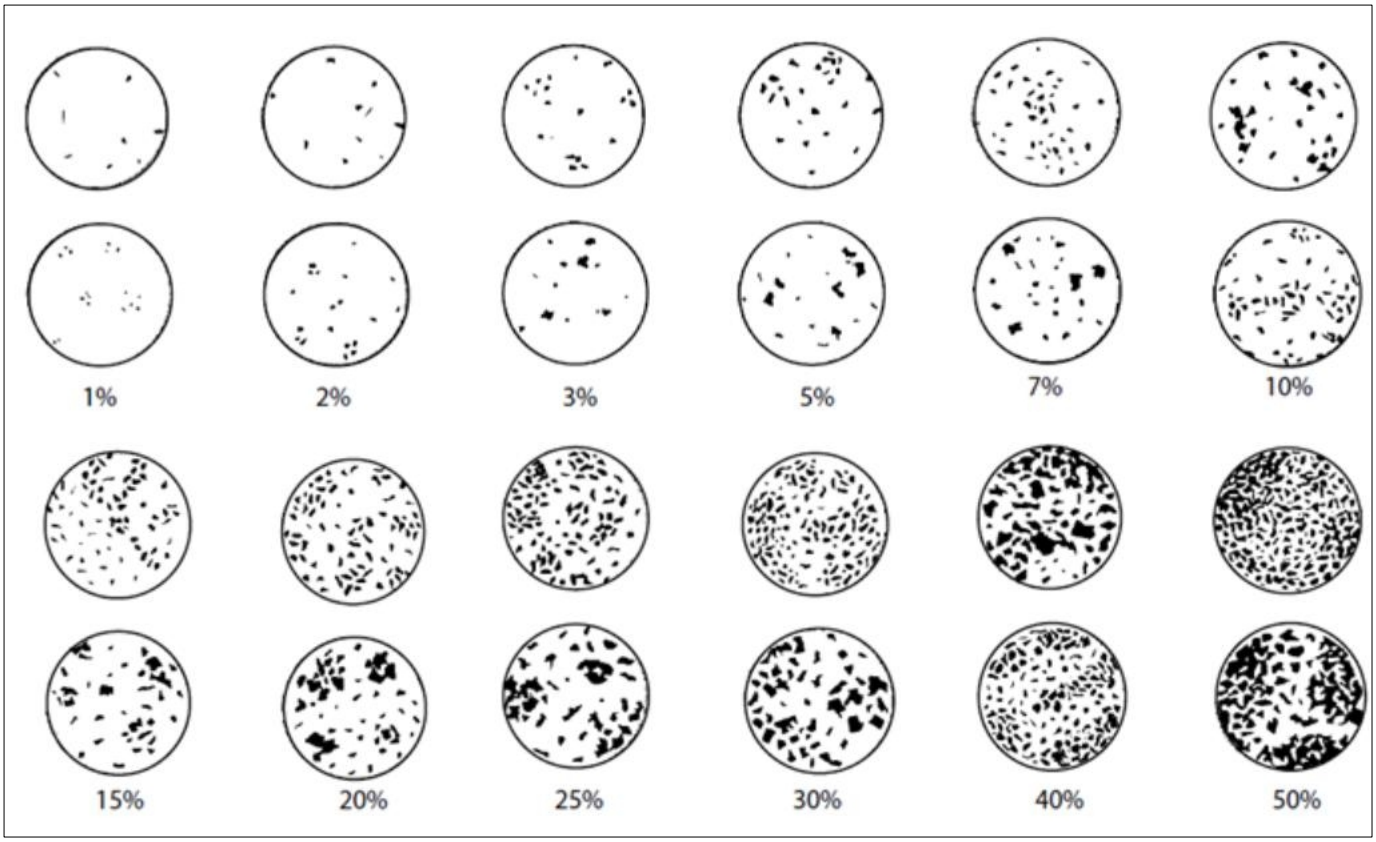


STEP 5 – Field Form & Operability Observations

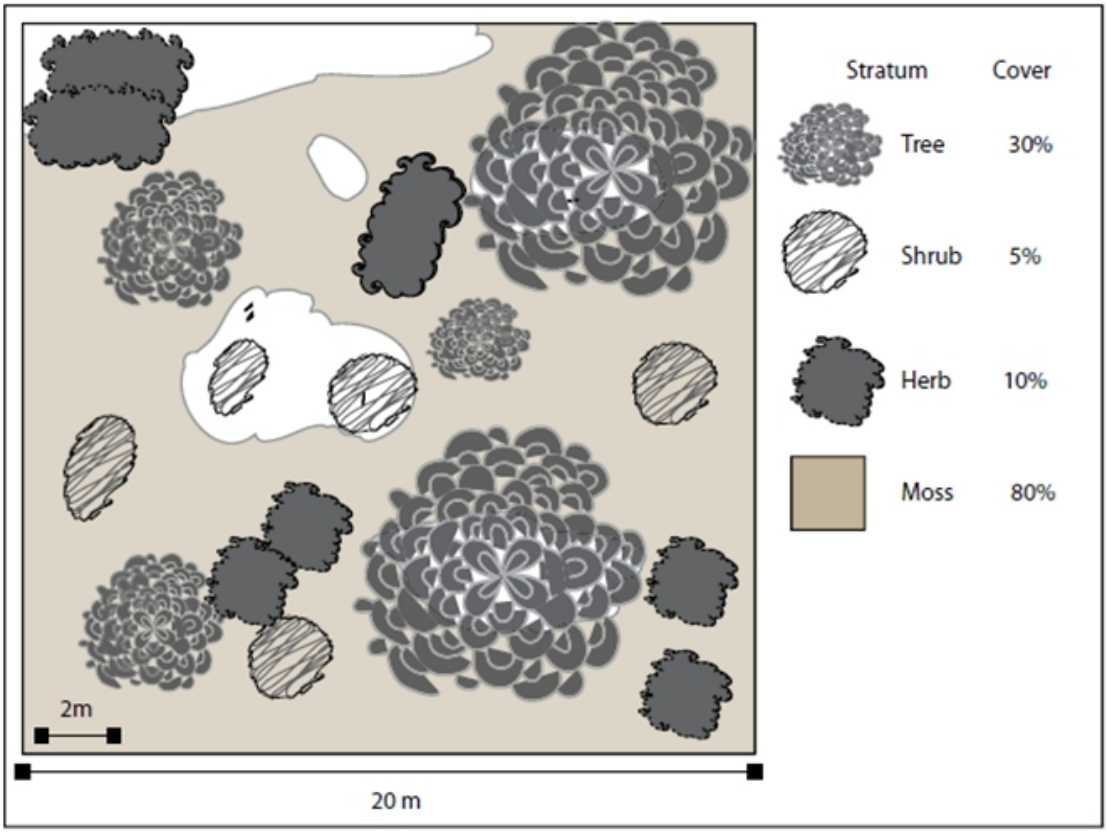
Complete the BCTS Species At Risk (SAR) Field Observation form (or similar), and take representative photos. Suggested plot size is 10 m x 10 m. Minimize edge effects by establishing plot at least one tree length into the stand from any edges. At minimum, record the following information:

Observer Details: Observer's Name, Date Observed, Location Information
AREC Observations: AREC Name, BEC unit (zone / subzone / variant / phase), site series, SMR, SNR, Area/size of AREC, List of vegetation and percent coverage (tree species, shrubs, herbs, mosses/lichens [see examples of foliage estimates for individual plants and of vegetation stratums on next page - total percent coverages by layer/stratum may not exceed 100%, but percent coverages by individual species within a stratum could exceed 100% when there are vegetation overlaps]), Answers to the questions in 2-A, Comments to support assessment (e.g., assessment completed within NDT1, which steps were completed to confirm the AREC, etc.).
Supportive information (forested ecosystems only): Record stand age and how age was estimated. Include tree core data (species, ring count, etc.), where applicable. If the stand is younger than 250 years, record estimated veteran tree age, and sph.
Photos: Take photos in each of the cardinal directions, of the representative vegetation, and of the tree crown.

Operability Observations
Take notes about the confirmed AREC location. Is the AREC located in an operable area? Is the area harvestable or not? Is the AREC already located within a reserve? Is the AREC located near established protected areas? Is the AREC location impeding access to current or future development? Are there any safety issues?



Visual representations of foliage percent estimates – from Land Management Handbook 25



Bird's eye view of example vegetation stratums in a plot – from Land Management Handbook 25

At Risk Ecological Communities (AREC) NDT1 Field Reference Card p.4

A summary of definitions referred to in STEP 2-A.2. The following definitions, examples and diagrams have been quoted from the Field Manual for Describing Terrestrial Ecosystems 2nd Edition (2010). Examples are not always characteristic of NDT1.

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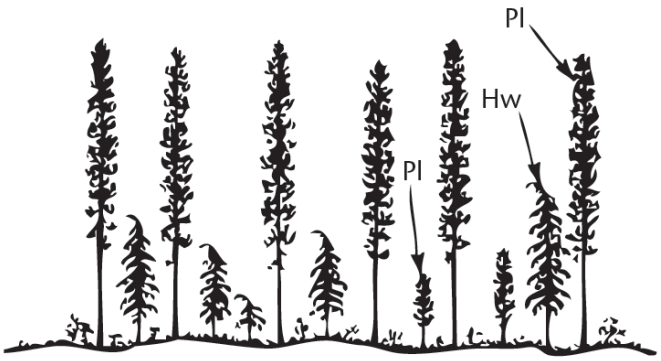
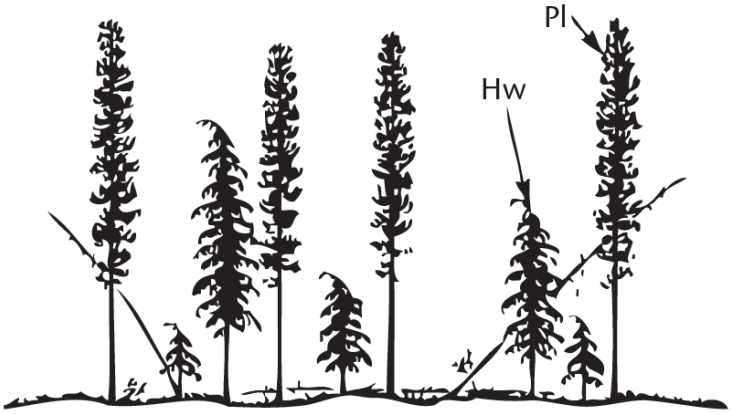
- Includes stands subject to frequent stand-replacing disturbances where regeneration to another cohort may be limited or absent, but where the stand has matured through natural thinning and development of the community, and the expected regeneration for the climate and ecosystem is to another, more shade-tolerant species.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.



Maturing seral stand

Overmature Seral:
Community where the seral overstorey species of the main upper canopy are dying.

- Usually > 140 years old.
- Typically with a secondary tree canopy consisting of more shade-tolerant species, or some of the same species as those dying; some individuals belonging to the secondary cohort may have entered the main canopy.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.

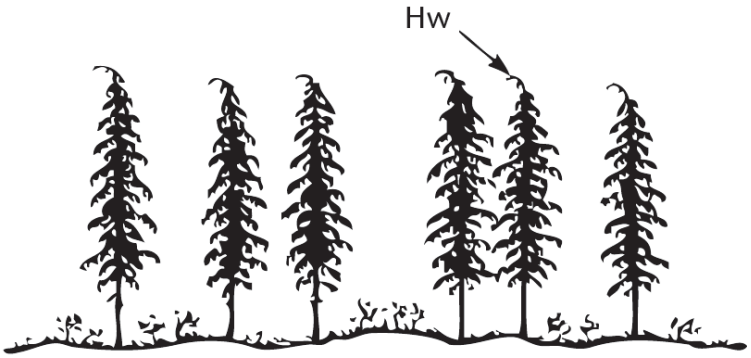


Overmature seral stand

Young Climax:

Community contains tree species typical of the climax expected for the site, but the proportional composition and structure expected at later climax stages has not developed; understorey seral species are usually still evident. This stage may follow the development and death of a stand of seral species or may develop from climax species regeneration on a recently disturbed site.

- In cases where climax tree species are the initial cohort, stands can be young (<30 years); this often occurs in wetter climates where stand-replacing fires are infrequent.
- Includes previously recognized Young Climatic Climax and Young Edaphic Climax stages.
- Examples: young subalpine fir – Engelmann spruce stand in a wet subalpine climate; young ponderosa pine stand in a dry climate where it would be the fire-maintained climax species; 50-60 year old hybrid white spruce stand 'released' from canopy of 100 year old lodgepole pine killed by mountain pine beetle."

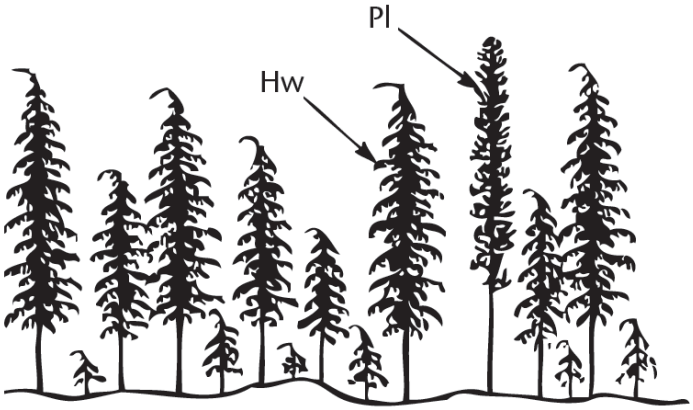


Young climax stand

Late Successional Status - includes ***Maturing Climax***, and ***Old Climax*** stands, as per the following:

"***Maturing Climax:***
Community composed of species in proportions more or less typical of late succession for the site; the stand has undergone natural thinning, and vertical structure has developed, but lacks the complex structure typical of old forests.

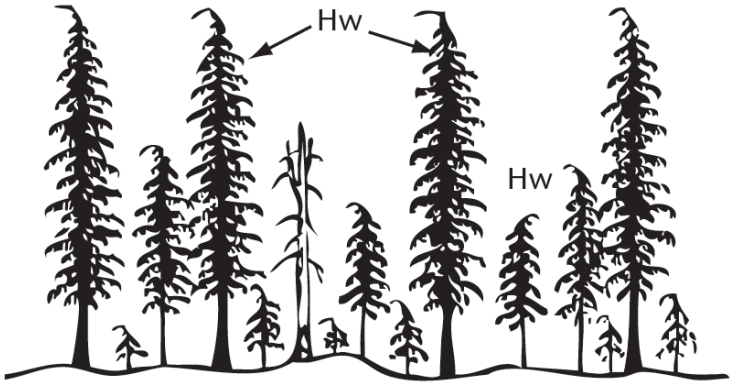
- Differs from [Young Climax] in having a typical mature forest understorey herb and shrub community; stands are developing continuous diameter and height class distributions of climax tree species; seral species may still exist.
- Stands are at least 80–120 years old, but usually older.
- Includes previously recognized Maturing Climatic Climax and Maturing Edaphic Climax stages.
- Examples: mature western redcedar – western hemlock forest with component of Douglas-fir in canopy; mature hybrid white spruce on high-bench floodplain with a developing understorey of multiple cohorts of spruce regeneration.



Maturing climax stand

Old Climax:
The plant community is composed of species expected to be present in the climax stand; vertical structure is well developed; live-tree decay is evident and tree death has led to canopy gaps and large woody debris on the forest floor; often with well developed and distinct epiphytic communities.

- Occasionally, very long-lived seral species (e.g., Douglas-fir) are present, as a minor component of stand, but their removal would not cause a significant change in the growth or establishment of the climax trees.
- Differs from MC in having better-developed vertical and horizontal structure and a more or less continuous age and height class distribution of climax tree species.
- Stands are at least 250 years old, but often much older.
- Examples: very old coastal forests, including subalpine mountain hemlock – amabilis fir or hypermaritime western hemlock – western redcedar – yellow-cedar – shore pine; western redcedar – Devil's club forest with epiphytic stubble-lichens in interior rainforest climate.



Old climax stand

Structural Stage 6: Mature Forest - Understorey reinitiation stage:
"Trees established after the last stand-replacing disturbance have matured; a second cycle of shade-tolerant trees may have become established; shrub and herb understories become well developed as the canopy opens up; time since disturbance is generally 80–140 years for BGCs with NDT 3 and 80–250 years for NDT 1, 2 & 4."

Structural Stage 7: Old Forest - Old-growth stages:
"Stands of old age with complex structure; patchy shrub and herb understories are typical; regeneration is usually of shade-tolerant species with composition similar to the overstorey; long-lived seral species may be present in some ecosystem types or on edaphic sites. Old growth structural attributes will differ across biogeoclimatic units and ecosystems."

Structural Stage 7a: Old Forest
"Stands with moderately to well developed structural complexity; stands comprised mainly of shade-tolerant tree species in canopy and regeneration layers, although older seral trees from a disturbance such as fire may still dominate the upper canopy; fire-maintained stands may have a 'single-storied' appearance; time since stand-replacing disturbance is generally 140 – 250 years for biogeoclimatic units with NDT 3 and > 250 years for NDT 1, 2 & 4."

Structural Stage 7b: Very Old Forest
"Very old stands having complex structure with abundant large-sized trees, snags and coarse woody debris (size is relative to the specific ecosystem); snags and CWD occur in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species with well-established canopy gaps; time since stand-replacing disturbance generally > 250 years for BGCs with NDT 3 and > 400 years for NDT 1, 2 & 4."

At Risk Ecological Communities (AREC) Field Assessment Procedures - Natural Disturbance Type 2 (NDT2)

1. Introduction / Preamble

These practical field assessment procedures have been developed for BC Timber Sales (BCTS) foresters and professional services contractors to follow when encountering a potential At Risk Ecological Community (AREC) during fieldwork. They provide step-by-step procedures for confirming an AREC location within Natural Disturbance Type 2 (NDT2). The distribution of NDT2 within BC is depicted in Figure 1. The spatial dataset for NDT2 is available from the BC Geographic Warehouse (BCGW), with the name WHSE_FOREST_VEGETATION.BEC_NATURAL_DISTURBANCE_SV.

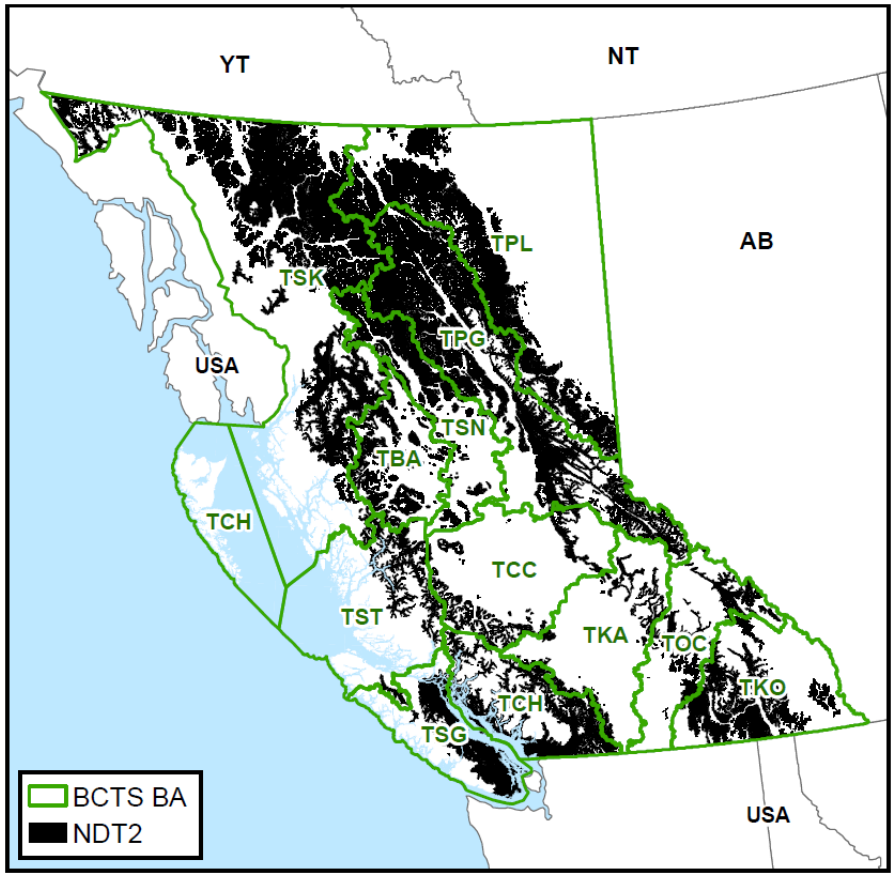


Figure 1: Distribution of NDT2 within BCTS Business Areas (BA)

All BCTS operations are certified under the Sustainable Forestry Initiative (SFI) Forest Management Standard. Indicator 4.2.2 states that certified organizations must have a program to locate and protect known sites of flora and fauna associated with viable occurrences of critically imperiled and imperiled species and ecological communities, defined as Forests with Exceptional Conservation Value.

In the BCTS context, an AREC is an ecological community that meets one or more of the following attributes:

- Red listed (Extirpated[1], Endangered, or Threatened) within the BC Conservation Data Centre (CDC) Species & Ecosystems Explorer database[2]– at greatest risk of being lost
- Blue listed (Special Concern) within the BC CDC Species & Ecosystems Explorer database
- Critically imperiled (G1/S1) or imperiled (G2/S2)[3]
- Red-listed or blue-listed on 'Schedules' of legislated Orders, including:
    - Great Bear Rainforest Order (GBRO) (replaced the Central and North Coast Land Use Order (LUO) & South Central Coast LUO in January 2016) – defined as plant communities
    - Haida Gwaii LUO – December 2010 (Amended April 2014 & September 2017)
- Identified Wildlife Management Strategy (IWMS) plant communities protected under the Forest and Range Practices Act (FRPA) Category of Species at Risk Government Actions Regulation (GAR) Orders:
    - Dates: May 6, 2004, June 5, 2006, & July 18, 2011

Note that some of the red- or blue-listed ecological/plant communities protected under legislation may not be listed, or may be listed under a different category within the BC CDC Species & Ecosystems Explorer database.

It is useful to understand the characteristics of NDT2 prior to undertaking fieldwork. The Biodiversity Guidebook (1995) defines NDT2 as "ecosystems with infrequent stand-initiating events." NDT2 ecosystems were historically characterized by even-aged stands. However, wildfire disturbances of 20 ha to 1,000 ha have resulted in uneven-aged stands, with multi-storied forest canopies, especially in the Engelmann Spruce – Subalpine Fir (ESSF), and Spruce – Willow – Birch (SWB) Biogeoclimatic (BEC) zones. Prior to extensive logging practices and wildfire suppression efforts, NDT2 ecosystems were characterized by mature forest, with some patches of regenerating young forest due to wildfire.

The average disturbance interval was originally defined as 200 years for certain BEC units of the Coastal Douglas Fir (CDF), Coastal Western Hemlock (CWH), Interior Cedar Hemlock (ICH), Sub-Boreal Spruce (SBS), ESSF, and SWB BEC zones.

Recent work has redefined average disturbance intervals for some BEC units on the coast and in northeastern BC, as summarized in Appendix 3 of the Interim Assessment Protocol for Forest Biodiversity in British Columbia – Standards for Assessing the Condition of Forest Biodiversity under British Columbia's Cumulative Effects Framework – Version 1.0 (Provincial Forest Biodiversity Technical Working Group, 2020). Table 1 provides a summary of average disturbance intervals from this most recent work, as well as intervals that still apply from the original Biodiversity Guidebook (1995). In northeastern BC, BEC units were categorized into Natural Disturbance Units and Sub-Units for better alignment with unique characteristics defined for each category (DeLong C. , 2011; Provincial Forest Biodiversity Technical Working Group, 2020).

[1] No extirpated AREC were extracted from BC Species & Ecosystems Explorer when developing the BCTS Business Area focus lists.
[2] The Glossary for Species & Ecosystems At Risk may be accessed here: https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/glossary-for-species-ecosystems-at-risk
[3] The Conservation Status Categories are defined here: https://explorer.natureserve.org/AboutTheData/DataTypes/ConservationStatusCategories

Table 1: Summary of average disturbance intervals for various BEC units within NDT2 (Provincial Forest Biodiversity Technical Working Group, 2020; BC Ministry of Forests & BC Ministry of Environment, 1995)

BEC Unit(s)*	Average disturbance/return interval (years)	Natural Disturbance (Sub)Unit (Northeastern BC) – if applicable
SBSwk1	100	Moist Interior – Plateau
SBSwk2, ICHmc1, SWBmk	120	Omineca - Valley
ESSFmv2	150	Boreal Foothills – Mountain
ICHmm, SBSvk	150	Moist Trench - Valley
CDFmm ESSFdc1, dcw, mc, mcw, mh, mk, mkw, mw1, mw2, wh2, wh3, wm1, wm3, wm4, xv1, xv2 ICHmc1a, mc2, mk3, mw1, mw2, mw4, mw5, wc SWBvk	200**	
ESSFmv1, mv3	200	Moist Interior - Mountain
SBSwk1, wk2	220	MacGregor Plateau
ESSFmm	300	Moist Trench - Mountain
ESSFmv3, mv4, SWBmk	300	Omineca - Mountain
SBSwk1	400	Caribou Mountain Foothills
CWHds1, ds2	500	
SBSvk, wk1	600	Wet Trench - Valley
CWHdm, ms1, ms2, xm1, xm2	700	
ESSFmm	800	Wet Trench - Mountain
CWHmm1, mm2, sw1, ws2	1,100	
ESSFmw	1,500	

* BEC units listed here are in alignment with the Version 12 BCGW BEC spatial dataset

** From original Biodiversity Guidebook (1995)

2. Scope

These NDT2 AREC Field Assessment Procedures apply to all BCTS Business Areas with operating areas within this disturbance type.

Primary resources needed to complete the fieldwork associated with identifying AREC within NDT2 are the appropriate Land Management Handbook (LMH) for the BEC unit, these procedures, the associated quick reference field card, and the appropriate BCTS Business Area AREC Focus Lists. Table 2 provides a summary of the appropriate LMH to use when working in the various BEC units, as well as the applicable BCTS Business Areas. Table 2 was derived from a GIS analysis that overlayed the BCTS Business Areas with the September 2nd, 2021 BEC and NDT dataset (WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY – Version 12), which was then cross-referenced with each LMH. As BEC units and LMHs are updated, Table 2 should be updated to reflect the changes.

The BCTS Business Area AREC Focus Lists provide references of the key AREC to be aware of during fieldwork. These AREC are risk ranked highest due to parameters specified in the risk ranking process used to score all AREC downloaded from the BC Species & Ecosystems Explorer.

Table 2: BEC units, LMHs, and BCTS Business Areas included in NDT2

BEC Unit	LMH Number(s)[4]	BCTS Business Area
CDFmm	28	Chinook (TCH), Strait of Georgia (TSG)
CWHdm	28	TCH, Seaward/tlasta (TST), TSG
CWHds1	28	Cariboo - Cilcotin (TCC), TCH
CWHds2	28	TST
CWHmm1	28	TCH, TSG
CWHmm2	28	TSG
CWHms1	28	TCC, TCH, Kamloops (TKA)
CWHms2	28	TST
CWHws1	26	Skeena (TSK)
CWHws2	26, 28	Babine (TBA), TST, TSK
CWHxm1	28	TCH, TSG
CWHxm2	28	TCH, TST, TSG
ESSFdc1	20, 23, 75	Kootenay (TKO), Okanagan - Columbia (TOC)
ESSFdcw	75	TCH, TKA, TKO, TOC
ESSFmc	26	TBA, Prince George (TPG), TST, TSK, Stuart - Nechako (TSN)
ESSFmcw	26	TBA, TPG, TST, TSK, TSN
ESSFmh	75	TKO, TOC
ESSFmk	26	TBA, TST, TSK
ESSFmkw	26	TBA, TST, TSK
ESSFmm1	15[a]	TCC, TKA, TOC, TPG
ESSFmm2	15[a]	TOC, TPG
ESSFmm3	20[b]	TKO, TOC
ESSFmmw	20[b]	TKA, TKO, TOC, TPG
ESSFmv1	24, 39	TBA, TCC, TPG, TSN
ESSFmv2	29	Peace - Liard (TPL), TPG,
ESSFmv3	54	TBA, TPG, TSN
ESSFmv4	29	TPG
ESSFmw	23, 28	TCC, TCH, TST
ESSFmw1	23, 76[c]	TCH, TKA
ESSFmw2	23, 76[d]	TCH, TKA
ESSFwh2	70	TKO
ESSFwh3	70	TKO
ESSFwm1	71	TKO
ESSFwm3	70	TKO
ESSFwm4	70	TKO
ESSFxv1	39	TCC, TKA, TST, TSN
ESSFxv2	39	TCC, TKA
ICHmc1	26	TBA, TSK, TSN
ICHmc1a	26	TSK
ICHmc2	26	TBA, TSK
ICHmk3	39	TCC, TKA
ICHmm	15[a]	TKA, TPG
ICHmw1	20	TKO, TOC
ICHmw2	20, 23, 70	TKO, TOC
ICHmw3	20, 23, 39	TKA, TKO, TOC
ICHmw4	70	TKO
ICHmw5	75	TKO, TOC
ICHwc	26	TSK
SBSvk	51	TCC, TPG
SBSwk1	39, 51	TCC, TPG
SBSwk2	54	TPG
SWBmk	54	TPL, TPG, TSK, TSN
SWBvk	26	TSK

[a] Updated guides for these variants have not been published yet. Refer to descriptions from BEC Web PDFs (Province of BC, 2023c).
[b] ESSFmm3 replaced areas mapped as ESSFwm in 2016 (Province of BC, 2023a). ESSFmmw is mapped above ESSFmm3.
[c] ESSFmw1 is only mentioned in the draft LMH 76. It was mapped in 2018 and differentiated from ESSFmw (Province of BC, 2023a).
[d] ESSFmw2 is not mentioned in any LMH. It was mapped in 2018 and differentiated from ESSFmw (Province of BC, 2023a).

It should be noted that limited confirmed AREC occurrences have been mapped by the CDC within BC, and some red and blue listed species may be found outside their known range within BEC units that may not be listed in the focus lists[5]. More information about confirmed AREC locations may be found within the BC CDC webpage and tools (BC Species & Ecosystems Explorer and CDC iMap). There are provincial standards for mapping and modelling ecosystems at risk, including utilizing Sensitive Ecosystems Inventory (SEI),

[4]References for each LMH are as follows: LMH 15 (Meidinger, McLeod, MacKinnon, DeLong, & Hope, 1988), LMH 20 (Braumandl & Curran, 1992), LMH 23 (Lloyd, Angove, Hope, & Thompson, 1990), LMH 24 (DeLong, Tanner, & Jull, 1993), LMH 26 (Banner A. , MacKenzie, Thomson, Pojar, & Trowbridge, 1993), LMH 28 (Green & Klinka, 1994), LMH 29 (DeLong, Tanner, & Jull, 1994), LMH 39 (Steen & Coupé, 1997), LMH 51 (DeLong, 2003), LMH 54 (DeLong, 2004), LMH 70 (MacKillop & Ehman, 2016), LMH 71 (MacKillop, Ehman, Iverson, & McKenzie, 2018), LMH 75 (MacKillop, et al., 2021), and LMH 76 (Ryan, Lloyd, & Iverson, 2021).
[5] Personal communication with Jason Straka, MSc, RPBio, Program Ecologist for the BC CDC.

Terrestrial Ecosystem Mapping (TEM), Predictive Ecosystem Mapping (PEM), or Broad Ecosystem Inventory (BEI) (Ministry of Environment, 2006).

3. Experience Considerations

To effectively identify potential AREC in the field, it is beneficial for the assessor to have the following experience:

- Knowledge of local indicator plants, and ability to identify them in the field
- Familiarity using BEC field guides (LMHs)
- Experience in field identification and confirmation of BEC site series within the local geographic location
- Proficiency collecting and preparing ecological data for cutblock Site Plans (Registered Professional Forester (RPF)) OR an experienced professional field ecologist (Registered Professional Biologist (RPBio))

If the assessor does not meet the competency requirements listed above, they should work under the direct supervision of an assessor who does meet them (Site Plan Forester or Ecologist).

4. Field Procedures

These field procedures have been developed based on the Biodiversity Guidebook (1995), the Field Manual for Describing Terrestrial Ecosystems – 2nd Edition (2010), and the guidance provided within the Guidelines to support implementation of the Great Bear Rainforest Order with respect to Old Forest and Listed Plant Communities - LMH 72 (Banner, Meidinger, Green, & Saunders, 2019). Although LMH 72 was developed specifically for assessing plant communities on the coast, it provides the best practical field assessment advice for this type of work in BC. A simplified, practical approach is used in these field procedures.

These field procedures help assessors determine whether a potential AREC meets the description of a red or blue listed ecological community, as per the following steps:

4.1 Office Prework;
4.2 Potential AREC & Site Series Observations (STEP 1);
4.3 Tree/Plant Species Identification, AREC Description Confirmation, Area, and Stand Age (STEP 2);
4.4 Stand Maturity Assessment (STEP 3);
4.5 Biodiversity Attributes Assessment (STEP 4); and
4.6 Field Form & Operability Observations (STEP 5).

Fieldwork Timing Considerations

Fieldwork should take place during the growing season, in the absence of snow. In spring, assessments may be undertaken several weeks after snowmelt, when deciduous understorey shrubs and herbs have started to appear, leaf out, and bloom. In the absence of drought, summer provides the best season for observing the full range of vegetation growing under the forest canopy, and therefore the best conditions for assessing potential AREC. Assessments should be completed prior to fall dieback of understorey vegetation. Seasonality of fieldwork will vary depending on BEC zone and location. Example windows for fieldwork along southern BC's low elevation coast are from May to October, whereas the northern interior window may be limited from June/July to August/September, depending on snowmelt and early season dieback.

4.1 Office Prework

Prior to beginning fieldwork, complete the following office prework to gain valuable information about the development area/area of interest (AOI):

- ☐ Review the following spatial data within the AOI, using iMap, Geographic Information Systems (GIS), or a similar mapping program:
  - ☐ NDT[6] (to ensure the correct field assessment procedure is used) – WHSE_FOREST_VEGETATION.BEC_NATURAL_DISTURBANCE_SV from BCGW.
  - ☐ BEC unit (zone / subzone / variant / phase) – WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY from BCGW.
  - ☐ Optional: TEM (common for coastal BC) or PEM (more common in BC's interior) – check Terrestrial Ecosystems Data & Information (TEI) project index maps online (Province of BC, 2023b), and/or search for data from the BCGW. TEM or PEM data may be used to gain an idea of site series locations, but site series must be field confirmed.
  - ☐ Known red or blue listed ecological community locations – WHSE_TERRESTRIAL_ECOLOGY.BIOT_OCCR_NON_SENS_AREA_SVW from BCGW for publicly available occurrences. Other datasets for masked, sensitive occurrences are available from BCGW as well.
- ☐ Review the AREC Focus List for the relevant BCTS Business Area:
  - ☐ Note AREC names for the BEC unit(s) within the AOI (the AREC Focus List spreadsheet is easily filtered). If working within the GBRO (2016) areas, refer to Appendix A to ensure all AREC within the BEC unit are noted. Some GBRO (2016) red- or blue-listed plant communities within NDT2 are not included in the focus lists, and/or the BC Species & Ecosystems Explorer.
  - ☐ Review AREC descriptions on the BC Species & Ecosystems Explorer (if available[7]) and ensure ability to identify the AREC in the field. For example, lodgepole pine / black huckleberry / reindeer lichens may occur within the SBSvk/09, SBSwk1/02, and SBSwk2/02. By clicking on the scientific name link in a BC Species & Ecosystems Explorer search, a list of reports and references appears, including the BC Community Summary.
  - ☐ Review the relevant LMH(s) to gain additional information about the AREC. Refer to the written descriptions and vegetation prominence tables within for the site series and geographic area.
  - ☐ Note AREC key characteristics, such as tree canopy species, shrub/herb/moss layer species and relative cover, soil textures, soil moisture regime (SMR), soil nutrient regime (SNR), forest productivity, and any other identifying qualities. This is extremely important to be aware of prior to fieldwork, so potential AREC may be easily identified.

[6] NDT is also included as an attribute within the BEC spatial data from the BCGW.
[7] Limited Ecological Community Summaries are available from the CDC. Where unavailable, refer to the relevant LMH.

- ☐ Gather an idea of stand age prior to fieldwork. Refer to Vegetation Resource Inventory (VRI), from BCGW and speak with field personnel who already know or can estimate stand age.

4.2 Potential AREC & Site Series Observations (STEP 1)

Potential AREC observations are usually completed as part of Site Plan field data collection, but could be observed during any fieldwork[8]. Assessors should carry a copy of the office prework notes, applicable LMH, and NDT2 field reference card. During fieldwork, a Site Plan Plot Card may be used to gather initial reconnaissance data where tree and plant species observations match AREC names from the BCTS business area focus list or GBRO (2016) schedules. Where a potential AREC is observed in the field, it is important that the tree and plant species relative abundance and percentages are in alignment with the AREC descriptions and vegetation tables gathered during the office prework stage. The observed site series does not need to match the AREC Focus List spreadsheet, because the downloaded CDC data might not include all BEC units/site series the AREC is found in. The CDC data is limited to the current known range for each AREC. However, where observed site series match the AREC focus list in addition to AREC descriptions and vegetation tables, more evidence can be applied towards confirming the AREC.

Potential AREC site series may be observed as per the following two definitions:

1) **a discrete observation** – a single site series, or almost entirely a single site series which supports a BCTS focus list or GBRO (2016) AREC; or,
2) **a complex observation** - a mosaic of two or more site series (unable to be mapped separately due to spatial complexity[9]) which supports one or more BCTS focus list or GBRO (2016) ARECs.

If a discrete or complex potential AREC observation is encountered during fieldwork, apply the appropriate field decision-making procedures as outlined in STEP 1 below. Work through the steps in the order they appear. If a statement does not apply, or there is no direction to skip to a specified step, proceed directly to the next statement. For example, if 1.1 does not apply, proceed to 1.2, and so forth for all field procedures steps.

STEP 1: A discrete or complex potential AREC observation is encountered during fieldwork. Apply location-specific procedures:

1.1 The potential AREC observation is located within the GBRO Central/North Coast Area or GBRO South Central Coast Area AND matches the information listed in Appendix A (Table 4 and/or Table 5), as collated from the red-listed and blue-listed GBRO (2016) schedules N and O for NDT2. → Follow the decision-making process in LMH 72 and refer to the GBRO Field Reference Card. Do not apply these BCTS field procedures.

1.2 The potential AREC observation is not listed in Appendix A and the GBRO (2016) schedules N and O. → Proceed to STEP 2.

[8] Proficiency with ecological Site Plan field data collection is required. Methodology is beyond the scope of this document.
[9] Definitions established based on listed community definitions within LMH 72 (Banner, Meidinger, Green, & Saunders, 2019).

4.3 Tree/Plant Species Identification, AREC Description Confirmation, Area, and Stand Age (STEP 2)

STEP 2-A applies diagnostic questions to confirm the potential AREC meets descriptions and classification parameters available from the office prework and relevant LMH. The AREC name sometimes represents the dominant tree and understorey species present. For example, as per LMHs 39, 51, and/or 54, observations for lodgepole pine / black huckleberry / reindeer lichens (SBSvk/09, SBSwk1/02, and SBSwk2/02) would include lodgepole pine as the dominant tree species, black huckleberry as the dominant shrub species, and reindeer lichens and red-stemmed feather moss as the dominant lichen/moss species. Other tree and understorey species could be present as per the vegetation summary from BC Species & Ecosystems Explorer, and the Vegetation Tables from LMHs 39, 51, and/or 54. Not all vegetation from the summaries and tables must be present for an observation to be considered as a potential AREC.

The AREC description confirmation requires professional judgement and due diligence.

STEP 2-A: Ask the following questions, and record supportive data:

2-A.1 Is the potential AREC observation located within a forested[10] ecosystem? → If **YES**, proceed to STEP 2-A.2 → If **NO**, proceed to STEP 2-A.3.

2-A.2 Is the site series able to support an AREC at mature and old stages of forest development?
The stand should be exhibiting signs of mid to late successional status[11] with a structural stage of 6 - mature or 7 - old[12]. See Appendix B for complete definitions. → Take notes and photos to support your answer. If **YES**, proceed to STEP 2-A.3. → If **NO**, the observation is not an AREC. Assessment complete.

2-A.3 Is the vegetation summary from BC Species & Ecosystems Explorer (if available) and the description/vegetation table from the relevant LMH in alignment with the tree/plant species observations for the potential AREC? If there is no vegetation summary available from BC Species & Ecosystem Explorer, refer only to the description/vegetation table from the relevant LMH when answering this question. → Take notes to support your answer of **YES** or **NO**. → If **NO**, AND within a non-forested ecosystem, the observation is not an AREC. Assessment complete. → Otherwise, proceed to STEP 2-B.

STEP 2-B involves determining the area occupied by the potential AREC, estimating stand age, and estimating veteran tree count. If the ecosystem is non-forested, stand age and veteran tree count is

[10] Forested ecosystems are defined as having ≥ 10% average cover of trees ≥ 10 m tall. If there is continuous tree cover of trees < 10 m tall, these sites are also considered to be forested (e.g., bog woodlands) (MacKenzie, 2012).
[11] Mid-successional stands usually have two cohorts with one dominant overstorey layer and one younger regenerating layer (BC Ministry of Forests and Range & BC Ministry of Environment, 2010). Later successional stands will eventually mature into old climax characteristics, with well-developed vertical structure, dead wood (standing and on the forest floor), canopy gaps, and well-developed plant communities.
[12] Definitions for structural stages of mature and old are in alignment with mid to late successional stages. Refer to the Site Description section of LMH 25 for complete definitions (BC Ministry of Forests and Range & BC Ministry of Environment, 2010).

not required. These determinations may be completed concurrently during a walk-through mapping exercise.

Mapping the area occupied by the potential AREC will indicate whether the observation is large enough to qualify as a confirmed AREC.

Stand age estimations are used to support determination of successional (seral or developmental) forest stages, e.g. mid/mature or late/old succession/structure. Table 3 summarizes stand age categories for BEC zones within NDT2 (Biodiversity Guidebook, 1995; Landscape Unit Planning Guide, 1999).

Table 3: Seral Stage Ages for BEC Zones within NDT2

BEC Zone	Mature	Old
CDF & CWH	> 80 yrs	> 250 yrs
ICH & SBS	> 100 yrs	
ESSF & SWB	> 120 yrs	

Veteran trees are living remnants that survived a previous stand-replacing disturbance (e.g. wildfire, windthrow, disease, or logging), and are much older than the rest of the stand (Banner, Meidinger, Green, & Saunders, 2019; BC Ministry of Forests, 2022). They are usually recognized as being much larger in diameter and height than other trees in the stand. For the purposes of these BCTS AREC field procedures, and in accordance with LMH 72, veteran trees are categorized as ≥ 200 years old.

STEP 2-B: Map the potential AREC location using GPS or accurate iPad tracks/mapping. Stand age and veteran tree count (stems per hectare(sph)) may be estimated at the same time. If the ecosystem is non-forested, stand age and veteran tree count is not required.

If the forest is not obviously old (> 250 years), collect age cores at breast height (1.3 m from high side ground) from at least 5 of the largest diameter, living trees in the main canopy (excluding veteran trees). Estimate ages by counting the rings and adding estimated age to breast height age based on the following (BC Ministry of Forests, 2022):

- Fd, Lw, Pl, Pw, Py → add 10 years
- Hw, Cw, Se, Sx, Ss, Bl, Ba, Bg → add 15 years

If the pith was not obtained from coring, apply Best Practices for Coring and Aging Trees to Determine Stand Age in older forests - available from Appendix 4 of Field Verification of Priority Old Forest Deferral Areas: Technical Guidance (2022). Determine the average stand age based on the 5 estimated tree ages. If the forest is obviously old, recommend coring at least one tree to confirm it is > 250 years old.

If the stand is < 250 years old, and veteran trees are present, recommend coring one or two veteran trees to confirm the veteran trees are ≥ 200 years old. During mapping, establish whether veteran tree count is ≥ 20 sph, 10-20 sph, or < 10 sph. Calculate average veteran tree density based on a few fixed radius (25 m) plots/ha[13]. Even if the potential AREC observation is less than 1 ha, ensure to calculate veteran density over at least 1 ha to avoid introducing bias.

[13] Based on LMH 72 (Banner, Meidinger, Green, & Saunders, 2019).

2-B.1 The **discrete observation** covers **≥ 0.25 ha** OR the **complex observation** covers **≥ 1.0 ha**[14] → Proceed to STEP 2B-3.

2-B.2 The discrete observation covers < 0.25 ha OR the complex observation covers < 1.0 ha → The observation is not large enough to be an AREC. Assessment complete.

2-B.3 The observation is within a non-forested ecosystem → **Observation is a confirmed AREC**. Proceed to STEP 5.

2-B.4 The stand age is obviously old at > 250 years → **Observation is a confirmed AREC**. Proceed to STEP 5.

2-B.5 The stand age is ≤ 250 years AND the answer from STEP 2-A.3 is **YES** → Proceed to STEP 3.

2-B.6 The stand age is ≤ 250 years AND the answer from STEP 2-A.3 is **NO** → The observation is not old enough, nor has the right species composition to be an AREC. Assessment complete.

4.4 Stand Maturity Assessment (STEP 3)

The stand maturity assessment is applied after stand age and veteran tree count estimations (STEP 2-B). This step applies a decision-making key to determine potential AREC confirmation where the stand is not obviously old, but has old forest characteristics. The key is based on mature stand age for the BEC zone (Table 3), and veteran trees present with ages ≥ 200 years. Veteran tree thresholds of ≥ 20 sph, indicating old forest characteristics, were established based on Field Verification of Priority Old Forest Deferral Areas: Technical Guidance (2022).

STEP 3: Work through the following decision-making key:

3.1 BEC zone is CDF or CWH, stand age is > 80 years, and contains ≥ 20 sph of veteran trees. → AREC has old forest characteristics. **Observation is a confirmed AREC.** Proceed to STEP 5.

3.2 BEC zone is ICH or SBS, stand age is > 100 years, and contains ≥ 20 sph of veteran trees. → AREC has old forest characteristics. **Observation is a confirmed AREC.** Proceed to STEP 5.

3.3 BEC zone is ESSF or SWB, stand age is > 120 years, and contains ≥ 20 sph of veteran trees. → AREC has old forest characteristics. **Observation is a confirmed AREC.** Proceed to STEP 5.

3.4 BEC zone is CDF or CWH, stand age is > 80 years, and contains < 20 sph of veteran trees. → Proceed to STEP 4.

3.5 BEC zone is ICH or SBS, stand age is > 100 years, and contains < 20 sph of veteran trees. → Proceed to STEP 4.

[14] Size criteria based on AREC SOP for TSG (BC Timber Sales, 2020). Compared with NDT1, size criterion is smaller for complex observations due to shorter average disturbance return intervals. Size is in alignment with the Special Tree Protection Regulation (BC Reg 229/2020; BC Ministry of Forests, 2020).

3.6 BEC zone is ESSF or SWB, stand age is > 120 years, and contains < 20 sph of veteran trees. → Proceed to STEP 4.

3.7 BEC zone is CDF or CWH and stand age is ≤ 80 years **OR** BEC zone is ICH or SBS, and stand age is ≤ 100 years **OR** BEC zone is ESSF or SWB, and stand age is ≤ 120 years. → The stand is not old enough to be an AREC. Assessment complete.

4.5 Biodiversity Attributes Assessment (STEP 4)

Based on the Biodiversity Guidebook (1995) and LMH 72, there are several important stand attributes that contribute to higher biodiversity levels in mature stands. Where the potential AREC observation was classified as mature (see Table 3 for age categories based on BEC zone), with < 20 sph veteran trees in STEP 3, they may be further assessed in STEP 4. If all suggested biodiversity attributes listed in the STEP 4 criteria are met, the AREC observation should be confirmed.

STEP 4 requires professional judgement and due diligence. Where not all STEP 4 criteria are met, and the assessor believes the AREC observation should be confirmed, they should make a case to the BCTS Business Area contact outlining why they believe the observation is a confirmed AREC.

STEP 4: Does the AREC observation, assessed as mature in age, meet the following criteria?

- ☐ 10-20 sph veteran trees (≥ 200 years old)
- ☐ > 14 sph dead trees
- ☐ Common pieces of large downed woody debris (or as per AREC description)
- ☐ Significant vertical structure – a variety of canopy layers > 2 cohorts
- ☐ 10-30% crown closure
- ☐ Patchy to well-developed understorey shrub and herb cover
- ☐ Previous disturbance history was natural (fire or wind) or selective harvest

If **NO,** the observation does not have enough biodiversity attributes to qualify as a confirmed AREC.

If **YES**, **observation is a confirmed AREC.** → Proceed to STEP 5.

4.6 Field Form & Operability Observations (STEP 5)

STEP 5: Complete the BCTS Species At Risk (SAR) Field Observation form (or similar), and take representative photos. Suggested plot size is 10 m x 10 m. Minimize edge effects by establishing the plot at least one tree length into the stand from any edges. At minimum, record the following information:

- Observer Details: Observer's Name, Date Observed, Location Information
- AREC Observations: AREC Name, BEC unit (zone / subzone / variant / phase), site series, SMR, SNR, Area/size of AREC, List of vegetation and percent coverage (tree species, shrubs, herbs, mosses/lichens [see examples of foliage estimates for individual plants in Figure 2, and of vegetation stratums in Figure 3 - total percent coverages by layer/stratum may not exceed 100%, but percent coverages by individual species within a stratum could exceed 100% when there are vegetation overlaps]), Answers to the questions in 2-A,

Comments to support assessment (e.g., assessment completed within NDT2, which steps were completed to confirm the AREC, etc.).

- Supportive information (forested ecosystems only): Record stand age and how age was estimated. Include tree core data (species, ring count, etc.), where applicable. If the stand is younger than 250 years, record estimated veteran tree age, and sph.
- Photos: Take photos in each of the cardinal directions, of the representative vegetation, and of the tree crown.

Operability Observations

Take notes about the confirmed AREC location. Is the AREC located in an operable area? Is the area harvestable or not? Is the AREC already located within a reserve? Is the AREC located near established protected areas? Is the AREC location impeding access to current or future development? Are there any safety issues?

Field assessment is complete. Ensure all data are collected, and consider the next steps when back in the office (see Section 5).

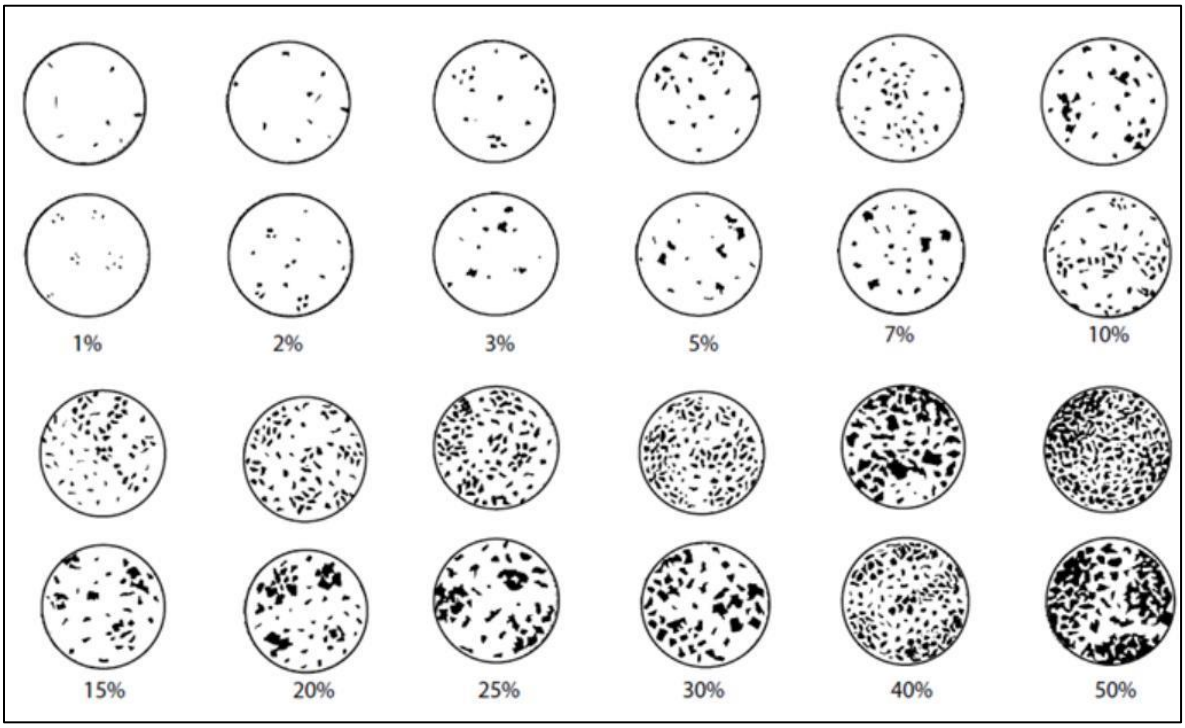


Figure 2: Visual representations of foliage percent estimates – from LMH 25 (BC Ministry of Forests and Range and BC Ministry of Environment, 2010)

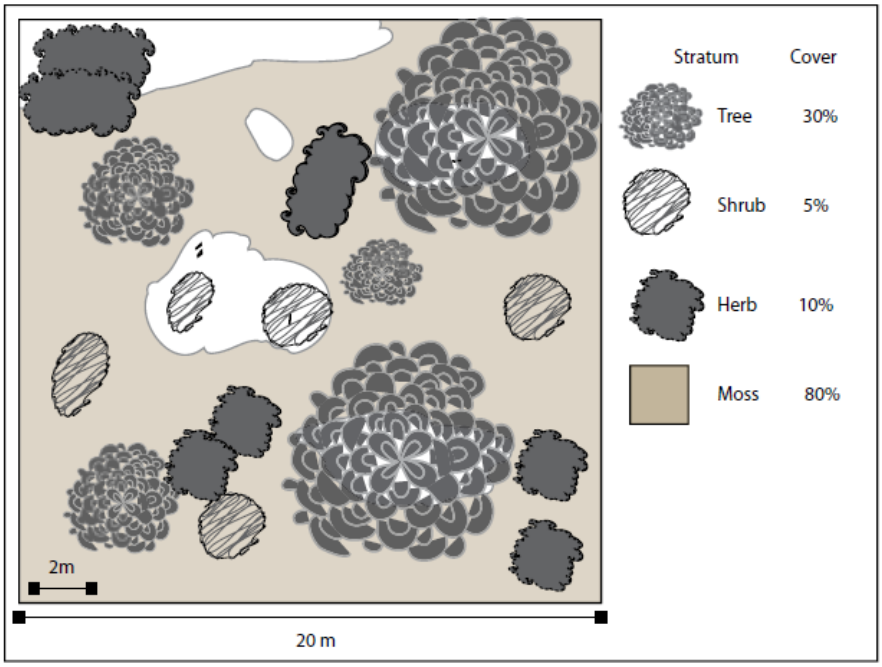


Figure 3: Bird's eye view of example vegetation stratums in a plot – from LMH 25 (BC Ministry of Forests and Range and BC Ministry of Environment, 2010)

5. Next Steps

Report the confirmed AREC observation to the appropriate BCTS contact. Provide all field data, including GPS or iPad tracks, plot data, photos, SAR Field Observation Form (or similar), and additional notes. Consult with any existing AREC management guidelines within the Business Area and Ministry region, such as local BMPs or SOPs, to develop a stand level management option. If necessary consult with a qualified registered professional. BCTS will submit details of the confirmed AREC to the BC Conservation Data Centre using the Incidental Observations submission process, where applicable.

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Appendix A

Table 4: GBRO (2016) Red-Listed Plant Communities within NDT2

GBRO Area	BEC unit	English Name
Central/North Coast	CWHds2/01	western hemlock - Douglas-fir / electrified cat's-tail moss Dry Submaritime 2
Central/North Coast	CWHds2/02	Douglas-fir - lodgepole pine / kinnikinnick Dry Submaritime
Central/North Coast	CWHds2/04	Douglas-fir / Douglas maple / Hooker's fairybells
Central/North Coast	CWHds2/06	western hemlock / queen's cup
Central/North Coast	CWHds2/07	western redcedar / devil's club
Central/North Coast	CWHds2/08	western hemlock - black cottonwood / salmonberry
Central/North Coast	CWHms2 CWHws1	dune wildrye - beach pea
Central/North Coast	CWHms2/07	Sitka spruce / salmonberry Moist Submaritime
Central/North Coast	CWHms2/09	black cottonwood / Sitka willow - thimbleberry
Central/North Coast	CWHws1/02 CWHws2/02	lodgepole pine / kinnikinnick
Central/North Coast	CWHws1/07	Sitka spruce / salmonberry
Central/North Coast	CWHws2/Wf51	Sitka sedge / peat-mosses
Central/North Coast	ESSFmc	Sandberg's bluegrass - slender wheatgrass
Central/North Coast	ESSFmc	Saskatoon / slender wheatgrass
Central/North Coast	ESSFmc/Wf09 ESSFxv1/Wf09	few-flowered spike-rush / hook-mosses
South Central Coast	CWHdm CWHxm2	dune wildrye - beach pea
South Central Coast	CWHdm/02	Douglas-fir - lodgepole pine / oceanspray / reindeer lichens*
South Central Coast	CWHdm/06 CWHxm2/06	western hemlock - western redcedar / deer fern
South Central Coast	CWHdm/08	Sitka spruce / salmonberry Dry
South Central Coast	CWHdm/13 CWHxm2/13	western redcedar / salmonberry
South Central Coast	CWHdm/14 CWHxm2/14	western redcedar / black twinberry
South Central Coast	CWHds2/01	western hemlock - Douglas-fir / electrified cat's-tail moss Dry Submaritime 2
South Central Coast	CWHds2/02	Douglas-fir - lodgepole pine / kinnikinnick Dry Submaritime
South Central Coast	CWHds2/04	Douglas-fir / Douglas maple / Hooker's fairybells
South Central Coast	CWHds2/06	western hemlock / queen's cup
South Central Coast	CWHds2/07	western redcedar / devil's club
South Central Coast	CWHds2/08	western hemlock - black cottonwood / salmonberry
South Central Coast	CWHws2/02	lodgepole pine / kinnikinnick
South Central Coast	CWHws2/Wf51	Sitka sedge / peat-mosses
South Central Coast	CWHxm2/01	western hemlock - Douglas-fir / Oregon beaked-moss
South Central Coast	CWHxm2/02	Douglas-fir - lodgepole pine / reindeer lichens
South Central Coast	CWHxm2/08	Sitka spruce / salmonberry Very Dry Maritime
South Central Coast	CWHxm2/Wf52	sweet gale / Sitka sedge
South Central Coast	CWHxm2/Wf53	slender sedge - white beak-rush
South Central Coast	CWHxm2/Wm51	three-way sedge

* Not currently in the BCTS focus lists. Is on the BC Species & Ecosystems Explorer as Yellow listed, G2G3.

Table 5: GBRO (2016) Blue-Listed Plant Communities within NDT2

GBRO Area	BEC unit	English Name
Central/North Coast South Central Coast	CWHds2/12 CWHms2/11	western redcedar - Sitka spruce / skunk cabbage
South Central Coast	CWHdm/01	western hemlock / flat-moss
South Central Coast	CWHdm/03 CWHxm2/03	Douglas-fir - western hemlock / salal Dry Maritime
South Central Coast	CWHdm/04 CWHxm2/04	Douglas-fir / sword fern
South Central Coast	CWHdm/05	western redcedar / sword fern Dry Maritime
South Central Coast	CWHdm/07	western redcedar / three-leaved foamflower Dry Maritime
South Central Coast	CWHdm/09 CWHxm2/09	black cottonwood - red alder / salmonberry
South Central Coast	CWHdm/10 CWHxm2/10	black cottonwood / Sitka willow
South Central Coast	CWHdm/11	lodgepole pine / peat-mosses
South Central Coast	CWHdm/12 CWHms2/11 CWHxm2/12	western redcedar - Sitka spruce / skunk cabbage
South Central Coast	CWHdm/20 CWHms2/20 CWHws2/20 CWHxm2/20	western redcedar – bluffs*
South Central Coast	CWHxm2/05	western redcedar / sword fern Very Dry Maritime
South Central Coast	CWHxm2/07	western redcedar / three-leaved foamflower Very Dry Maritime
South Central Coast	CWHxm2/11	lodgepole pine / peat-mosses Very Dry Maritime

* Not currently in the BCTS focus lists, nor the BC Species & Ecosystems Explorer

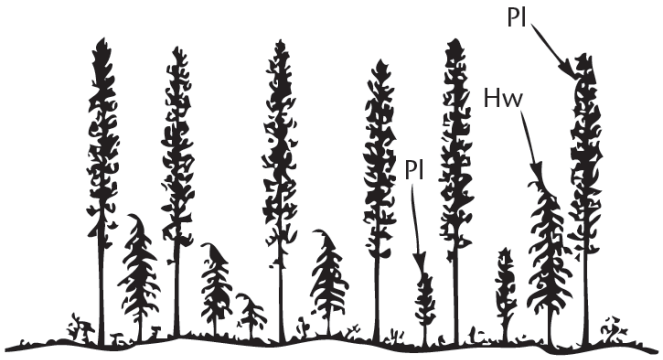
Appendix B

A summary of definitions referred to in STEP 2-A.2. The following definitions, examples and diagrams have been quoted from the Field Manual for Describing Terrestrial Ecosystems 2nd Edition (2010). Examples are not always characteristic of NDT2.

Mid Successional Status - includes ***Maturing Seral***, ***Overmature Seral***, and ***Young Climax*** stands, as per the following:

"***Maturing Seral:***
Community of early-successional tree species that have generally gone through an initial natural thinning due to species interactions such as within-stand competition for light or root-growing space, or a community where mid-successional species dominate. Very open stands may not go through a stem exclusion phase but could have a succession of understorey plant species occurring.

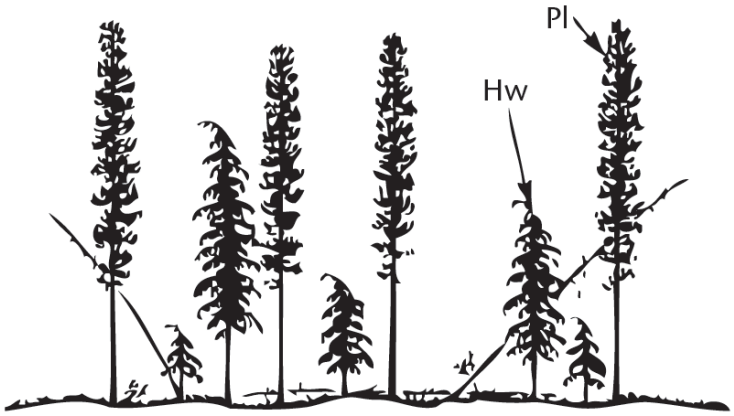
- Trees of mature age (generally 60–140 years old).
- Generally two cohorts: one in the overstorey and a younger one in the regeneration layer, usually of species with greater shade tolerance, but may include a component of species that are the same as the overstorey (e.g., fluvial cottonwood stands).
- Includes stands subject to frequent stand-replacing disturbances where regeneration to another cohort may be limited or absent, but where the stand has matured through natural thinning and development of the community, and the expected regeneration for the climate and ecosystem is to another, more shade-tolerant species.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.



Maturing seral stand

Overmature Seral:
Community where the seral overstorey species of the main upper canopy are dying.

- Usually > 140 years old.
- Typically with a secondary tree canopy consisting of more shade-tolerant species, or some of the same species as those dying; some individuals belonging to the secondary cohort may have entered the main canopy.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.

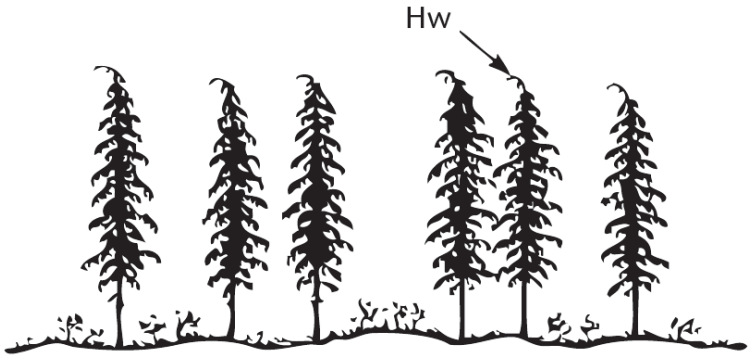


Overmature seral stand

Young Climax:

Community contains tree species typical of the climax expected for the site, but the proportional composition and structure expected at later climax stages has not developed; understorey seral species are usually still evident. This stage may follow the development and death of a stand of seral species or may develop from climax species regeneration on a recently disturbed site.

- In cases where climax tree species are the initial cohort, stands can be young (<30 years); this often occurs in wetter climates where stand-replacing fires are infrequent.
- Includes previously recognized Young Climatic Climax and Young Edaphic Climax stages.
- Examples: young subalpine fir – Engelmann spruce stand in a wet subalpine climate; young ponderosa pine stand in a dry climate where it would be the fire-maintained climax species; 50-60 year old hybrid white spruce stand 'released' from canopy of 100 year old lodgepole pine killed by mountain pine beetle."

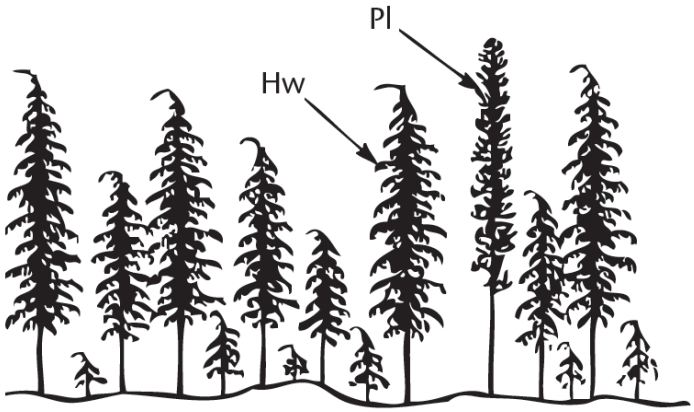


Young climax stand

Late Successional Status - includes ***Maturing Climax***, and ***Old Climax*** stands, as per the following:

"***Maturing Climax:***
Community composed of species in proportions more or less typical of late succession for the site; the stand has undergone natural thinning, and vertical structure has developed, but lacks the complex structure typical of old forests.

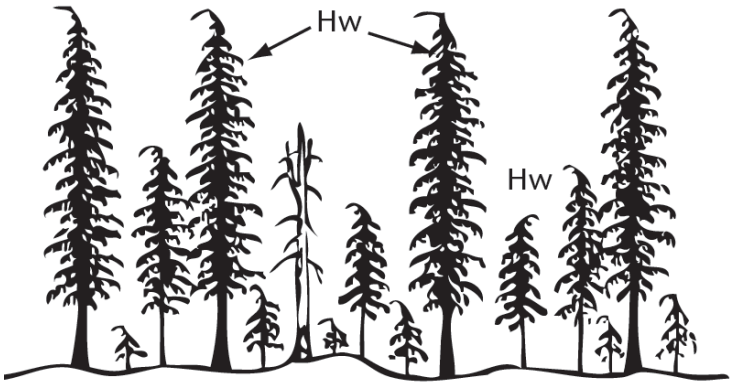
- Differs from [Young Climax] in having a typical mature forest understorey herb and shrub community; stands are developing continuous diameter and height class distributions of climax tree species; seral species may still exist.
- Stands are at least 80–120 years old, but usually older.
- Includes previously recognized Maturing Climatic Climax and Maturing Edaphic Climax stages.
- Examples: mature western redcedar – western hemlock forest with component of Douglas-fir in canopy; mature hybrid white spruce on high-bench floodplain with a developing understorey of multiple cohorts of spruce regeneration.



Maturing climax stand

Old Climax:
The plant community is composed of species expected to be present in the climax stand; vertical structure is well developed; live-tree decay is evident and tree death has led to canopy gaps and large woody debris on the forest floor; often with well developed and distinct epiphytic communities.

- Occasionally, very long-lived seral species (e.g., Douglas-fir) are present, as a minor component of stand, but their removal would not cause a significant change in the growth or establishment of the climax trees.
- Differs from MC in having better-developed vertical and horizontal structure and a more or less continuous age and height class distribution of climax tree species.
- Stands are at least 250 years old, but often much older.
- Examples: very old coastal forests, including subalpine mountain hemlock – amabilis fir or hypermaritime western hemlock – western redcedar – yellow-cedar – shore pine; western redcedar – Devil's club forest with epiphytic stubble-lichens in interior rainforest climate.



Old climax stand

Structural Stage 6: Mature Forest - Understorey reinitiation stage:
"Trees established after the last stand-replacing disturbance have matured; a second cycle of shade-tolerant trees may have become established; shrub and herb understories become well developed as the canopy opens up; time since disturbance is generally 80–140 years for BGCs with NDT 3 and 80–250 years for NDT 1, 2 & 4."

Structural Stage 7: Old Forest - Old-growth stages:
"Stands of old age with complex structure; patchy shrub and herb understories are typical; regeneration is usually of shade-tolerant species with composition similar to the overstorey; long-lived seral species may be present in some ecosystem types or on edaphic sites. Old growth structural attributes will differ across biogeoclimatic units and ecosystems."

Structural Stage 7a: Old Forest
"Stands with moderately to well developed structural complexity; stands comprised mainly of shade-tolerant tree species in canopy and regeneration layers, although older seral trees from a disturbance such as fire may still dominate the upper canopy; fire-maintained stands may have a 'single-storied' appearance; time since stand-replacing disturbance is generally 140 – 250 years for biogeoclimatic units with NDT 3 and > 250 years for NDT 1, 2 & 4."

Structural Stage 7b: Very Old Forest
"Very old stands having complex structure with abundant large-sized trees, snags and coarse woody debris (size is relative to the specific ecosystem); snags and CWD occur in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species with well-established canopy gaps; time since stand-replacing disturbance generally > 250 years for BGCs with NDT 3 and > 400 years for NDT 1, 2 & 4."

At Risk Ecological Communities (AREC) NDT2 Field Reference Card p.1

STEP 1 – Potential AREC & Site Series Observations

Discrete or complex potential AREC observed & site series identified

1.1 Located within GBRO Central/North Coast Area or South Central Coast Area & listed on GBRO schedules N or O

Follow decision-making process in LMH 72. Refer to GBRO Field Reference Card

1.2 Not listed on GBRO schedules N or O

STEP 2 - Tree/Plant Species Identification, AREC Description Confirmation, Area, and Stand Age

A

2-A.1 Is the potential AREC observation located within a forested ecosystem (≥ 10% tree cover ≥ 10 m tall or continuous tree cover < 10 m tall)?

No → **2-A.3** Note whether prework AREC summaries* & BEC descriptions/ vegetation table are in alignment with field observations – **Yes** or **No**

Yes → **2-A.2** Is the site series able to support an AREC at mature and old stages of forest development?

No → No further action

Yes → Mid to late successional status Structural stage 6 or 7 → **2-A.3**

If NO AND within a non-forested ecosystem. No further action.

Go to 2-B.1 if in a forested ecosystem, or if YES AND within a non-forested ecosystem.

B

2-B.1 Meets area requirements for discrete (≥ 0.25 ha) or complex (≥ 1.0 ha) observation?

No → **2-B.2** No further action

Yes → **2-B.3** Site is Non-forested **2-B.4** Stand Age > 250 years → AREC Confirmed → **STEP 5**

2-B.5 Stand Age ≤ 250 years & 2-A.3 is **Yes**

2-B.6 Stand Age ≤ 250 years & 2-A.3 is **No** → No further action

**If no AREC summary available from BC Ecosystems & Explorer, refer only to the BEC guides.*

STEP 3 – Stand Maturity Assessment

3.1 or 3.4 Stand Age >80 years & CDF or CWH

3.2 or 3.5 Stand Age >100 years & ICH or SBS

3.3 or 3.6 Stand Age >120 years & ESSF or SW

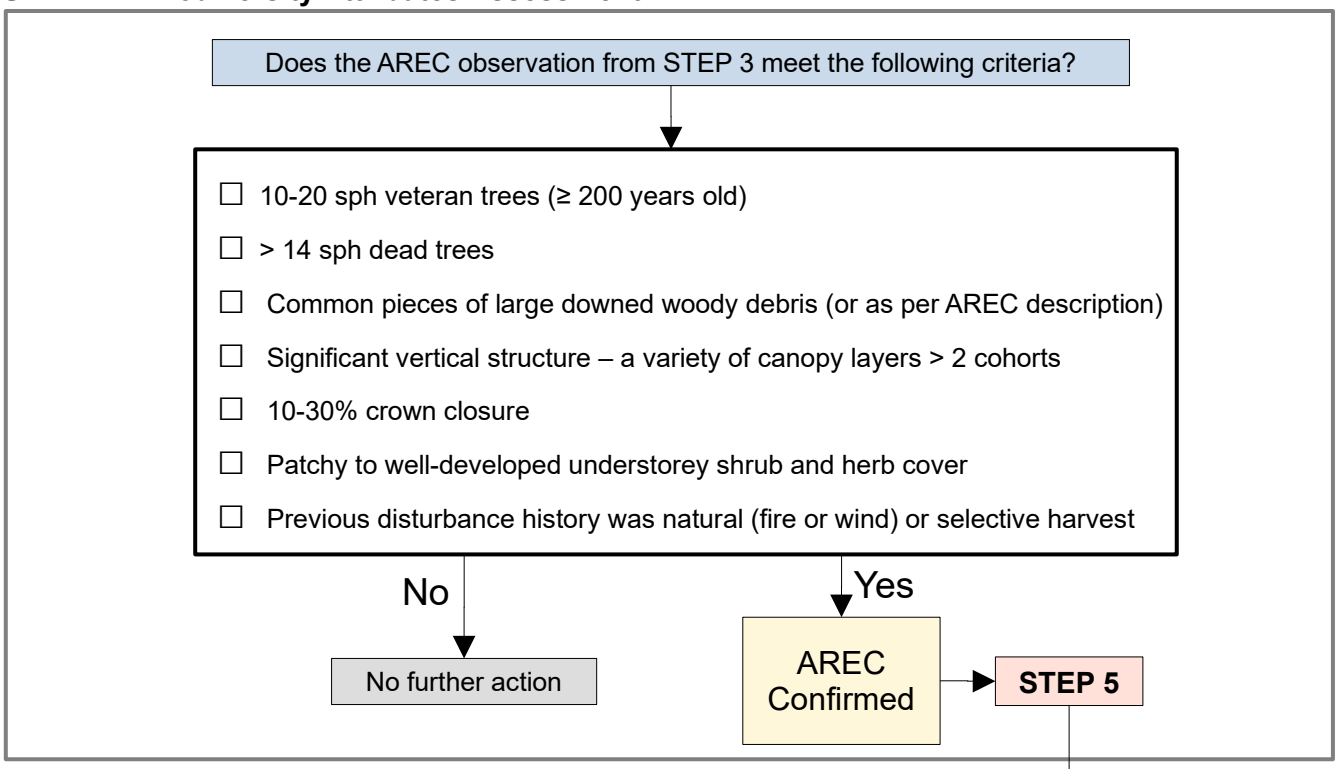
3.1, 3.2, or 3.3 Veteran trees ≥ 20 sph → AREC Confirmed → **STEP 5**

3.4, 3.5, or 3.6 Veteran trees < 20 sph → **STEP 4**

3.7 Stand Age ≤ 80 years & CDF or CWH OR Stand Age ≤100 years & ICH or SBS OR Stand Age ≤120 years & ESSF or SWB → No further action

At Risk Ecological Communities (AREC) NDT2 Field Reference Card p.2

STEP 4 – Biodiversity Attributes Assessment

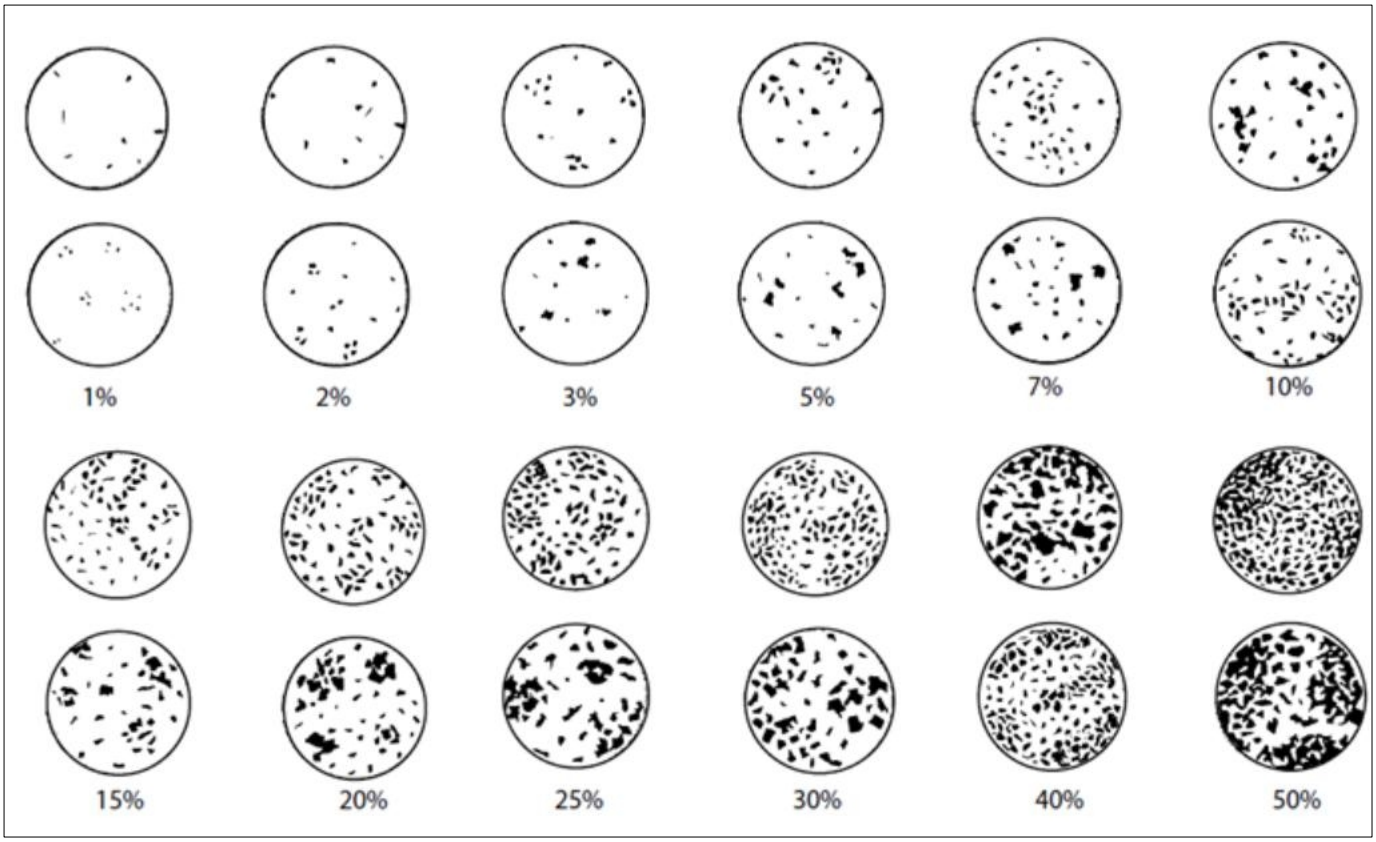


STEP 5 – Field Form & Operability Observations

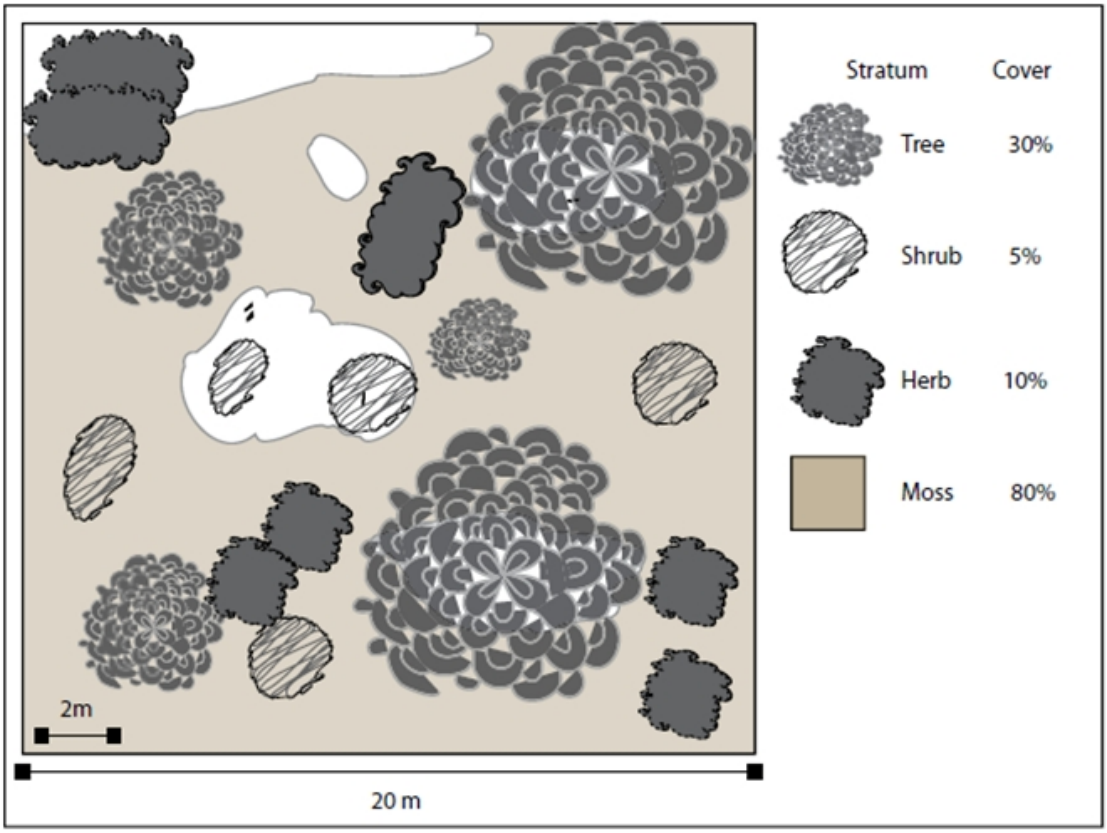
Complete the BCTS Species At Risk (SAR) Field Observation form (or similar), and take representative photos. Suggested plot size is 10 m x 10 m. Minimize edge effects by establishing plot at least one tree length into the stand from any edges. At minimum, record the following information:

Observer Details: Observer's Name, Date Observed, Location Information
AREC Observations: AREC Name, BEC unit (zone / subzone / variant / phase), site series, SMR, SNR, Area/size of AREC, List of vegetation and percent coverage (tree species, shrubs, herbs, mosses/lichens [see examples of foliage estimates for individual plants and of vegetation stratums on next page - total percent coverages by layer/stratum may not exceed 100%, but percent coverages by individual species within a stratum could exceed 100% when there are vegetation overlaps]), Answers to the questions in 2-A, Comments to support assessment (e.g., assessment completed within NDT2, which steps were completed to confirm the AREC, etc.).
Supportive information (forested ecosystems only): Record stand age and how age was estimated. Include tree core data (species, ring count, etc.), where applicable. If the stand is younger than 250 years, record estimated veteran tree age, and sph.
Photos: Take photos in each of the cardinal directions, of the representative vegetation, and of the tree crown.

Operability Observations
Take notes about the confirmed AREC location. Is the AREC located in an operable area? Is the area harvestable or not? Is the AREC already located within a reserve? Is the AREC located near established protected areas? Is the AREC location impeding access to current or future development? Are there any safety issues?



Visual representations of foliage percent estimates – from Land Management Handbook 25



Bird's eye view of example vegetation stratums in a plot – from Land Management Handbook 25

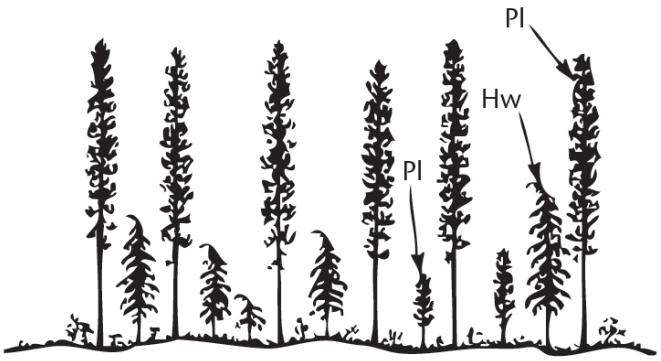
At Risk Ecological Communities (AREC) NDT2 Field Reference Card p.4

A summary of definitions referred to in STEP 2-A.2. The following definitions, examples and diagrams have been quoted from the Field Manual for Describing Terrestrial Ecosystems 2nd Edition (2010). Examples are not always characteristic of NDT2.

Mid Successional Status - includes ***Maturing Seral***, ***Overmature Seral***, and ***Young Climax*** stands, as per the following:

"***Maturing Seral:***
Community of early-successional tree species that have generally gone through an initial natural thinning due to species interactions such as within-stand competition for light or root-growing space, or a community where mid-successional species dominate. Very open stands may not go through a stem exclusion phase but could have a succession of understorey plant species occurring.

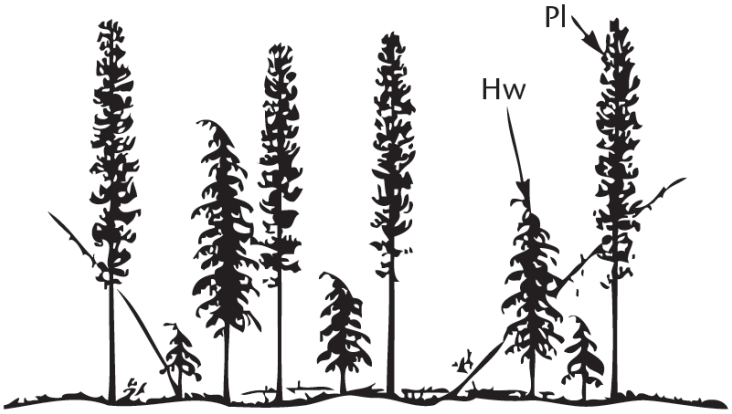
- Trees of mature age (generally 60–140 years old).
- Generally two cohorts: one in the overstorey and a younger one in the regeneration layer, usually of species with greater shade tolerance, but may include a component of species that are the same as the overstorey (e.g., fluvial cottonwood stands).
- Includes stands subject to frequent stand-replacing disturbances where regeneration to another cohort may be limited or absent, but where the stand has matured through natural thinning and development of the community, and the expected regeneration for the climate and ecosystem is to another, more shade-tolerant species.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.



Maturing seral stand

Overmature Seral:
Community where the seral overstorey species of the main upper canopy are dying.

- Usually > 140 years old.
- Typically with a secondary tree canopy consisting of more shade-tolerant species, or some of the same species as those dying; some individuals belonging to the secondary cohort may have entered the main canopy.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.

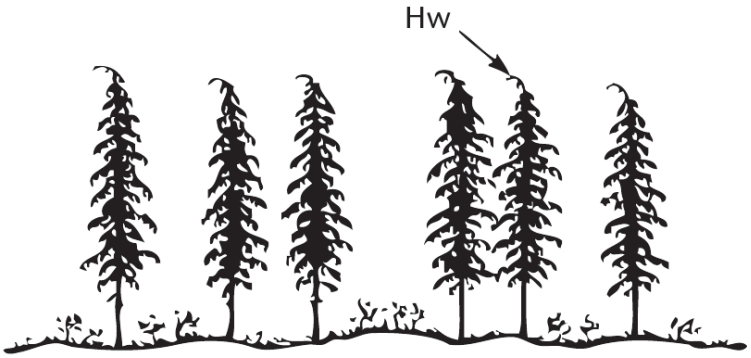


Overmature seral stand

Young Climax:

Community contains tree species typical of the climax expected for the site, but the proportional composition and structure expected at later climax stages has not developed; understorey seral species are usually still evident. This stage may follow the development and death of a stand of seral species or may develop from climax species regeneration on a recently disturbed site.

- In cases where climax tree species are the initial cohort, stands can be young (<30 years); this often occurs in wetter climates where stand-replacing fires are infrequent.
- Includes previously recognized Young Climatic Climax and Young Edaphic Climax stages.
- Examples: young subalpine fir – Engelmann spruce stand in a wet subalpine climate; young ponderosa pine stand in a dry climate where it would be the fire-maintained climax species; 50-60 year old hybrid white spruce stand 'released' from canopy of 100 year old lodgepole pine killed by mountain pine beetle."

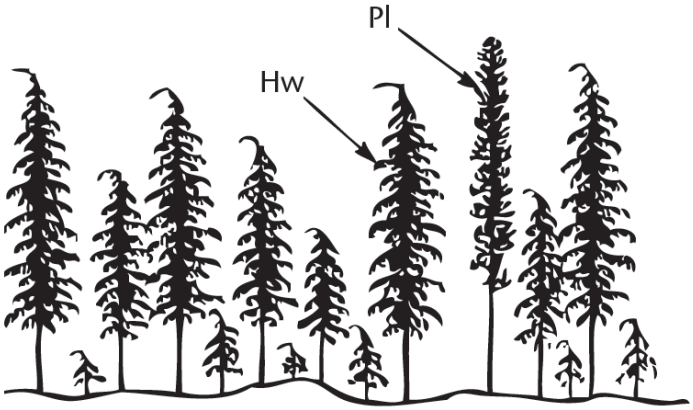


Young climax stand

Late Successional Status - includes ***Maturing Climax***, and ***Old Climax*** stands, as per the following:

"***Maturing Climax:***
Community composed of species in proportions more or less typical of late succession for the site; the stand has undergone natural thinning, and vertical structure has developed, but lacks the complex structure typical of old forests.

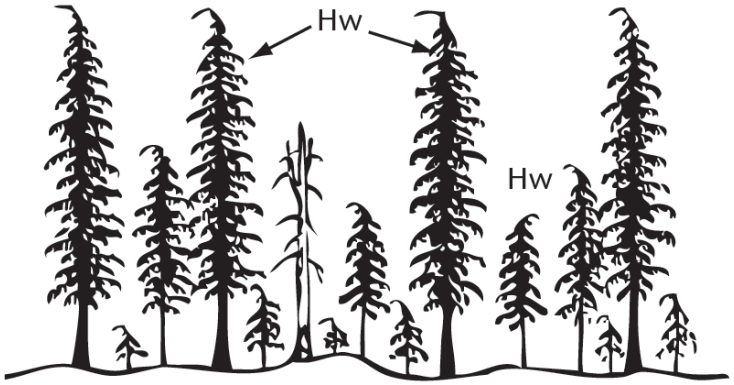
- Differs from [Young Climax] in having a typical mature forest understorey herb and shrub community; stands are developing continuous diameter and height class distributions of climax tree species; seral species may still exist.
- Stands are at least 80–120 years old, but usually older.
- Includes previously recognized Maturing Climatic Climax and Maturing Edaphic Climax stages.
- Examples: mature western redcedar – western hemlock forest with component of Douglas-fir in canopy; mature hybrid white spruce on high-bench floodplain with a developing understorey of multiple cohorts of spruce regeneration.



Maturing climax stand

Old Climax:
The plant community is composed of species expected to be present in the climax stand; vertical structure is well developed; live-tree decay is evident and tree death has led to canopy gaps and large woody debris on the forest floor; often with well developed and distinct epiphytic communities.

- Occasionally, very long-lived seral species (e.g., Douglas-fir) are present, as a minor component of stand, but their removal would not cause a significant change in the growth or establishment of the climax trees.
- Differs from MC in having better-developed vertical and horizontal structure and a more or less continuous age and height class distribution of climax tree species.
- Stands are at least 250 years old, but often much older.
- Examples: very old coastal forests, including subalpine mountain hemlock – amabilis fir or hypermaritime western hemlock – western redcedar – yellow-cedar – shore pine; western redcedar – Devil's club forest with epiphytic stubble-lichens in interior rainforest climate.



Old climax stand

Structural Stage 6: Mature Forest - Understorey reinitiation stage:
"Trees established after the last stand-replacing disturbance have matured; a second cycle of shade-tolerant trees may have become established; shrub and herb understories become well developed as the canopy opens up; time since disturbance is generally 80–140 years for BGCs with NDT 3 and 80–250 years for NDT 1, 2 & 4."

Structural Stage 7: Old Forest - Old-growth stages:
"Stands of old age with complex structure; patchy shrub and herb understories are typical; regeneration is usually of shade-tolerant species with composition similar to the overstorey; long-lived seral species may be present in some ecosystem types or on edaphic sites. Old growth structural attributes will differ across biogeoclimatic units and ecosystems."

Structural Stage 7a: Old Forest
"Stands with moderately to well developed structural complexity; stands comprised mainly of shade-tolerant tree species in canopy and regeneration layers, although older seral trees from a disturbance such as fire may still dominate the upper canopy; fire-maintained stands may have a 'single-storied' appearance; time since stand-replacing disturbance is generally 140 – 250 years for biogeoclimatic units with NDT 3 and > 250 years for NDT 1, 2 & 4."

Structural Stage 7b: Very Old Forest
"Very old stands having complex structure with abundant large-sized trees, snags and coarse woody debris (size is relative to the specific ecosystem); snags and CWD occur in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species with well-established canopy gaps; time since stand-replacing disturbance generally > 250 years for BGCs with NDT 3 and > 400 years for NDT 1, 2 & 4."

At Risk Ecological Communities (AREC) Field Assessment Procedures - Natural Disturbance Type 3 (NDT3)

1. Introduction / Preamble

These practical field assessment procedures have been developed for BC Timber Sales (BCTS) foresters and professional services contractors to follow when encountering a potential At Risk Ecological Community (AREC) during fieldwork. They provide step-by-step procedures for confirming an AREC location within Natural Disturbance Type 3 (NDT3). The distribution of NDT3 within BC is depicted in Figure 1. The spatial dataset for NDT3 is available from the BC Geographic Warehouse (BCGW), with the name WHSE_FOREST_VEGETATION.BEC_NATURAL_DISTURBANCE_SV.

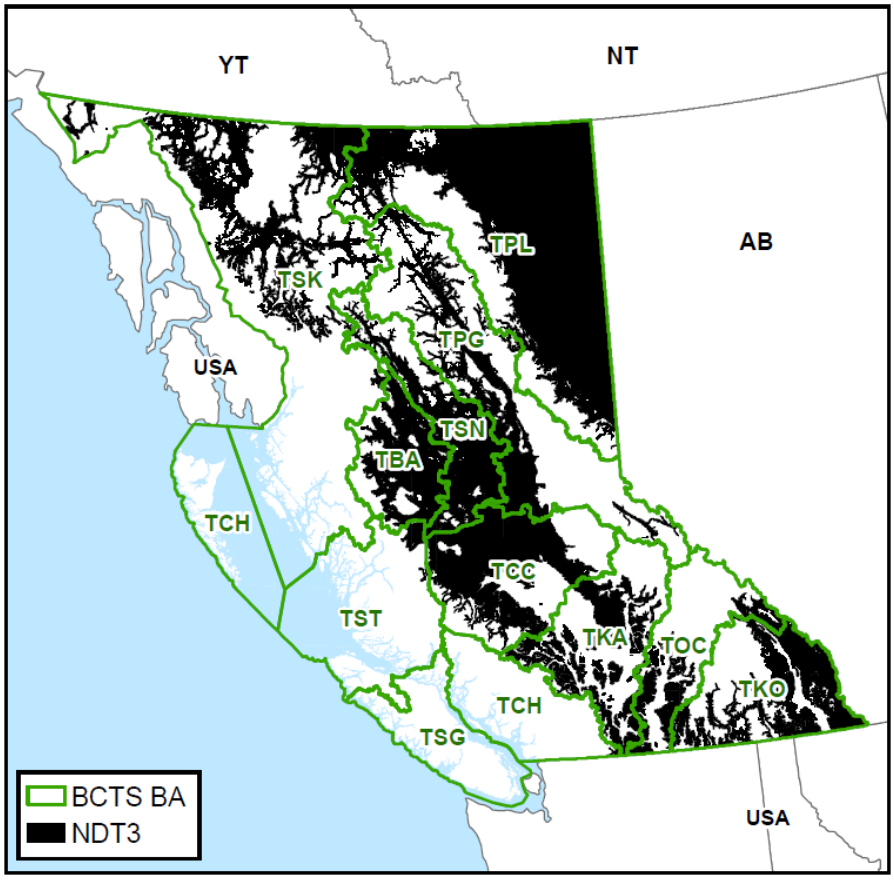


Figure 1: Distribution of NDT3 within BCTS Business Areas (BA)[1]

All BCTS operations are certified under the Sustainable Forestry Initiative (SFI) Forest Management Standard. Indicator 4.2.2 states that certified organizations must have a program to locate and protect

[1] Note that Coastal Western Hemlock (CWH)vm1, CWHvm2, CWHvh1, and CWHvh2 may be treated as NDT3 on some exposed coastal areas where extreme ~100-year return interval windthrow events have occurred.

known sites of flora and fauna associated with viable occurrences of critically imperiled and imperiled species and ecological communities, defined as Forests with Exceptional Conservation Value.
In the BCTS context, an AREC is an ecological community that meets one or more of the following attributes:

- Red listed (Extirpated[2], Endangered, or Threatened) within the BC Conservation Data Centre (CDC) Species & Ecosystems Explorer database[3]– at greatest risk of being lost
- Blue listed (Special Concern) within the BC CDC Species & Ecosystems Explorer database
- Critically imperiled (G1/S1) or imperiled (G2/S2)[4]
- Red-listed or blue-listed on 'Schedules' of legislated Orders, including:
    - Great Bear Rainforest Order (GBRO) (replaced the Central and North Coast Land Use Order (LUO) & South Central Coast LUO in January 2016) – defined as plant communities
    - Haida Gwaii LUO – December 2010 (Amended April 2014 & September 2017)
- Identified Wildlife Management Strategy (IWMS) plant communities protected under the Forest and Range Practices Act (FRPA) Category of Species at Risk Government Actions Regulation (GAR) Orders:
    - Dates: May 6, 2004, June 5, 2006, & July 18, 2011

Note that some of the red- or blue-listed ecological/plant communities protected under legislation may not be listed, or may be listed under a different category within the BC CDC Species & Ecosystems Explorer database.

It is useful to understand the characteristics of NDT3 prior to undertaking fieldwork. The Biodiversity Guidebook (1995) defines NDT3 as "ecosystems with frequent stand-initiating events." Prior to intensive logging practices and rigorous wildfire suppression efforts, NDT3 ecosystems were characterized by various sized mosaics (a few to thousands of hectares) of even-aged, regenerating stands, with patches of remnant mature forests. Frequent wildfire disturbances shaped the regenerating landscape, with burn sizes from small spot fires to 200,000 ha, depending on Biogeoclimatic (BEC) zone, and topography. Insect defoliation and root disease were other key disturbance types within NDT3. These disturbances resulted in special habitat types in riparian zones, and dead trees, coarse woody debris, and canopy gaps in remaining mature forest patches.

Average disturbance intervals were originally defined as 100 years for Boreal White and Black Spruce (BWBS) BEC zones with deciduous species prominent, and for Sub-Boreal Pine – Spruce (SBPS) BEC zones, as 125 years for BWBS BEC zones with coniferous species prominent, and for Sub-Boreal Spruce (SBS) BEC zones, and as 150 years for the Engelmann Spruce – Subalpine Fir (ESSF), Interior Cedar Hemlock (ICH), and Montane Spruce (MS) BEC Zones (BC Ministry of Forests & BC Ministry of Environment, 1995). On some exposed coastal areas, extreme ~100-year return interval windthrow events have occurred in BEC units that are associated with Natural Disturbance Type 1 (NDT1): Coastal Western Hemlock (CWH)vm1, CWHvm2,

[2] No extirpated AREC were extracted from BC Species & Ecosystems Explorer when developing the BCTS Business Area focus lists.
[3] The Glossary for Species & Ecosystems At Risk may be accessed here: https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/glossary-for-species-ecosystems-at-risk
[4] The Conservation Status Categories are defined here: https://explorer.natureserve.org/AboutTheData/DataTypes/ConservationStatusCategories

CWHvh1, and CWHvh2. Where ~100-year windthrow events are observed in those units, use these AREC field procedures.

Recent work has redefined average disturbance intervals for some BEC units in northeastern BC, as summarized in Appendix 3 of the Interim Assessment Protocol for Forest Biodiversity in British Columbia – Standards for Assessing the Condition of Forest Biodiversity under British Columbia's Cumulative Effects Framework – Version 1.0 (Provincial Forest Biodiversity Technical Working Group, 2020). Table 1 provides a summary of average disturbance intervals from this most recent work, as well as intervals that still apply from the original Biodiversity Guidebook (1995). In northeastern BC, BEC units were categorized into Natural Disturbance Units and Sub-Units for better alignment with unique characteristics defined for each category (DeLong C. , Land units and benchmarks for developing natural disturbance-based forest management guidance for, 2011; Provincial Forest Biodiversity Technical Working Group, 2020).

Table 1:Summary of average disturbance intervals for various BEC units within NDT3 (Provincial Forest Biodiversity Technical Working Group, 2020; BC Ministry of Forests & BC Ministry of Environment, 1995)

BEC Unit(s)*	Average disturbance/return interval (years)	Natural Disturbance (Sub)Unit (Northeastern BC) – if applicable
BWBSmw, mk, wk1, wk2	100	Boreal Plains - Upland
SBPSdc, mc SBSdk, dw1, dw2, dw3, mc2, mc3, mh, mk1, mw, wk3a	100	Moist Interior – Plateau
BWBSvk[a] SBPSmk, xc	100**	
CWHvh1, vh2, vm1, vm2	100***	
BWBSwk1, mw	120	Boreal Foothills – Valley
SBSdk, mc2, mk1, mk2, wk3	120	Omineca - Valley
BWBSvk[b] SBSdh1, dh2, mc1, mm	125**	
ESSFdc2, dc3, dh1, dk1, dk2, dkw, dv1, dv2, xc1, xc2, xc3 ICHdk, dm, dw1, dw3, dw4, mk1, mk2, mk4, mk5 MSdc1, dc2, dc3, dk, dm1, dm2, dv, dw, xk1, xk2, xk3, xv	150**	
BWBSdk, wk2, mk, wk2, wk3 SBSmk1	180	Northern Boreal Mountains
BWBSmk	200	Boreal Plains - Alluvial

* BEC units listed here are in alignment with the Version 12 BCGW BEC spatial dataset

** From original Biodiversity Guidebook (1995)

*** For extreme windthrow on exposed coastal areas – described for NDT1 in Biodiversity Guidebook (1995)

a Deciduous species prominent

b Coniferous species prominent

2. Scope

These NDT3 AREC Field Assessment Procedures apply to all BCTS Business Areas with operating areas within this disturbance type.

Primary resources needed to complete the fieldwork associated with identifying AREC within NDT3 are the appropriate Land Management Handbook (LMH) for the BEC unit, these procedures, the associated quick reference field card, and the appropriate BCTS Business Area AREC Focus Lists. Table 2 provides a summary

Table 2: BEC Units, LMHs, and BCTS Business Areas included in NDT3

BEC Zone / Subzone / Variant	LMH Number(s)	BCTS Business Area
BWBSdk	65	Peace - Liard (TPL), Prince George (TPG), Skeena (TSK), Stuart - Nechako (TSN)
BWBSmk	65	TPL, TSK
BWBSmw	65	TPL
BWBSvk	26	TSK
BWBSwk1	65	TPL
BWBSwk2	65	TPL
BWBSwk3	65	TPL
CWHvh1[a]	28	Chinook (TCH), Seaward/tlasta (TST), Strait of Georgia (TSG)
CWHvh2[a]	28	TCH, TST, TSK
CWHvm1[a]	26, 28	TCH, TST, TSK, TSG
CWHvm2[a]	26, 28	TCH, TST, TSK, TSG
ESSFdc2	23, 39, 76	TCH, Kamloops (TKA), Kootenay (TKO), Okanagan - Columbia (TOC)
ESSFdc3	23[b]	TKA, TOC
ESSFdh1	76[c]	TCH, TKA
ESSFdk1	71	TKO
ESSFdk2	71	TKO, TOC
ESSFdkw	71	TKO, TOC
ESSFdv1	23[d]	TCH, TKA
ESSFdv2	23[d]	TKA
ESSFxc1	76	TKA, TOC
ESSFxc2	76	TKA, TOC
ESSFcx3	23, 39	Cariboo - Cilcotin (TCC), TKA
ICHdk	39	TCC, TKA
ICHdm	70	TKO
ICHdw1	70	TKO
ICHdw3	23[e]	TKA
ICHdw4	75	TOC
ICHmk1	23, 75	TKO, TOC
ICHmk2	23	TKA, TOC
ICHmk4	71	TKO
ICHmk5	71[f]	TKO, TOC
MSdc1	23[g]	TKA
MSdc2	39	TCC, TST
MSdc3	23[g]	TKA
MSdk	20, 71	TKO, TOC
MSdm1	20, 23, 75	TKO, TOC
MSdm2	23, 76	TCH, TKA, TOC
MSdv	39	TCC
MSdw	71	TKO
MSxk1	76	TKA, TOC
MSxk2	76	TKA, TOC
MSxk3	39[h]	TCC, TKA
MSxv	39	TCC, TKA, TST, TSN
SBPSdc	39	TCC, TPG, TSN
SBPSmc	24, 26, 39	Babine (TBA), TCC, TST, TSN
SBPSmk	39	TCC, TKA, TPG, TSN
SBPSxc	39	TCC, TST
SBSdh1	15[i]	TKA, TPG
SBSdh2	15[i]	TPG
SBSdk	24, 26	TBA, TCC, TSN
SBSdw1	39, 51	TCC, TKA, TPG
SBSdw2	24, 39	TCC, TKA, TPG, TSN
SBSdw3	24	TBA, TPG, TSN
SBSmc1	39	TCC, TKA
SBSmc2	24, 26, 39	TBA, TCC, TPG, TST, TSK, TSN
SBSmc3	24	TCC, TPG, TSN
SBSmh	39, 51	TCC, TPG
SBSmk1	24	TPG, TSN
SBSmk2	54	TPG
SBSmm	23	TKA
SBSmw	39, 51	TCC, TPG
SBSwk3	54	TBA, TSN
SBSwk3a	54	TSN

[a] For windthrow dominant areas only. Refer to AREC Field Assessment Procedures for NDT1 for areas without 100-year wind events.

[b] There is no LMH for ESSFdc3. Use the LMH 23 or LMH 39 for ESSFdc2 (Ryan, 2012).

[c] LMH76 is currently in draft form. ESSFdh1 was formerly MSmw1 (Province of BC, 2023a).

[d] ESSFdv1 changed from ESSFdv, and ESSFdv2 changed from ESSFdv d in 2008. No updated LMH for this variant yet (Province of BC, 2023a).

[e] ICHdw3 changed from ICHmw3 in 2006. No updated LMH for this variant yet. Use LMH23 for ICHmw3 (Ryan, 2012).

[f] ICHmk5 replaced some of ICHmk4 in 2018. No updated LMH for this variant yet (Province of BC, 2023a).

[g] MSdc1 and MSdc3 changed from MSdc in 2006. No updated LMH for these variants yet. Use LMH 23 for MSdc (Ryan, 2012).

[h] MSxk3 changed from MSxk in 2006. No updated LMH for this variant yet. Use LMH39 for MSxk (Ryan, 2012).

[i] Updated guides for these variants have not been published yet. Refer to descriptions from BEC Web PDFs (Province of BC, 2023c).

of the appropriate LMH to use when working in the various BEC units, as well as the applicable BCTS Business Areas. Table 2 was derived from a GIS analysis that overlayed the BCTS Business Areas with the September 2nd, 2021 BEC and NDT dataset (WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY), which was then cross-

referenced with each LMH. References for each LMH are listed in the below footnote[5]. As BEC units and LMHs are updated, Table 2 should be updated to reflect the changes.

The BCTS Business Area AREC Focus Lists provide references of the key AREC to be aware of during fieldwork. These AREC are risk ranked highest due to parameters specified in the risk ranking process used to score all AREC downloaded from the BC Species & Ecosystems Explorer.

It should be noted that limited confirmed AREC occurrences have been mapped by the CDC within BC, and some red and blue listed species may be found outside their known range within some BEC units that may not be listed in the focus lists[6]. More information about confirmed AREC locations may be found within the BC CDC webpage and tools (BC Species & Ecosystems Explorer and CDC iMap). There are provincial standards for mapping and modelling ecosystems at risk, including utilizing Sensitive Ecosystems Inventory (SEI), Terrestrial Ecosystem Mapping (TEM), Predictive Ecosystem Mapping (PEM), or Broad Ecosystem Inventory (BEI) (Ministry of Environment, 2006).

3. Experience Considerations

To effectively identify potential AREC in the field, it is beneficial for the assessor to have the following experience:

- Knowledge of local indicator plants, and ability to identify them in the field
- Familiarity using BEC field guides (LMHs)
- Experience in field identification and confirmation of BEC site series within the local geographic location
- Proficiency collecting and preparing ecological data for cutblock Site Plans (Registered Professional Forester (RPF)) OR an experienced professional field ecologist (Registered Professional Biologist (RPBio))

If the assessor does not meet the competency requirements listed above, they should work under the direct supervision of an assessor who does meet them (Site Plan Forester or Ecologist).

4. Field Procedures

These field procedures have been developed based on the Biodiversity Guidebook (1995), the Field Manual for Describing Terrestrial Ecosystems – 2nd Edition (2010), and the guidance provided within the Guidelines to support implementation of the Great Bear Rainforest Order with respect to Old Forest and Listed Plant Communities - LMH 72 (Banner, Meidinger, Green, & Saunders, 2019). Although LMH 72 was developed specifically for assessing plant communities on the coast, it provides the best practical field assessment advice for this type of work in BC.

[5] LMH 15 (Meidinger, McLeod, MacKinnon, DeLong, & Hope, 1988), LMH 20 (Braumandl & Curran, 1992), LMH 23 (Lloyd, Angove, Hope, & Thompson, 1990), LMH 24 (DeLong, Tanner, & Jull, 1993), LMH 26 (Banner A. , MacKenzie, Thomson, Pojar, & Trowbridge, 1993), LMH 28 (Green & Klinka, 1994), LMH 39 (Steen & Coupé, 1997), LMH 51 (DeLong, 2003), LMH 54 (DeLong, 2004), LMH 65 (DeLong, Banner, MacKenzie, Rogers, & Kaytor, 2011), LMH 70 (MacKillop & Ehman, 2016), LMH 71 (MacKillop, Ehman, Iverson, & McKenzie, 2018), LMH 75 (MacKillop, et al., 2021), and LMH 76 (Ryan, Lloyd, & Iverson, 2021).
[6] Personal communication with Jason Straka, MSc, RPBio, Program Ecologist for the BC CDC.

These field procedures help assessors determine whether a potential AREC meets the description of a red or blue listed ecological community, as per the following steps:

4.1 Office Prework;
4.2 Potential AREC & Site Series Observations (STEP 1);
4.3 Tree/Plant Species Identification, AREC Description Confirmation, Area, and Stand Age (STEP 2);
4.4 Stand Maturity Assessment (STEP 3);
4.5 Biodiversity Attributes Assessment (STEP 4); and
4.6 Field Form & Operability Observations (STEP 5).

Fieldwork Timing Considerations

Fieldwork should take place during the growing season, in the absence of snow. In spring, assessments may be undertaken several weeks after snowmelt, when deciduous understorey shrubs and herbs have started to appear, leaf out, and bloom. In the absence of drought, summer provides the best phase for observing the full range of vegetation growing under the forest canopy, and therefore the best conditions for assessing potential AREC. Assessments should be completed prior to fall dieback of understorey vegetation. Seasonality of fieldwork will vary depending on BEC zone and location. Example windows for fieldwork at low elevations in BC's southern interior could be from May to October, whereas the northern interior window may be limited from June to September, depending on snowmelt and early season dieback.

4.1 Office Prework

Prior to beginning fieldwork, complete the following office prework to gain valuable information about the development area/area of interest (AOI):

- ☐ Review the following spatial data within the AOI, using iMap, Geographic Information Systems (GIS), or a similar mapping program:
  - ☐ NDT[7] (to ensure the correct field assessment procedure is used) – WHSE_FOREST_VEGETATION.BEC_NATURAL_DISTURBANCE_SV from BCGW.
  - ☐ BEC unit (zone / subzone / variant / phase) – WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY from BCGW.
  - ☐ Optional: TEM (select locations throughout interior BC) or PEM (common throughout BC) – check Terrestrial Ecosystems Data & Information (TEI) project index maps online (Province of BC, 2023b), and/or search for data from the BCGW. TEM or PEM data may be used to gain an idea of site series locations, but site series must be field confirmed.
  - ☐ Known red or blue listed ecological community locations – WHSE_TERRESTRIAL_ECOLOGY.BIOT_OCCR_NON_SENS_AREA_SVW from BCGW for publicly available occurrences. Other datasets for masked, sensitive occurrences are available from BCGW as well.
- ☐ Review the AREC Focus List for the relevant BCTS Business Area:
  - ☐ Note AREC names for the BEC unit(s) within the AOI (the AREC Focus List spreadsheet is easily filtered). If working within the GBRO (2016) areas, refer to Appendix A to ensure all

[7] NDT is also included as an attribute within the BEC spatial data from the BCGW.

AREC within the BEC unit are noted. Some GBRO (2016) blue-listed plant communities within NDT3 are not included in the focus lists, and/or the BC Species & Ecosystems Explorer.

- ☐ Review AREC descriptions on the BC Species & Ecosystems Explorer (if available[8]) and ensure ability to identify the AREC in the field. For example, subalpine fir / black huckleberry / ragged-mosses may occur within the ESSFdv/04, and generally within the ESSFdv1. By clicking on the scientific name link in a BC Species & Ecosystems Explorer search, a list of reports and references appears, including the BC Community Summary.
- ☐ Review the relevant LMH(s) to gain additional information about the AREC. Refer to the written descriptions and vegetation prominence tables within for the site series and geographic area.
- ☐ Take note of key characteristics, such as tree canopy species, shrub/herb/moss layer species and relative cover, soil textures, soil moisture regime (SMR), soil nutrient regime (SNR), forest productivity, and any other identifying qualities. This is extremely important to be aware of prior to fieldwork, so potential AREC may be easily identified.

- ☐ Gather an idea of stand age prior to fieldwork. Refer to Vegetation Resource Inventory (VRI), from BCGW and speak with field personnel who already know or can estimate stand age.

4.2 Potential AREC & Site Series Observations (STEP 1)

Potential AREC observations are usually completed as part of Site Plan field data collection, but could be observed during any fieldwork[9]. Assessors should carry a copy of the office prework notes, applicable LMH, and NDT3 field reference card. During fieldwork, a Site Plan Plot Card may be used to gather initial reconnaissance data where tree and plant species observations match AREC names from the BCTS business area focus list or GBRO (2016) schedules. Where a potential AREC is observed in the field, it is important that the tree and plant species relative abundance and percentages are in alignment with the AREC descriptions and vegetation tables gathered during the office prework stage. The observed site series does not need to match the AREC Focus List spreadsheet, because the downloaded CDC data might not include all BEC units/site series the AREC is found in. The CDC data is limited to the current known range for each AREC. However, where observed site series match the AREC focus list in addition to AREC descriptions and vegetation tables, more evidence can be applied towards confirming the AREC.

Potential AREC site series may be observed as per the following two definitions:

1) **a discrete observation** – a single site series, or almost entirely a single site series which supports a BCTS focus list or GBRO (2016) AREC; or,
2) **a complex observation** - a mosaic of two or more site series (unable to be mapped separately due to spatial complexity[10]) which supports one or more BCTS focus list or GBRO (2016) ARECs.

If a discrete or complex potential AREC observation is encountered during fieldwork, apply the appropriate field decision-making procedures as outlined in STEP 1. Work through the steps in the order

[8] Limited Ecological Community Summaries are available from the CDC. Where unavailable, refer to the relevant LMH.
[9] Proficiency with ecological Site Plan field data collection is required. Methodology is beyond the scope of this document.
[10] Definitions established based on listed community definitions within LMH 72 (Banner, Meidinger, Green, & Saunders, 2019).

they appear. If a statement does not apply, or there is no direction to skip to a specified step, proceed directly to the next statement. For example, if 1.1 does not apply, proceed to 1.2, and so forth for all field procedures steps.

STEP 1: A discrete or complex potential AREC observation is encountered during fieldwork. Apply location-specific procedures:

1.1 The potential AREC observation is located within the GBRO Central/North Coast Area or GBRO South Central Coast Area AND matches the information listed in Appendix A (Table 4 and/or Table 5), as collated from the red-listed and blue-listed GBRO (2016) schedules N and O for NDT3. → Follow the decision-making process in LMH 72 and refer to the GBRO Field Reference Card. Do not apply these BCTS field procedures.

1.2 The potential AREC observation is not listed in Appendix A and the GBRO (2016) schedules N and O. → Proceed to STEP 2.

4.3 Tree/Plant Species Identification, AREC Description Confirmation, Area, and Stand Age (STEP 2)

STEP 2-A applies diagnostic questions to confirm the potential AREC meets descriptions and classification parameters available from the office prework and relevant LMH. The AREC name sometimes represents the dominant tree and understorey species present. For example, as per LMH23 and the BC Species & Ecosystems Explorer, observations for subalpine fir / black huckleberry / ragged-mosses (ESSFdv/04, and ESSFdv1) would include subalpine fir, hybrid spruce and lodgepole pine as the dominant tree species, black huckleberry and falsebox as the dominant shrub species, and low cover of ragged-mosses and pelt lichens as the dominant moss/lichen species. Other understorey species could be present as per the vegetation summary from BC Species & Ecosystems Explorer, and the Vegetation Table from LMH 23. Not all vegetation from the summaries and tables must be present for an observation to be considered as a potential AREC.

The AREC description confirmation requires professional judgement and due diligence.

STEP 2-A: Ask the following questions, and record supportive data:

2-A.1 Is the potential AREC observation located within a forested[11] ecosystem? → If **YES**, proceed to STEP 2-A.2 → If **NO**, proceed to STEP 2-A.3.

2-A.2 Is the site series able to support an AREC at mature and old stages of forest development?
The stand should be exhibiting signs of mid to late successional status[12] with a

[11] Forested ecosystems are defined as having ≥ 10% average cover of trees ≥ 10 m tall. If there is continuous tree cover of trees < 10 m tall, these sites are also considered to be forested (e.g., bog woodlands) (MacKenzie, 2012).
[12] Mid-successional stands usually have two cohorts with one dominant overstorey layer and one younger regenerating layer (BC Ministry of Forests and Range & BC Ministry of Environment, 2010). Later successional stands will eventually mature into old climax characteristics, with well-developed vertical structure, dead wood (standing and on the forest floor), canopy gaps, and well-developed plant communities.

structural stage of 6 - mature or 7 - old[13]. See Appendix B for complete definitions. → Take notes and photos to support your answer. If **YES**, proceed to STEP 2-A.3. → If **NO**, the observation is not an AREC. Assessment complete.

2-A.3 Is the vegetation summary from BC Species & Ecosystems Explorer (if available) and the description/vegetation table from the relevant LMH in alignment with the tree/plant species observations for the potential AREC? If there is no vegetation summary available from BC Species & Ecosystem Explorer, refer only to the description/vegetation table from the relevant LMH when answering this question. → Take notes to support your answer of **YES** or **NO**. → If **NO**, AND within a non-forested ecosystem, the observation is not an AREC. Assessment complete. → Otherwise, proceed to STEP 2-B.

STEP 2-B involves determining the area occupied by the potential AREC, estimating stand age, and estimating veteran tree count. If the ecosystem is non-forested, stand age and veteran tree count is not required. These determinations may be completed concurrently during a walk-through mapping exercise.

Mapping the area occupied by the potential AREC will indicate whether the observation is large enough to qualify as a confirmed AREC.

Stand age estimations are used to support determination of successional (seral or developmental) forest stages, e.g. mid/mature or late/old succession/structure. Table 3 summarizes stand age categories for BEC zones within NDT3 (Biodiversity Guidebook, 1995; Landscape Unit Planning Guide, 1999).

Table 3: Seral Stage Ages for BEC Zones within NDT3

BEC Zone	Mature	Old
BWBS*	> 80 yrs	> 100 yrs
CWH^	> 80 yrs	> 140 yrs
BWBS**, ICH, MS, SBPS, SBS	> 100 yrs	
ESSF	> 120 yrs	

* BWBS with deciduous prominent

^ CWH exposed coastal areas subject to 100-year extensive windthrow disturbances

** BWBS with coniferous prominent

Veteran trees are living remnants that survived a previous stand-replacing disturbance (e.g. wildfire, windthrow, disease, or logging), and are much older than the rest of the stand (Banner, Meidinger, Green, & Saunders, 2019; BC Ministry of Forests, 2022). They are usually recognized as being much larger in diameter and height than other trees in the stand. For the purposes of these BCTS AREC field procedures, and in accordance with old seral stage ages (Table 3), veteran trees are categorized as > 100 years old in the BWBS with deciduous prominent, and > 140 years old in the BWBS with coniferous prominent/the other BEC zones within NDT3.

[13] Definitions for structural stages of mature and old are in alignment with mid to late successional stages. Refer to the Site Description section of LMH 25 for complete definitions (BC Ministry of Forests and Range & BC Ministry of Environment, 2010).

STEP 2-B: Map the potential AREC location using GPS or accurate iPad tracks/mapping. Stand age and veteran tree count (stems per hectare(sph)) may be estimated at the same time. If the ecosystem is non-forested, stand age and veteran tree count is not required.

If the forest is not obviously old (> 100 years in BWBS with deciduous prominent or > 140 years in BWBS with coniferous prominent/other BEC zones within NDT3), collect age cores at breast height (1.3 m from high side ground) from at least 5 of the largest diameter, living trees in the main canopy (excluding veteran trees). Estimate ages by counting the rings and adding estimated age to breast height age based on the following (BC Ministry of Forests, 2022):

- Fd, Lw, Pl, Pw, Py → add 10 years
- Hw, Cw, Se, Sx, Ss, Bl, Ba, Bg → add 15 years

If the pith was not obtained from coring, apply Best Practices for Coring and Aging Trees to Determine Stand Age in older forests - available from Appendix 4 of Field Verification of Priority Old Forest Deferral Areas: Technical Guidance (2022). Determine the average stand age based on the 5 estimated tree ages. If the forest is obviously old, recommend coring at least one tree to confirm its age.

If the stand is ≤ 100 years in BWBS with deciduous prominent or ≤ 140 years in BWBS with coniferous prominent/other BEC zones within NDT3, and veteran trees are present, recommend coring one or two veteran trees to confirm the veteran tree age(s). During mapping, establish whether veteran tree count is ≥ 20 sph, 10-20 sph, or < 10 sph. Calculate average veteran tree density based on a few fixed radius (25 m) plots/ha[14]. Even if the potential AREC observation is less than 1 ha, ensure to calculate veteran density over at least 1 ha to avoid introducing bias.

2-B.1 The **discrete observation** covers **≥ 0.25 ha** OR the **complex observation** covers **≥ 0.50 ha**[15] → Proceed to STEP 2-B.3.

2-B.2 The discrete observation covers < 0.25 ha OR the complex observation covers < 0.50 ha → The observation is not large enough to be an AREC. Assessment complete.

2-B.3 The observation is within a non-forested ecosystem → **Observation is a confirmed AREC**. Proceed to STEP 5.

2-B.4 The stand age is obviously old at > 100 years for BWBS with deciduous prominent or at > 140 years for BWBS with coniferous prominent/other BEC zones within NDT3 → **Observation is a confirmed AREC**. Proceed to STEP 5.

2-B.5 The stand age is ≤ 100 years in BWBS with deciduous prominent or is ≤ 140 years in BWBS with coniferous prominent/other BEC zones within NDT3 AND the answer from STEP 2-A.3 is **YES** → Proceed to STEP 3.

2-B.6 The stand age is ≤ 100 years in BWBS with deciduous prominent or is ≤ 140 years in BWBS with coniferous prominent/other BEC zones within NDT3 AND the answer from STEP 2-A.3 is **NO** → The observation is not old enough, nor has the right species composition to be an AREC. Assessment complete.

[14] Based on LMH 72 (Banner, Meidinger, Green, & Saunders, 2019).

[15] Compared with NDT2, size criterion is smaller for complex observations due to shorter average disturbance return intervals, and patchy nature of remnant mature forests.

4.4 Stand Maturity Assessment (STEP 3)

The stand maturity assessment is applied after stand age and veteran tree count estimations (STEP 2-B). This step applies a decision-making key to determine potential AREC confirmation where the stand is not obviously old, but has old forest characteristics. The key is based on mature stand age for the BEC zone (Table 3), and veteran trees present with ages > 100 years in BWBS with deciduous prominent or > 140 years in BWBS with coniferous prominent/other BEC zones within NDT3. Veteran tree thresholds of ≥ 20 sph, indicating old forest characteristics, were established based on Field Verification of Priority Old Forest Deferral Areas: Technical Guidance (2022).

STEP 3: Work through the following decision-making key:

3.1 BEC zone is BWBS with deciduous prominent or CWH subject to extensive 100-year windthrow disturbance, stand age is > 80 years, and contains ≥ 20 sph of veteran trees. → AREC has old forest characteristics. **Observation is a confirmed AREC.** Proceed to STEP 5.

3.2 BEC zone is one of the following BEC zones: BWBS with coniferous prominent, ICH, MS, SBPS, or SBS; stand age is > 100 years, and contains ≥ 20 sph of veteran trees. → AREC has old forest characteristics. **Observation is a confirmed AREC.** Proceed to STEP 5.

3.3 BEC zone is ESSF, stand age is > 120 years, and contains ≥ 20 sph of veteran trees. → AREC has old forest characteristics. **Observation is a confirmed AREC.** Proceed to STEP 5.

3.4 BEC zone is BWBS with deciduous prominent or CWH subject to extensive 100-year windthrow disturbance, stand age is > 80 years, and contains < 20 sph of veteran trees. → Proceed to STEP 4.

3.5 BEC zone is one of the following BEC zones: BWBS with coniferous prominent, ICH, MS, SBPS, or SBS; stand age is > 100 years, and contains < 20 sph of veteran trees. → Proceed to STEP 4.

3.6 BEC zone is ESSF, stand age is > 120 years, and contains < 20 sph of veteran trees. → Proceed to STEP 4.

3.7 BEC zone is BWBS with deciduous prominent or CWH subject to extensive 100-year windthrow disturbance and stand age is ≤ 80 years;
OR
BEC zone is one of the following BEC zones: BWBS with coniferous prominent, ICH, MS, SBPS, or SBS; and stand age is ≤ 100 years;
OR
BEC zone is ESSF, and stand age is ≤ 120 years.
→ The stand is not old enough to be an AREC. Assessment complete.

4.5 Biodiversity Attributes Assessment (STEP 4)

Based on the Biodiversity Guidebook (1995) and LMH 72, there are several important stand attributes that contribute to higher biodiversity levels in mature stands. Where the potential AREC observation was classified as mature (see Table 3 for age categories based on BEC zone), with < 20 sph veteran trees in

STEP 3, they may be further assessed in STEP 4. If all suggested biodiversity attributes listed in the STEP 4 criteria are met, the AREC observation should be confirmed.

STEP 4 requires professional judgement and due diligence. Where not all STEP 4 criteria are met, and the assessor believes the AREC observation should be confirmed, they should make a case to the BCTS Business Area contact outlining why they believe the observation is a confirmed AREC.

STEP 4: Does the AREC observation, assessed as mature in age, meet the following criteria?

- ☐ 10-20 sph veteran trees (> 100 years old in the BWBS with deciduous prominent, and > 140 years old in the BWBS with coniferous prominent/the other BEC zones within NDT3)
- ☐ > 14 sph unburned dead trees
- ☐ Common pieces of large downed woody debris (or as per AREC description)
- ☐ Significant vertical structure – a variety of canopy layers > 2 cohorts
- ☐ 10-30% crown closure
- ☐ Patchy to well-developed understorey shrub and herb cover
- ☐ Previous disturbance history was natural (fire or wind) or selective harvest

If **NO,** the observation does not have enough biodiversity attributes to qualify as a confirmed AREC.

If **YES**, **observation is a confirmed AREC.** → Proceed to STEP 5.

4.6 Field Form & Operability Observations (STEP 5)

STEP 5: Complete the BCTS Species At Risk (SAR) Field Observation form (or similar), and take representative photos. Suggested plot size is 10 m x 10 m. Minimize edge effects by establishing the plot at least one tree length into the stand from any edges. At minimum, record the following information:

- Observer Details: Observer's Name, Date Observed, Location Information
- AREC Observations: AREC Name, BEC unit (zone / subzone / variant / phase), site series, SMR, SNR, Area/size of AREC, List of vegetation and percent coverage (tree species, shrubs, herbs, mosses/lichens [see examples of foliage estimates for individual plants in Figure 2, and of vegetation stratums in Figure 3 - total percent coverages by layer/stratum may not exceed 100%, but percent coverages by individual species within a stratum could exceed 100% when there are vegetation overlaps]), Answers to the questions in 2-A, Comments to support assessment (e.g., assessment completed within NDT3, which steps were completed to confirm the AREC, etc.).
- Supportive information (forested ecosystems only): Record stand age and how age was estimated. Include tree core data (species, ring count, etc.), where applicable. If the stand is ≤ 100 years in BWBS with deciduous prominent or ≤ 140 years in BWBS with coniferous prominent/other BEC zones within NDT3, then record estimated veteran tree age, and sph.
- Photos: Take photos in each of the cardinal directions, of the representative vegetation, and of the tree crown.

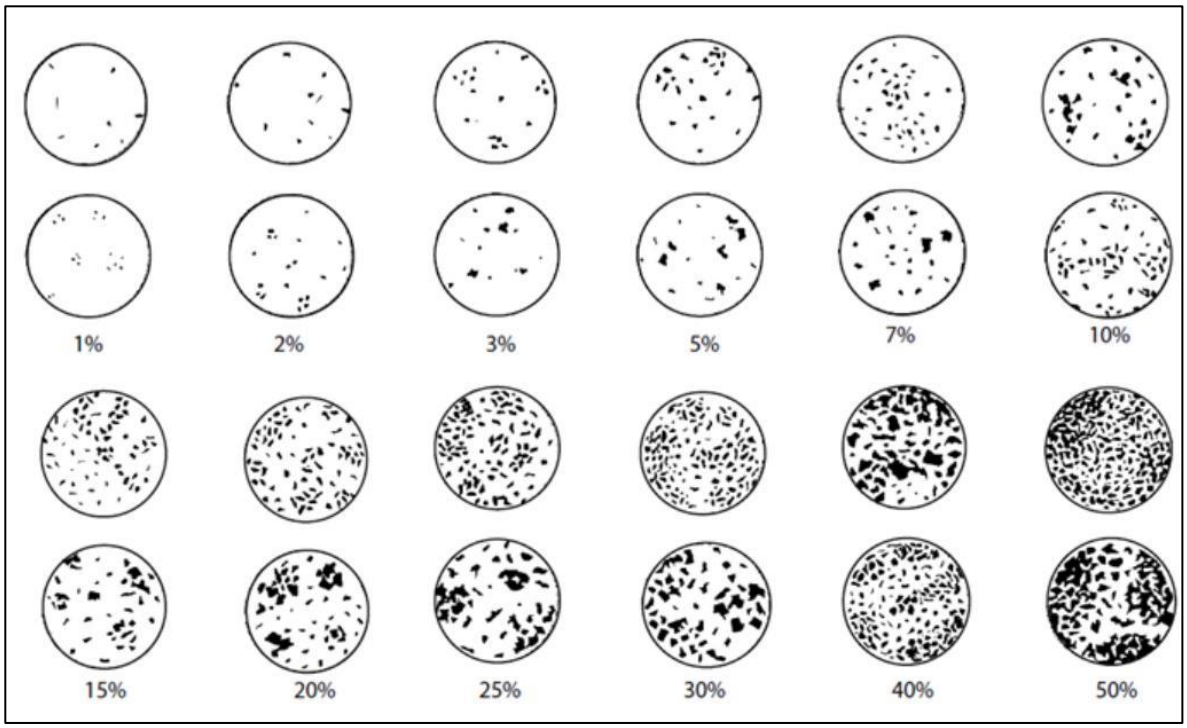


Figure 2: Visual representations of foliage percent estimates – from LMH 25 (BC Ministry of Forests and Range and BC Ministry of Environment, 2010)

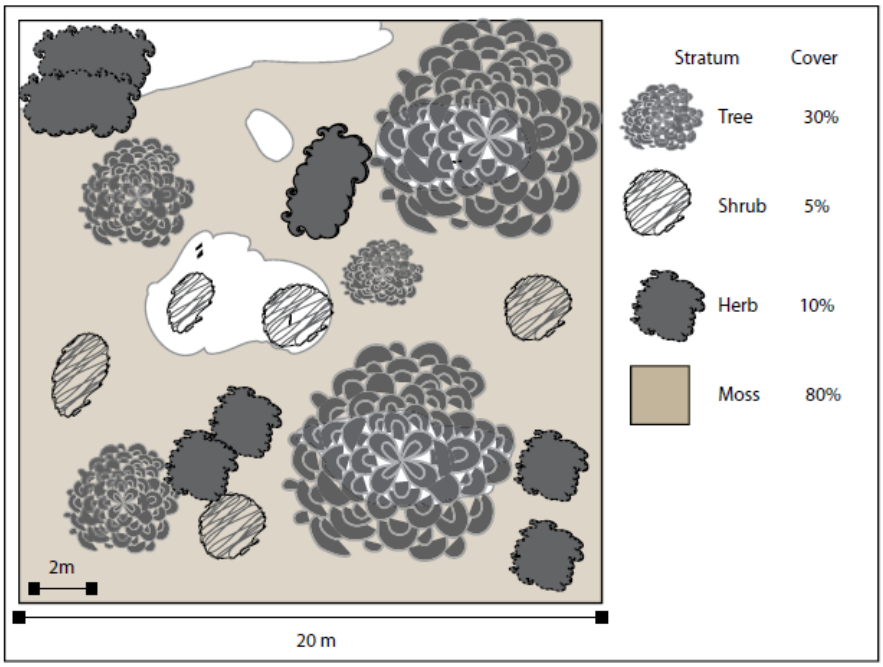


Figure 3: Bird's eye view of example vegetation stratums in a plot – from LMH 25 (BC Ministry of Forests and Range and BC Ministry of Environment, 2010)

Operability Observations

Take notes about the confirmed AREC location. Is the AREC located in an operable area? Is the area harvestable or not? Is the AREC already located within a reserve? Is the AREC located near established protected areas? Is the AREC location impeding access to current or future development? Are there any safety issues?

Field assessment is complete. Ensure all data are collected, and consider the next steps when back in the office (see Section 5).

5. Next Steps

Report the confirmed AREC observation to the appropriate BCTS contact. Provide all field data, including GPS or iPad tracks, plot data, photos, SAR Field Observation Form (or similar), and additional notes. Consult with any existing AREC management guidelines within the Business Area and Ministry region, such as local BMPs or SOPs, to develop a stand level management option. If necessary consult with a qualified registered professional. BCTS will submit details of the confirmed AREC to the BC Conservation Data Centre using the Incidental Observations submission process, where applicable.

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Appendix A

Table 4: GBRO (2016) Red-Listed Plant Communities within NDT3

GBRO Area	BEC unit*	English Name
Central/North Coast	MSdc2/Gs02	Nuttall's alkaligrass - foxtail barley
Central/North Coast	SBSmc2	Sandberg's bluegrass - slender wheatgrass
Central/North Coast	SBSmc2	Saskatoon / slender wheatgrass
Central/North Coast	SBSmc2/Wf09	few-flowered spike-rush / hook-mosses
Central/North Coast	SBSmc2/Wf10	Hudson Bay clubrush / rusty hook-moss
South Central Coast	CWHvh1	dune bluegrass Herbaceous Vegetation
South Central Coast	CWHvh1 CWHvh2 CWHvm1	dune wildrye - beach pea
South Central Coast	CWHvh1/00	large-headed sedge Herbaceous Vegetation
South Central Coast	CWHvh1/08	Sitka spruce / false lily-of-the-valley Very Wet Hypermaritime1
South Central Coast	CWHvh1/09	Sitka spruce / tall trisetum
South Central Coast	CWHvh2/Wf51 CWHvm1/Wf51 CWHvm2/Wf51	Sitka sedge / peat-mosses

* CWH BEC units only apply to NDT3 where extreme 100-year windthrow events occur on exposed coastal areas

Table 5: GBRO (2016) Blue-listed Plant Communities within NDT3

GBRO Area	BEC unit*	English Name
Central/North Coast South Central Coast	CWHvh1/04	western hemlock - Sitka spruce / lanky moss
Central/North Coast South Central Coast	CWHvh1/06	western redcedar - Sitka spruce / three-leaved foamflower**
Central/North Coast South Central Coast	CWHvh1/07	western redcedar - Sitka spruce / devil's club Very Wet Hypermaritime
Central/North Coast South Central Coast	CWHvh1/10	red alder / salmonberry / common horsetail
Central/North Coast South Central Coast	CWHvm1/04 CWHvm2/04	western redcedar - western hemlock / sword fern
Central/North Coast South Central Coast	CWHvm2/Ws54	western redcedar - western hemlock - skunk cabbage***
South Central Coast	CWHvh1/20	western redcedar – bluffs***

* CWH BEC units only apply to NDT3 where extreme 100-year windthrow events occur on exposed coastal areas

** Not currently in the BCTS focus lists. Is on the BC Species & Ecosystems Explorer as Yellow listed, GNR.

*** Not currently in the BCTS focus lists, nor the BC Species & Ecosystems Explorer

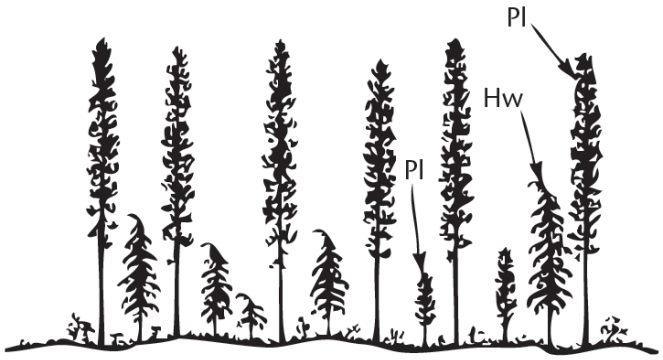
Appendix B

A summary of definitions referred to in STEP 2-A.2. The following definitions, examples and diagrams have been quoted from the Field Manual for Describing Terrestrial Ecosystems 2nd Edition (2010). Examples are not always characteristic of NDT3.

Mid Successional Status - includes ***Maturing Seral***, ***Overmature Seral***, and ***Young Climax*** stands, as per the following:

"***Maturing Seral:***
Community of early-successional tree species that have generally gone through an initial natural thinning due to species interactions such as within-stand competition for light or root-growing space, or a community where mid-successional species dominate. Very open stands may not go through a stem exclusion phase but could have a succession of understorey plant species occurring.

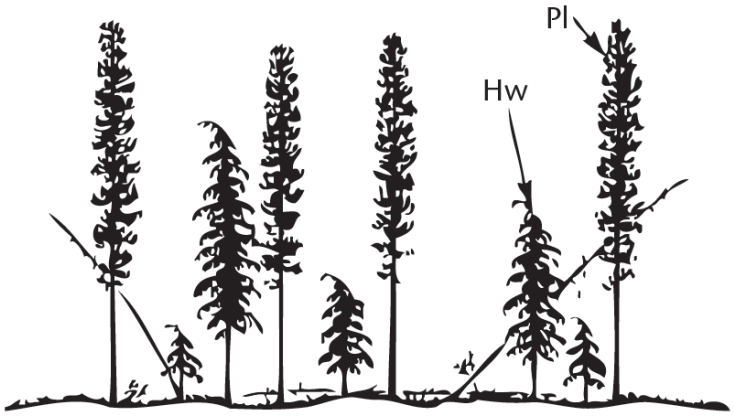
- Trees of mature age (generally 60–140 years old).
- Generally two cohorts: one in the overstorey and a younger one in the regeneration layer, usually of species with greater shade tolerance, but may include a component of species that are the same as the overstorey (e.g., fluvial cottonwood stands).
- Includes stands subject to frequent stand-replacing disturbances where regeneration to another cohort may be limited or absent, but where the stand has matured through natural thinning and development of the community, and the expected regeneration for the climate and ecosystem is to another, more shade-tolerant species.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.



Maturing seral stand

Overmature Seral:
Community where the seral overstorey species of the main upper canopy are dying.

- Usually > 140 years old.
- Typically with a secondary tree canopy consisting of more shade-tolerant species, or some of the same species as those dying; some individuals belonging to the secondary cohort may have entered the main canopy.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.

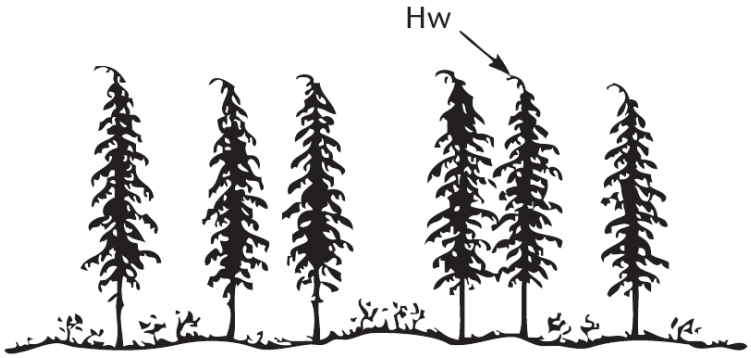


Overmature seral stand

Young Climax:

Community contains tree species typical of the climax expected for the site, but the proportional composition and structure expected at later climax stages has not developed; understorey seral species are usually still evident. This stage may follow the development and death of a stand of seral species or may develop from climax species regeneration on a recently disturbed site.

- In cases where climax tree species are the initial cohort, stands can be young (<30 years); this often occurs in wetter climates where stand-replacing fires are infrequent.
- Includes previously recognized Young Climatic Climax and Young Edaphic Climax stages.
- Examples: young subalpine fir – Engelmann spruce stand in a wet subalpine climate; young ponderosa pine stand in a dry climate where it would be the fire-maintained climax species; 50-60 year old hybrid white spruce stand 'released' from canopy of 100 year old lodgepole pine killed by mountain pine beetle."

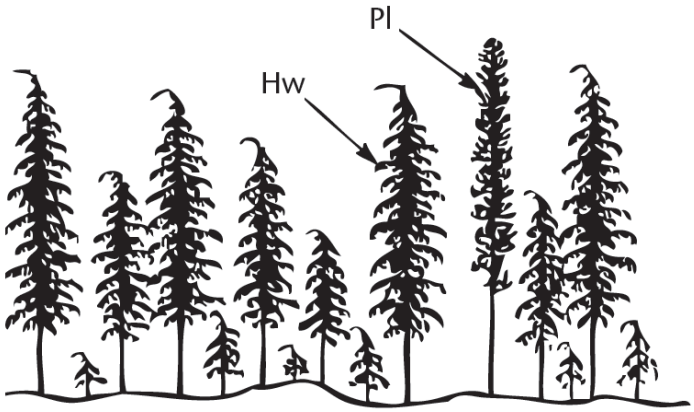


Young climax stand

Late Successional Status - includes ***Maturing Climax***, and ***Old Climax*** stands, as per the following:

"***Maturing Climax:***
Community composed of species in proportions more or less typical of late succession for the site; the stand has undergone natural thinning, and vertical structure has developed, but lacks the complex structure typical of old forests.

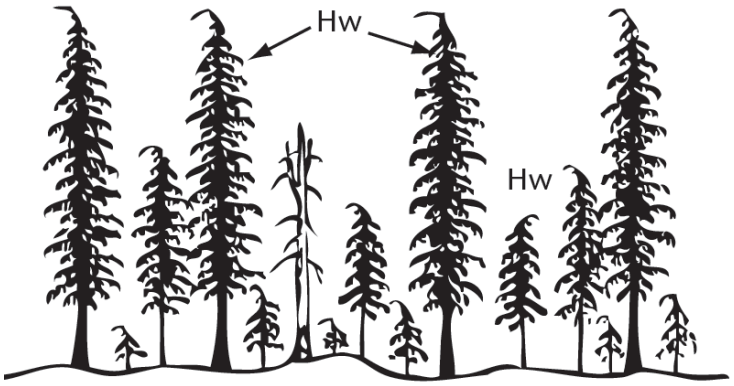
- Differs from [Young Climax] in having a typical mature forest understorey herb and shrub community; stands are developing continuous diameter and height class distributions of climax tree species; seral species may still exist.
- Stands are at least 80–120 years old, but usually older.
- Includes previously recognized Maturing Climatic Climax and Maturing Edaphic Climax stages.
- Examples: mature western redcedar – western hemlock forest with component of Douglas-fir in canopy; mature hybrid white spruce on high-bench floodplain with a developing understorey of multiple cohorts of spruce regeneration.



Maturing climax stand

Old Climax:
The plant community is composed of species expected to be present in the climax stand; vertical structure is well developed; live-tree decay is evident and tree death has led to canopy gaps and large woody debris on the forest floor; often with well developed and distinct epiphytic communities.

- Occasionally, very long-lived seral species (e.g., Douglas-fir) are present, as a minor component of stand, but their removal would not cause a significant change in the growth or establishment of the climax trees.
- Differs from MC in having better-developed vertical and horizontal structure and a more or less continuous age and height class distribution of climax tree species.
- Stands are at least 250 years old, but often much older.
- Examples: very old coastal forests, including subalpine mountain hemlock – amabilis fir or hypermaritime western hemlock – western redcedar – yellow-cedar – shore pine; western redcedar – Devil's club forest with epiphytic stubble-lichens in interior rainforest climate.



Old climax stand

Structural Stage 6: Mature Forest - Understorey reinitiation stage:
"Trees established after the last stand-replacing disturbance have matured; a second cycle of shade-tolerant trees may have become established; shrub and herb understories become well developed as the canopy opens up; time since disturbance is generally 80–140 years for BGCs with NDT 3 and 80–250 years for NDT 1, 2 & 4."

Structural Stage 7: Old Forest - Old-growth stages:
"Stands of old age with complex structure; patchy shrub and herb understories are typical; regeneration is usually of shade-tolerant species with composition similar to the overstorey; long-lived seral species may be present in some ecosystem types or on edaphic sites. Old growth structural attributes will differ across biogeoclimatic units and ecosystems."

Structural Stage 7a: Old Forest
"Stands with moderately to well developed structural complexity; stands comprised mainly of shade-tolerant tree species in canopy and regeneration layers, although older seral trees from a disturbance such as fire may still dominate the upper canopy; fire-maintained stands may have a 'single-storied' appearance; time since stand-replacing disturbance is generally 140 – 250 years for biogeoclimatic units with NDT 3 and > 250 years for NDT 1, 2 & 4."

Structural Stage 7b: Very Old Forest
"Very old stands having complex structure with abundant large-sized trees, snags and coarse woody debris (size is relative to the specific ecosystem); snags and CWD occur in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species with well-established canopy gaps; time since stand-replacing disturbance generally > 250 years for BGCs with NDT 3 and > 400 years for NDT 1, 2 & 4."

At Risk Ecological Communities (AREC) NDT3 Field Reference Card p.1

STEP 1 – Potential AREC & Site Series Observations

Discrete or complex potential AREC observed & site series identified

1.1 Located within GBRO Central/North Coast Area or South Central Coast Area & listed on GBRO schedules N or O

Follow decision-making process in LMH 72. Refer to GBRO Field Reference Card

1.2 Not listed on GBRO schedules N or O

STEP 2 - Tree/Plant Species Identification, AREC Description Confirmation, Area, and Stand Age

A

2-A.1 Is the potential AREC observation located within a forested ecosystem (≥ 10% tree cover ≥ 10 m tall or continuous tree cover < 10 m tall)?

No

^*If no AREC summary available from BC Ecosystems & Explorer, refer only to the BEC guides.*

Yes

No

No further action

2-A.2 Is the site series able to support an AREC at mature and old stages of forest development?

Yes

Mid to late successional status Structural stage 6 or 7

2-A.3 Note whether prework AREC summaries^ & BEC descriptions/ vegetation table are in alignment with field observations – **Yes** or **No**

Go to 2-B.1 if in a forested ecosystem, or if YES AND within a non-forested ecosystem.

If NO AND within a non-forested ecosystem. No further action.

B

2-B.1 Meets area requirements for discrete (≥ 0.25 ha) or complex (≥ 0.50 ha) observation

No

2-B.2 No further action

Yes

2-B.3
Site is Non-forested
2-B.4
Stand Age > 100 years*
OR > 140 years**

AREC Confirmed

STEP 5

2-B.5
Stand Age
≤ 100 years*
OR
≤ 140 years**
& 2-A.3 is **Yes**

2-B.6
Stand Age ≤ 100 years*
OR ≤ 140 years**
& 2-A.3 is **No**

No further action

STEP 3 – Stand Maturity Assessment

3.1 or 3.4 Stand Age >80 years & BWBS* or CWH***

3.2 or 3.5 Stand Age >100 years & BWBS**, ICH, MS, SBPS, or SBS

3.3 or 3.6 Stand Age >120 years & ESSF

3.1, 3.2, or 3.3
Veteran trees ≥ 20 sph

AREC Confirmed

STEP 5

3.4, 3.5, or 3.6
Veteran trees < 20 sph

STEP 4

3.7
Stand Age ≤ 80 years & BWBS* or CWH***
OR
Stand Age ≤100 years & BWBS**, ICH, MS, SBPS, or SBS
OR
Stand Age ≤ 120 years & ESSF

No further action

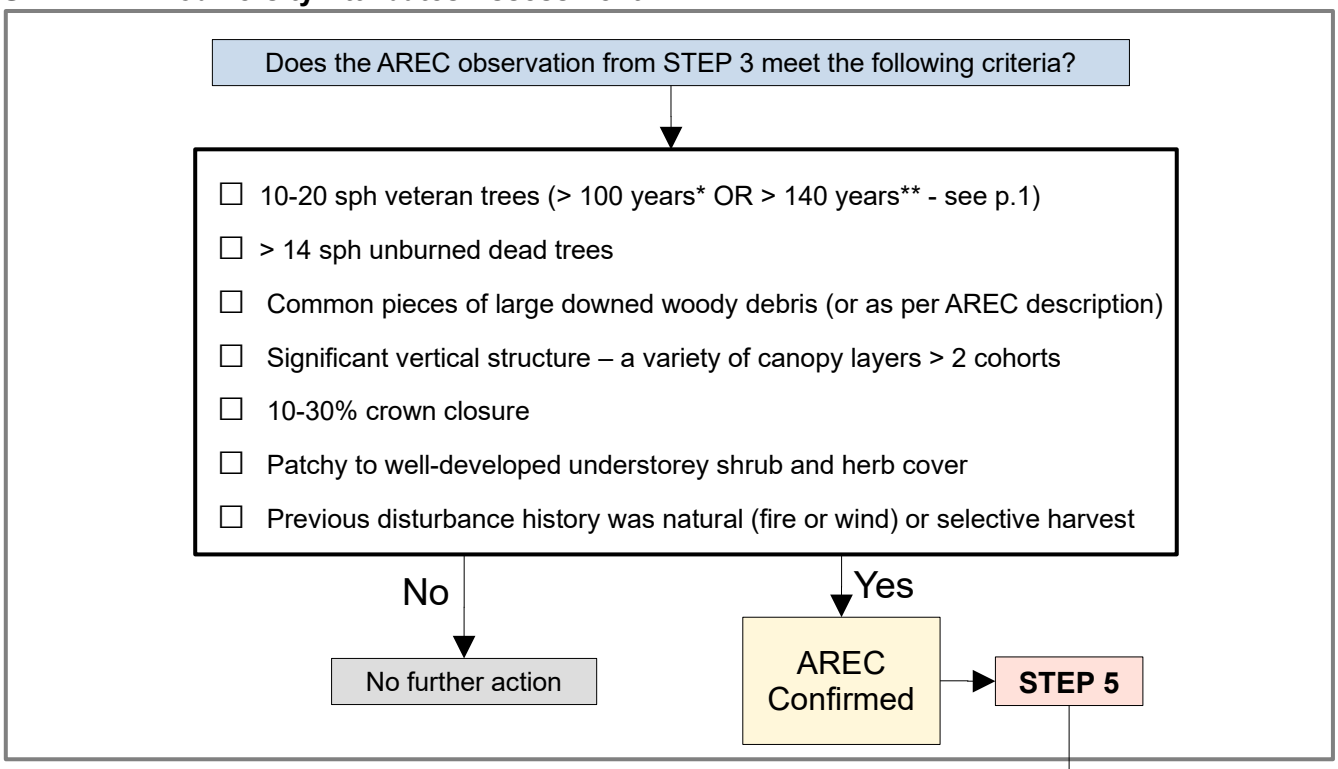
* for BWBS with deciduous prominent

** for BWBS with coniferous prominent/ other BEC zones within NDT3

*** CWH subject to extensive coastal 100-year windthrow disturbance

At Risk Ecological Communities (AREC) NDT3 Field Reference Card p.2

STEP 4 – Biodiversity Attributes Assessment

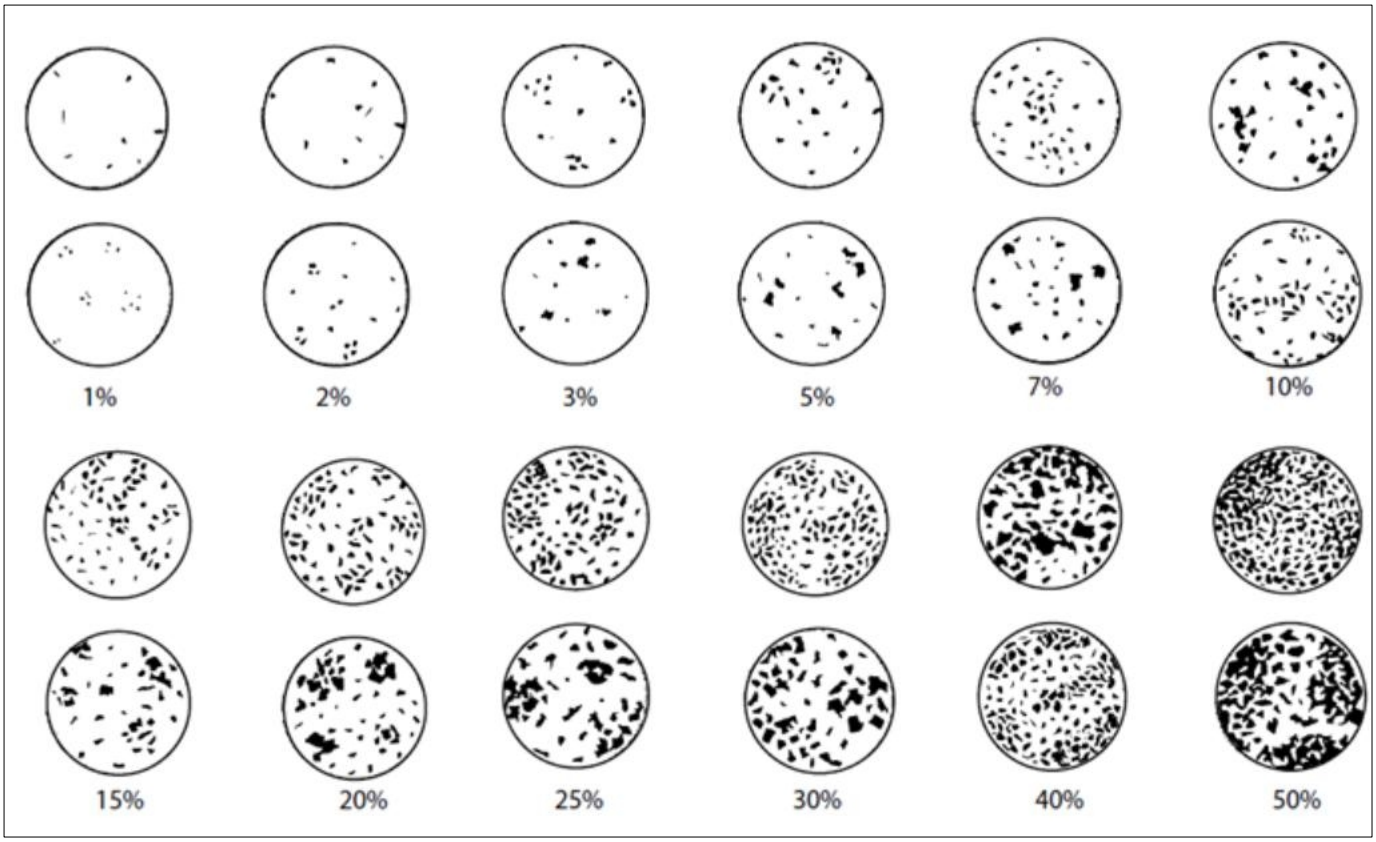


STEP 5 – Field Form & Operability Observations

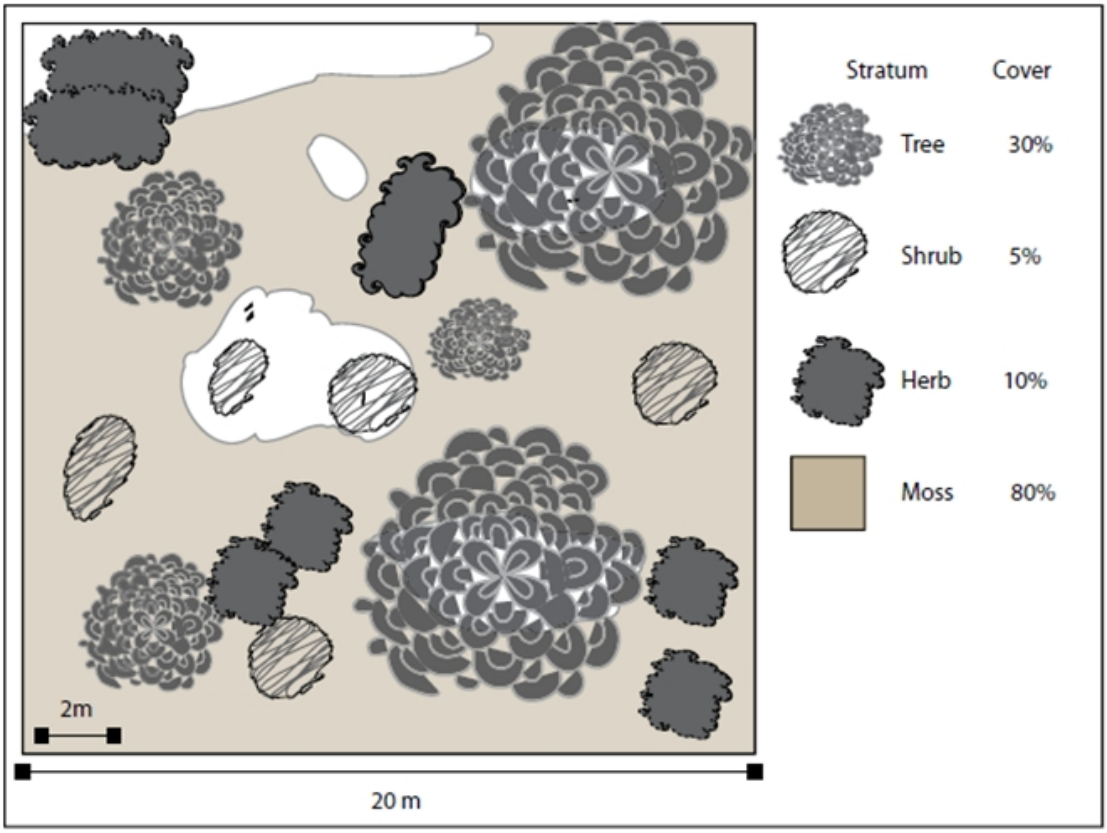
Complete the BCTS Species At Risk (SAR) Field Observation form (or similar), and take representative photos. Suggested plot size is 10 m x 10 m. Minimize edge effects by establishing plot at least one tree length into the stand from any edges. At minimum, record the following information:

Observer Details: Observer's Name, Date Observed, Location Information
AREC Observations: AREC Name, BEC unit (zone / subzone / variant / phase), site series, SMR, SNR, Area/size of AREC, List of vegetation and percent coverage (tree species, shrubs, herbs, mosses/lichens [see examples of foliage estimates for individual plants and of vegetation stratums on next page - total percent coverages by layer/stratum may not exceed 100%, but percent coverages by individual species within a stratum could exceed 100% when there are vegetation overlaps]), Answers to the questions in 2-A, Comments to support assessment (e.g., assessment completed within NDT3, which steps were completed to confirm the AREC, etc.).
Supportive information (forested ecosystems only): Record stand age and how age was estimated. Include tree core data (species, ring count, etc.), where applicable. If the stand is ≤ 100 years in BWBS with deciduous prominent or ≤ 140 years in BWBS with coniferous prominent/other BEC zones within NDT3, then record estimated veteran tree age, and sph.
Photos: Take photos in each of the cardinal directions, of the representative vegetation, and of the tree crown.

Operability Observations
Take notes about the confirmed AREC location. Is the AREC located in an operable area? Is the area harvestable or not? Is the AREC already located within a reserve? Is the AREC located near established protected areas? Is the AREC location impeding access to current or future development? Are there any safety issues?



Visual representations of foliage percent estimates – from Land Management Handbook 25



Bird's eye view of example vegetation stratums in a plot – from Land Management Handbook 25

At Risk Ecological Communities (AREC) NDT3 Field Reference Card p.4

A summary of definitions referred to in STEP 2-A.2. The following definitions, examples and diagrams have been quoted from the Field Manual for Describing Terrestrial Ecosystems 2nd Edition (2010). Examples are not always characteristic of NDT3.

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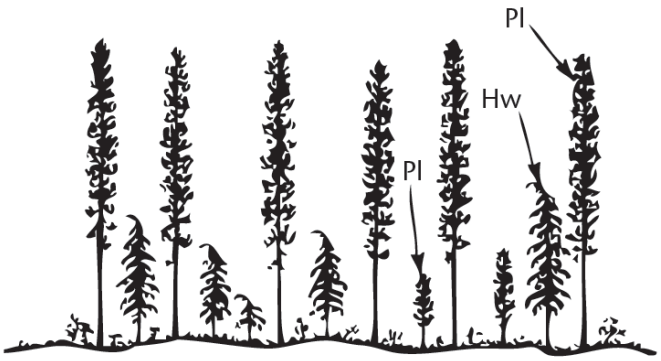
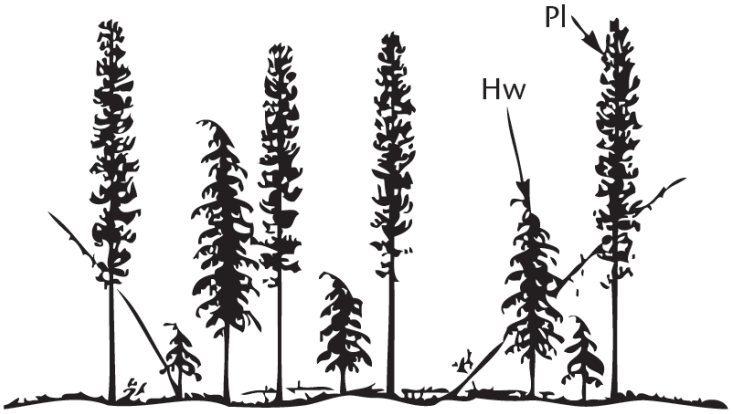
- Includes stands subject to frequent stand-replacing disturbances where regeneration to another cohort may be limited or absent, but where the stand has matured through natural thinning and development of the community, and the expected regeneration for the climate and ecosystem is to another, more shade-tolerant species.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.



Maturing seral stand

Overmature Seral:
Community where the seral overstorey species of the main upper canopy are dying.

- Usually > 140 years old.
- Typically with a secondary tree canopy consisting of more shade-tolerant species, or some of the same species as those dying; some individuals belonging to the secondary cohort may have entered the main canopy.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.



Overmature seral stand

Young Climax:

Community contains tree species typical of the climax expected for the site, but the proportional composition and structure expected at later climax stages has not developed; understorey seral species are usually still evident. This stage may follow the development and death of a stand of seral species or may develop from climax species regeneration on a recently disturbed site.

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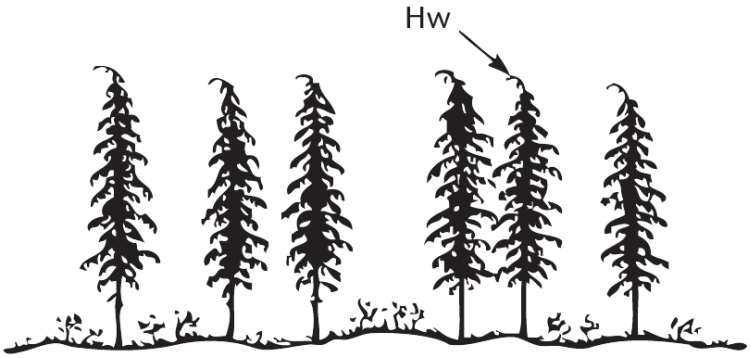
- Examples: young subalpine fir – Engelmann spruce stand in a wet subalpine climate; young ponderosa pine stand in a dry climate where it would be the fire-maintained climax species; 50-60 year old hybrid white spruce stand 'released' from canopy of 100 year old lodgepole pine killed by mountain pine beetle."



Young climax stand

Late Successional Status - includes ***Maturing Climax***, and ***Old Climax*** stands, as per the following:

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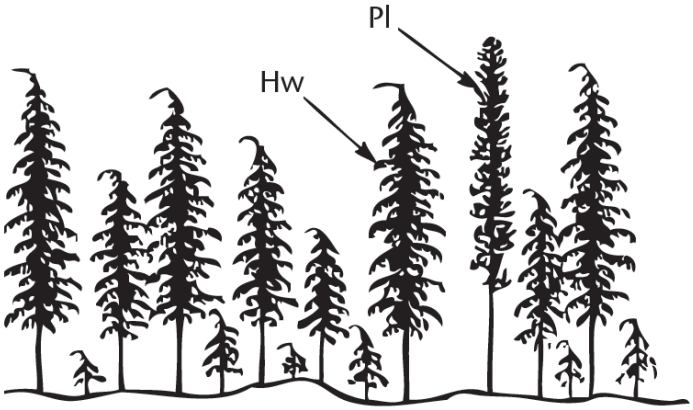
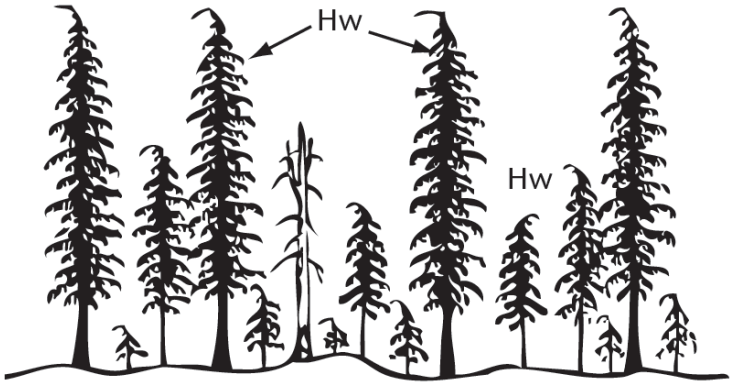
- Differs from [Young Climax] in having a typical mature forest understorey herb and shrub community; stands are developing continuous diameter and height class distributions of climax tree species; seral species may still exist.
- Stands are at least 80–120 years old, but usually older.
- Includes previously recognized Maturing Climatic Climax and Maturing Edaphic Climax stages.
- Examples: mature western redcedar – western hemlock forest with component of Douglas-fir in canopy; mature hybrid white spruce on high-bench floodplain with a developing understorey of multiple cohorts of spruce regeneration.



Maturing climax stand

Old Climax:
The plant community is composed of species expected to be present in the climax stand; vertical structure is well developed; live-tree decay is evident and tree death has led to canopy gaps and large woody debris on the forest floor; often with well developed and distinct epiphytic communities.

- Occasionally, very long-lived seral species (e.g., Douglas-fir) are present, as a minor component of stand, but their removal would not cause a significant change in the growth or establishment of the climax trees.
- Differs from MC in having better-developed vertical and horizontal structure and a more or less continuous age and height class distribution of climax tree species.
- Stands are at least 250 years old, but often much older.
- Examples: very old coastal forests, including subalpine mountain hemlock – amabilis fir or hypermaritime western hemlock – western redcedar – yellow-cedar – shore pine; western redcedar – Devil's club forest with epiphytic stubble-lichens in interior rainforest climate.



Old climax stand

Structural Stage 6: Mature Forest - Understorey reinitiation stage:
"Trees established after the last stand-replacing disturbance have matured; a second cycle of shade-tolerant trees may have become established; shrub and herb understories become well developed as the canopy opens up; time since disturbance is generally 80–140 years for BGCs with NDT 3 and 80–250 years for NDT 1, 2 & 4."

Structural Stage 7: Old Forest - Old-growth stages:
"Stands of old age with complex structure; patchy shrub and herb understories are typical; regeneration is usually of shade-tolerant species with composition similar to the overstorey; long-lived seral species may be present in some ecosystem types or on edaphic sites. Old growth structural attributes will differ across biogeoclimatic units and ecosystems."

Structural Stage 7a: Old Forest
"Stands with moderately to well developed structural complexity; stands comprised mainly of shade-tolerant tree species in canopy and regeneration layers, although older seral trees from a disturbance such as fire may still dominate the upper canopy; fire-maintained stands may have a 'single-storied' appearance; time since stand-replacing disturbance is generally 140 – 250 years for biogeoclimatic units with NDT 3 and > 250 years for NDT 1, 2 & 4."

Structural Stage 7b: Very Old Forest
"Very old stands having complex structure with abundant large-sized trees, snags and coarse woody debris (size is relative to the specific ecosystem); snags and CWD occur in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species with well-established canopy gaps; time since stand-replacing disturbance generally > 250 years for BGCs with NDT 3 and > 400 years for NDT 1, 2 & 4."

At Risk Ecological Communities (AREC) Field Assessment Procedures - Natural Disturbance Type 4 (NDT4)

1. Introduction / Preamble

These practical field assessment procedures have been developed for BC Timber Sales (BCTS) foresters and professional services contractors to follow when encountering a potential At Risk Ecological Community (AREC) during fieldwork. They provide step-by-step procedures for confirming an AREC location within Natural Disturbance Type 4 (NDT4). The distribution of NDT4 within BC is depicted in Figure 1. The spatial dataset for NDT4 is available from the BC Geographic Warehouse (BCGW), with the name WHSE_FOREST_VEGETATION.BEC_NATURAL_DISTURBANCE_SV.

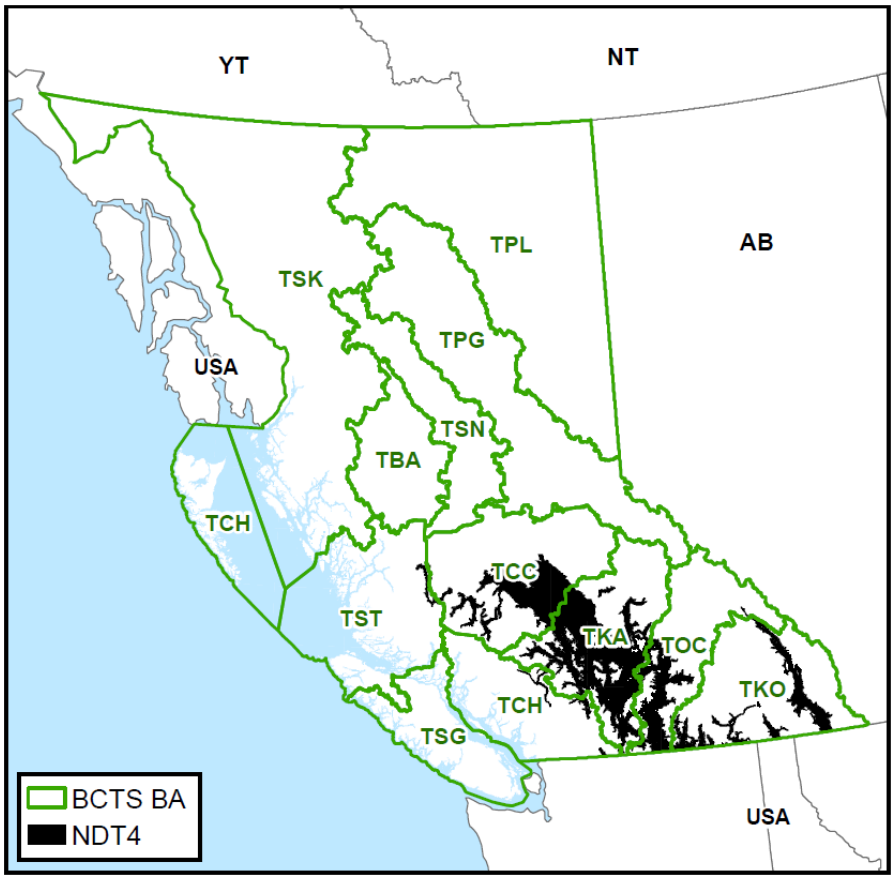


Figure 1: Distribution of NDT4 within BCTS Business Areas (BA)

All BCTS operations are certified under the Sustainable Forestry Initiative (SFI) Forest Management Standard. Indicator 4.2.2 states that certified organizations must have a program to locate and protect known sites of flora and fauna associated with viable occurrences of critically imperiled and imperiled species and ecological communities, defined as Forests with Exceptional Conservation Value.

In the BCTS context, an AREC is an ecological community that meets one or more of the following attributes:

- Red listed (Extirpated[1], Endangered, or Threatened) within the BC Conservation Data Centre (CDC) Species & Ecosystems Explorer database[2]– at greatest risk of being lost
- Blue listed (Special Concern) within the BC CDC Species & Ecosystems Explorer database
- Critically imperiled (G1/S1) or imperiled (G2/S2)[3]
- Red-listed or blue-listed on 'Schedules' of legislated Orders, including:
    - Great Bear Rainforest Order (GBRO) (replaced the Central and North Coast Land Use Order (LUO) & South Central Coast LUO in January 2016) – defined as plant communities
    - Haida Gwaii LUO – December 2010 (Amended April 2014 & September 2017)
- Identified Wildlife Management Strategy (IWMS) plant communities protected under the Forest and Range Practices Act (FRPA) Category of Species at Risk Government Actions Regulation (GAR) Orders:
    - Dates: May 6, 2004, June 5, 2006, & July 18, 2011

Note that some of the red- or blue-listed ecological/plant communities protected under legislation may not be listed, or may be listed under a different category within the BC CDC Species & Ecosystems Explorer database.

It is useful to understand the characteristics of NDT4 prior to undertaking fieldwork. The Biodiversity Guidebook (1995) defines NDT4 as "ecosystems with frequent stand-maintaining fires." NDT4 forested, grassland and shrubland ecosystems were often subject to low-intensity fire, which reduces the density and age of new trees and woody shrubs. Years of wildfire suppression efforts have resulted in forest encroachment into areas that were historically limited to grassland and shrubland, and build-up of ladder fuels and dead fuel on the forest floor. Overall, the NDT4 landscape is characterized by a mosaic of uneven-aged forests, with fire-resistant trees on less arid sites, and less fire-resistant trees on sites that have escaped fire, interspersed with patches of grasses and shrub species (BC Ministry of Forests & BC Ministry of Environment, 1995).

Prior to rigorous wildfire suppression efforts, surface fires occurred every 4-50 years in the Ponderosa Pine (PP) and Interior Douglas-fir (IDF) Biogeoclimatic (BEC) zones. Stand-replacing crown fires rarely occurred in the PP, and occurred every 150-250+ years in the IDF and Interior Cedar Hemlock (ICH) BEC zones (BC Ministry of Forests & BC Ministry of Environment, 1995; Provincial Forest Biodiversity Technical Working Group, 2020).

Recent work has redefined average disturbance intervals for some BEC units near the coast, as summarized in Appendix 3 of the Interim Assessment Protocol for Forest Biodiversity in British Columbia – Standards for Assessing the Condition of Forest Biodiversity under British Columbia's Cumulative Effects Framework – Version 1.0 (Provincial Forest Biodiversity Technical Working Group, 2020). Generally, average stand replacing disturbance intervals of 250 years apply to the Bunchgrass (BG), PP, IDF, and ICH BEC zones. However, near the coast, the IDFww the stand replacing disturbance interval has been estimated as closer to 500 years.

NDT4 is also characterized by forested and non-forested rangeland that is commonly used for grazing. This has had a detrimental effect on natural biodiversity within the NDT4 BEC zones. This, alongside human and natural

[1] No extirpated AREC were extracted from BC Species & Ecosystems Explorer when developing the BCTS Business Area focus lists.
[2] The Glossary for Species & Ecosystems At Risk may be accessed here: https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/glossary-for-species-ecosystems-at-risk
[3] The Conservation Status Categories are defined here: https://explorer.natureserve.org/AboutTheData/DataTypes/ConservationStatusCategories

disturbances, has resulted in reduced abundance of understorey vegetation, which makes it imperative to be able to identify and protect AREC within NDT4.

2. Scope

These NDT4 AREC Field Assessment Procedures apply to the following BCTS Business Areas if their operating areas are within this disturbance type: Cariboo – Chilcotin, Chinook, Kamloops, Kootenay, Okanagan – Columbia, and Seaward Tlasta.

Primary resources needed to complete the fieldwork associated with identifying AREC within NDT4 are the appropriate Land Management Handbook (LMH) for the BEC unit, these procedures, the associated quick reference field card, and the appropriate BCTS Business Area AREC Focus Lists. Table 1 (following page) provides a summary of the appropriate LMH to use when working in the various BEC units, as well as the applicable BCTS Business Areas. Table 1 was derived from a GIS analysis that overlayed the BCTS Business Areas with the September 2nd, 2021 BEC and NDT dataset (WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY), which was then cross-referenced with each LMH. As BEC units and LMHs are updated, Table 1 should be updated to reflect the changes.

The BCTS Business Area AREC Focus Lists provide references of the key AREC to be aware of during fieldwork. These AREC are risk ranked highest due to parameters specified in the risk ranking process used to score all AREC downloaded from the BC Species & Ecosystems Explorer.

It should be noted that limited confirmed AREC occurrences have been mapped by the CDC within BC, and some red and blue listed species may be found outside their known range within some BEC units that may not be listed in the focus lists[4]. More information about confirmed AREC locations may be found within the BC CDC webpage and tools (BC Species & Ecosystems Explorer and CDC iMap). There are provincial standards for mapping and modelling ecosystems at risk, including utilizing Sensitive Ecosystems Inventory (SEI), Terrestrial Ecosystem Mapping (TEM), Predictive Ecosystem Mapping (PEM), or Broad Ecosystem Inventory (BEI) (Ministry of Environment, 2006).

3. Experience Considerations

To effectively identify potential AREC in the field, it is beneficial for the assessor to have the following experience:

- Knowledge of local indicator plants, and ability to identify them in the field
- Familiarity using BEC field guides (LMHs)
- Experience in field identification and confirmation of BEC site series within the local geographic location
- Proficiency collecting and preparing ecological data for cutblock Site Plans (Registered Professional Forester (RPF)) OR an experienced professional field ecologist (Registered Professional Biologist (RPBio))

If the assessor does not meet the competency requirements listed above, they should work under the direct supervision of an assessor who does meet them (Site Plan Forester or Ecologist).

[4] Personal communication with Jason Straka, MSc, RPBio, Program Ecologist for the BC CDC.

Table 1: BEC Units, LMHs, and BCTS Business Areas included in NDT4

BEC Zone / Subzone / Variant	LMH Number(s) [5]	BCTS Business Area
BGxh1	23[a], 76	Okanagan - Columbia (TOC)
BGxh2	23[a], 76	Kamloops (TKA)
BGxh3	39	Cariboo - Cilcotin (TCC), TKA
BGxw1	23[a], 76	TKA
BGxw2	39	TCC, TKA
ICHxw	70	Kootenay (TKO)
IDFdc	23[a], 76[b]	Chinook (TCH), TKA
IDFdh	75	TKO
IDFdk1	23[a], 76	TKA, TOC
IDFdk2	23[a], 76	TCH, TKA, TOC
IDFdk3	39	TCC, TKA
IDFdk4	39	TCC
IDFdk5	71	TKO, TOC
IDFdm1	20, 23, 75	TKO, TOC
IDFdm2	20, 71	TKO
IDFdw	39	TCC, Seaward/tlasta (TST)
IDFmw2	23	TKA, TOC
IDFww	28	TCC, TCH, TKA, TST
IDFww1	28[c]	TCH, TKA
IDFxc	23[a], 76[d]	TKA
IDFxh1	20, 23[a], 76	TKA, TOC
IDFxh2	23[a], 76	TKA, TOC
IDFxk	71	TKO
IDFxm	39	TCC, TKA
IDFxw	39	TCC, TKA
IDFxx1	75	TKO
IDFxx2	71	TKO
PPxh1	23[a], 76	TKA, TOC
PPxh2	23[a], 76	TKA, TOC

[a] LMH 23 is expected to be replaced by LMH 76 (once the final version is released) for relevant geographic areas.

[b] IDFdc replaced some of IDFdk2 in 2006. No updated LMH for this variant yet. Use LMH23, or LMH76 (Ryan, 2012).

[c] IDFww1 replaced some of IDFww in 2006. No updated LMH for this variant yet. Use LMH28 (Ryan, 2012)

[d] IDFxc replaced some of IDFxh2 in 2006. No updated LMH for this variant yet. Use LMH23, or LMH76 (Ryan, 2012)

4. Field Procedures

These field procedures have been developed based on the Biodiversity Guidebook (1995), the Field Manual for Describing Terrestrial Ecosystems – 2nd Edition (2010), and the guidance provided within the Guidelines to support implementation of the Great Bear Rainforest Order with respect to Old Forest and Listed Plant Communities - LMH 72 (Banner, Meidinger, Green, & Saunders, 2019). Although LMH 72 was developed specifically for assessing plant communities on the coast, it provides applicable field assessment advice for this type of work in NDT4.

[5] LMH 20 (Braumandl & Curran, 1992), LMH 23 (Lloyd, Angove, Hope, & Thompson, 1990), LMH 28 (Green & Klinka, 1994), LMH 39 (Steen & Coupé, 1997), LMH 70 (MacKillop & Ehman, 2016), LMH 71 (MacKillop, Ehman, Iverson, & McKenzie, 2018), LMH 75 (MacKillop, et al., 2021), and LMH 76 (Ryan, Lloyd, & Iverson, 2021).

These field procedures help assessors determine whether a potential AREC meets the description of a red or blue listed ecological community, as per the following steps:

4.1 Office Prework;
4.2 Potential AREC & Site Series Observations (STEP 1);
4.3 Tree/Plant Species Identification, AREC Description Confirmation, Area, and Stand Age (STEP 2);
4.4 Stand Maturity Assessment (STEP 3);
4.5 Biodiversity Attributes Assessment (STEP 4); and
4.6 Field Form & Operability Observations (STEP 5).

Fieldwork Timing Considerations

Fieldwork should take place during the growing season, in the absence of snow. In spring, assessments may be undertaken several weeks after snowmelt, when deciduous understorey shrubs and herbs have started to appear, leaf out, and bloom. In the absence of drought, summer provides the best phase for observing the full range of vegetation growing under the forest canopy, and therefore the best conditions for assessing potential AREC. Assessments should be completed prior to fall dieback of understorey vegetation. Seasonality of fieldwork will vary depending on BEC zone and location. Example windows for fieldwork at low elevations in BC's southern interior could be from May to October, whereas higher elevations may be limited from June to September, depending on snowmelt and early season dieback.

4.1 Office Prework

Prior to beginning fieldwork, complete the following office prework to gain valuable information about the development area/area of interest (AOI):

- ☐ Review the following spatial data within the AOI, using iMap, Geographic Information Systems (GIS), or a similar mapping program:
  - ☐ NDT[6] (to ensure the correct field assessment procedure is used) – WHSE_FOREST_VEGETATION.BEC_NATURAL_DISTURBANCE_SV from BCGW.
  - ☐ BEC unit (zone / subzone / variant / phase) – WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY from BCGW.
  - ☐ Optional: TEM (select locations throughout interior BC) or PEM (common throughout BC) – check Terrestrial Ecosystems Data & Information (TEI) project index maps online (Province of BC, 2023), and/or search for data from the BCGW. TEM or PEM data may be used to gain an idea of site series locations, but site series must be field confirmed.
  - ☐ Known red or blue listed ecological community locations – WHSE_TERRESTRIAL_ECOLOGY.BIOT_OCCR_NON_SENS_AREA_SVW from BCGW for publicly available occurrences. Other datasets for masked, sensitive occurrences are available from BCGW as well.
- ☐ Review the AREC Focus List for the relevant BCTS Business Area:
  - ☐ Note AREC names for the BEC unit(s) within the AOI (the AREC Focus List spreadsheet is easily filtered). If working within the GBRO (2016) areas, refer to Appendix A to ensure all AREC within the BEC unit are noted.

[6] NDT is also included as an attribute within the BEC spatial data from the BCGW.

- ☐ Review AREC descriptions on the BC Species & Ecosystems Explorer (if available[7]) and ensure ability to identify the AREC in the field. For example, Douglas-fir / common juniper / clad lichens may occur within the IDFxm/03. By clicking on the scientific name link in a BC Species & Ecosystems Explorer search, a list of reports and references appears, including the BC Community Summary.
- ☐ Review the relevant LMH(s) to gain additional information about the AREC. Refer to the written descriptions and vegetation prominence tables within for the site series and geographic area.
- ☐ Take note of key characteristics, such as tree canopy species, shrub/herb/moss layer species and relative cover, soil textures, soil moisture regime (SMR), soil nutrient regime (SNR), forest productivity, and any other identifying qualities. This is extremely important to be aware of prior to fieldwork, so potential AREC may be easily identified.

☐ Gather an idea of stand age prior to fieldwork. Refer to Vegetation Resource Inventory (VRI), from BCGW and speak with field personnel who already know or can estimate stand age.

4.2 Potential AREC & Site Series Observations (STEP 1)

Potential AREC observations are usually completed as part of Site Plan field data collection, but could be observed during any fieldwork[8]. Assessors should carry a copy of the office prework notes, applicable LMH, and NDT4 field reference card. During fieldwork, a Site Plan Plot Card may be used to gather initial reconnaissance data where tree and plant species observations match AREC names from the BCTS business area focus list or GBRO (2016) schedules. Where a potential AREC is observed in the field, it is important that the tree and plant species relative abundance and percentages are in alignment with the AREC descriptions and vegetation tables gathered during the office prework stage. The observed site series does not need to match the AREC Focus List spreadsheet, because the downloaded CDC data might not include all BEC units/site series the AREC is found in. The CDC data is limited to the current known range for each AREC. However, where observed site series match the AREC focus list in addition to AREC descriptions and vegetation tables, more evidence can be applied towards confirming the AREC.

Potential AREC site series may be observed as per the following two definitions:

1) **a discrete observation** – a single site series, or almost entirely a single site series which supports a BCTS focus list or GBRO (2016) AREC; or,
2) **a complex observation** - a mosaic of two or more site series (unable to be mapped separately due to spatial complexity[9]) which supports one or more BCTS focus list or GBRO (2016) ARECs.

If a discrete or complex potential AREC observation is encountered during fieldwork, apply the appropriate field decision-making procedures as outlined in STEP 1. Work through the steps in the order they appear. If a statement does not apply, or there is no direction to skip to a specified step, proceed

[7] Limited Ecological Community Summaries are available from the CDC. Where unavailable, refer to the relevant LMH.
[8] Proficiency with ecological Site Plan field data collection is required. Methodology is beyond the scope of this document.
[9] Definitions established based on listed community definitions within LMH 72 (Banner, Meidinger, Green, & Saunders, 2019).

directly to the next statement. For example, if 1.1 does not apply, proceed to 1.2, and so forth for all field procedures steps.

STEP 1: A discrete or complex potential AREC observation is encountered during fieldwork. Apply location-specific procedures:

1.1 The potential AREC observation is located within the GBRO Central/North Coast Area or GBRO South Central Coast Area AND matches the information listed in Appendix A (Table 3), as collated from the red-listed and blue-listed GBRO (2016) schedules N and O for NDT4. Note there are no blue-listed GBRO (2016) AREC within NDT4. → Follow the decision-making process in LMH 72 and refer to the GBRO Field Reference Card. Do not apply these BCTS field procedures.

1.2 The potential AREC observation is not listed in Appendix A and the GBRO (2016) schedules N and O. → Proceed to STEP 2.

4.3 Tree/Plant Species Identification, AREC Description Confirmation, Area, and Stand Age (STEP 2)

STEP 2-A applies diagnostic questions to confirm the potential AREC meets descriptions and classification parameters available from the office prework and relevant LMH. The AREC name sometimes represents the dominant tree and understorey species present. For example, as per LMH39 and the BC Species & Ecosystems Explorer, observations for Douglas-fir / common juniper / clad lichens (IDFxm/03) would include Douglas-fir (as climax species and/or regeneration layer) and lodgepole pine (usually abundant) as the dominant tree species, common juniper and kinnikinnick as the dominant shrub and herb species, and lichens as the dominant moss/lichen species. Bluebunch wheatgrass and spreading needlegrass are always present in low amounts. Other understorey species could be present as per the vegetation summary and Vegetation Table from LMH 39. Not all vegetation from the summaries and tables must be present for an observation to be considered as a potential AREC.

The AREC description confirmation requires professional judgement and due diligence.

STEP 2-A: Ask the following questions, and record supportive data:

2-A.1 Is the potential AREC observation located within a forested[10] ecosystem? → If **YES**, proceed to STEP 2-A.2 → If **NO**, proceed to STEP 2-A.3.

2-A.2 Is the site series able to support an AREC at mature and old stages of forest development?
The stand should be exhibiting signs of mid to late successional status[11] with a

[10] Forested ecosystems are defined as having ≥ 10% average cover of trees ≥ 10 m tall. If there is continuous tree cover of trees < 10 m tall, these sites are also considered to be forested (e.g., bog woodlands) (MacKenzie, 2012).
[11] Mid-successional stands usually have two cohorts with one dominant overstorey layer and one younger regenerating layer (BC Ministry of Forests and Range & BC Ministry of Environment, 2010). Later successional stands will eventually mature into old climax characteristics, with well-developed vertical structure, dead wood (standing and on the forest floor), canopy gaps, and well-developed plant communities.

structural stage of 6 - mature or 7 - old[12]. See Appendix B for complete definitions. → Take notes and photos to support your answer. If **YES**, proceed to STEP 2-A.3. → If **NO**, the observation is not an AREC. Assessment complete.

2-A.3 Is the vegetation summary from BC Species & Ecosystems Explorer (if available) and the description/vegetation table from the relevant LMH in alignment with the tree/plant species observations for the potential AREC? If there is no vegetation summary available from BC Species & Ecosystem Explorer, refer only to the description/vegetation table from the relevant LMH when answering this question. → Take notes to support your answer of **YES** or **NO**. → If **NO**, AND within a non-forested ecosystem, the observation is not an AREC. Assessment complete. → Otherwise, proceed to STEP 2-B.

STEP 2-B involves determining the area occupied by the potential AREC, estimating stand age, and estimating veteran tree count. If the ecosystem is non-forested, stand age and veteran tree count is not required. These determinations may be completed concurrently during a walk-through mapping exercise.

Mapping the area occupied by the potential AREC will indicate whether the observation is large enough to qualify as a confirmed AREC.

Stand age estimations are used to support determination of successional (seral or developmental) forest stages, e.g. mid/mature or late/old succession/structure. Table 2 summarizes stand age categories for BEC zones within NDT4 (Biodiversity Guidebook, 1995; Landscape Unit Planning Guide, 1999).

Table 2: Seral Stage Ages for BEC Zones within NDT4

BEC Zone	Mature	Old
BG*,ICH, IDF, PP	> 100 yrs	> 250 yrs

* Generally, the BG BEC zone is non-forested; however, some sites meet the definition of a forested stand (see definition in footnote 10), so forested sites within the BG zone should adhere to mature and old age criteria in accordance with other BEC zones within NDT4.

Veteran trees are living remnants that survived a previous stand-replacing disturbance (e.g. wildfire, windthrow, disease, or logging), and are much older than the rest of the stand (Banner, Meidinger, Green, & Saunders, 2019; BC Ministry of Forests, 2022). They are usually recognized as being much larger in diameter and height than other trees in the stand. For the purposes of these BCTS AREC field procedures, and in accordance with LMH 72, veteran trees are categorized as ≥ 200 years old.

STEP 2-B: Map the potential AREC location using GPS or accurate iPad tracks/mapping. Stand age and veteran tree count (stems per hectare(sph)) may be estimated at the same time. If the ecosystem is non-forested, stand age and veteran tree count is not required.

If the forest is not obviously old (> 250 years), collect age cores at breast height (1.3 m from high side ground) from at least 5 of the largest diameter, living trees in the main canopy (excluding

[12] Definitions for structural stages of mature and old are in alignment with mid to late successional stages. Refer to the Site Description section of LMH 25 for complete definitions (BC Ministry of Forests and Range & BC Ministry of Environment, 2010).

veteran trees). Estimate ages by counting the rings and adding estimated age to breast height age based on the following (BC Ministry of Forests, 2022):

- Fd, Lw, Pl, Pw, Py → add 10 years
- Hw, Cw, Se, Sx, Ss, Bl, Ba, Bg → add 15 years

If the pith was not obtained from coring, apply Best Practices for Coring and Aging Trees to Determine Stand Age in older forests - available from Appendix 4 of Field Verification of Priority Old Forest Deferral Areas: Technical Guidance (2022). Determine the average stand age based on the 5 estimated tree ages. If the forest is obviously old, recommend coring at least one tree to confirm it is > 250 years old.

If the stand is < 250 years old, and veteran trees are present, recommend coring one or two veteran trees to confirm the veteran trees are ≥ 200 years old. During mapping, establish whether veteran tree count is ≥ 20 sph, 10-20 sph, or < 10 sph. Calculate average veteran tree density based on a few fixed radius (25 m) plots/ha[13]. Even if the potential AREC observation is less than 1 ha, ensure to calculate veteran density over at least 1 ha to avoid introducing bias.

2-B.1 The **discrete or complex observation** covers **≥ 0.25 ha[14].** If a complex observation, at least 50% of the observation should be characterized by a potential AREC. → Proceed to STEP 2-B.3.

2-B.2 The discrete or complex observation covers < 0.25 ha → The observation is not large enough to be an AREC. Assessment complete.

2-B.3 The observation is within a non-forested ecosystem → **Observation is a confirmed AREC**. Proceed to STEP 5.

2-B.4 The stand age is obviously old at > 250 years→ **Observation is a confirmed AREC**. Proceed to STEP 5.

2-B.5 The stand age is ≤ 250 years AND the answer from STEP 2-A.3 is **YES** → Proceed to STEP 3.

2-B.6 The stand age is ≤ 250 years AND the answer from STEP 2-A.3 is **NO** → The observation is not old enough, nor has the right species composition to be an AREC. Assessment complete.

4.4 Stand Maturity Assessment (STEP 3)

The stand maturity assessment is applied after stand age and veteran tree count estimations (STEP 2-B). This step applies a decision-making key to determine potential AREC confirmation where the stand is not obviously old, but has old forest characteristics. The key is based on mature stand age for the BEC zone (Table 2), and veteran trees present with ages ≥ 200. Veteran tree thresholds of ≥ 20 sph, indicating old forest characteristics, were established based on Field Verification of Priority Old Forest Deferral Areas: Technical Guidance (2022).

[13] Based on LMH 72 (Banner, Meidinger, Green, & Saunders, 2019).

[14] Compared with NDT3, size criterion is smaller for complex observations due to shorter average disturbance return intervals, extent of rangeland present, and importance of restoring natural biodiversity within the highly disturbed NDT4.

STEP 3: Work through the following decision-making key:

3.1 Stand age is > 100 years, and contains ≥ 20 sph of veteran trees. → AREC has old forest characteristics. **Observation is a confirmed AREC.** Proceed to STEP 5.

3.2 Stand age is > 100 years, and contains < 20 sph of veteran trees. → Proceed to STEP 4.

3.3 Stand age is ≤ 100 years → The stand is not old enough to be an AREC. Assessment complete.

4.5 Biodiversity Attributes Assessment (STEP 4)

Based on the Biodiversity Guidebook (1995) and LMH 72, there are several important stand attributes that contribute to higher biodiversity levels in mature stands. Where the potential AREC observation was classified as mature (see Table 2 for age categories), with < 20 sph veteran trees in STEP 3, they may be further assessed in STEP 4. If all suggested biodiversity attributes listed in the STEP 4 criteria are met, the AREC observation should be confirmed.

STEP 4 requires professional judgement and due diligence. Where not all STEP 4 criteria are met, and the assessor believes the AREC observation should be confirmed, they should make a case to the BCTS Business Area contact outlining why they believe the observation is a confirmed AREC.

STEP 4: Does the AREC observation, assessed as mature in age, meet the following criteria?

- ☐ 10-20 sph veteran trees (≥ 200 years old)
- ☐ > 14 sph unburned dead trees
- ☐ Common pieces of large downed woody debris (or as per AREC description)
- ☐ Significant vertical structure – a variety of canopy layers > 2 cohorts
- ☐ 10-30% crown closure
- ☐ Patchy to well-developed understorey shrub and herb cover
- ☐ Previous disturbance history was natural (fire or wind) or selective harvest

If **NO,** the observation does not have enough biodiversity attributes to qualify as a confirmed AREC.

If **YES**, **observation is a confirmed AREC.** → Proceed to STEP 5.

4.6 Field Form & Operability Observations (STEP 5)

STEP 5: Complete the BCTS Species At Risk (SAR) Field Observation form (or similar), and take representative photos. Suggested plot size is 10 m x 10 m. Minimize edge effects by establishing the plot at least one tree length into the stand from any edges. At minimum, record the following information:

- Observer Details: Observer's Name, Date Observed, Location Information
- AREC Observations: AREC Name, BEC unit (zone / subzone / variant / phase), site series, SMR, SNR, Area/size of AREC, List of vegetation and percent coverage (tree species, shrubs, herbs, mosses/lichens [see examples of foliage estimates for individual plants in Figure 2, and of vegetation stratums in Figure 3 - total percent

coverages by layer/stratum may not exceed 100%, but percent coverages by individual species within a stratum could exceed 100% when there are vegetation overlaps]), Answers to the questions in 2-A, Comments to support assessment (e.g., assessment completed within NDT4, which steps were completed to confirm the AREC, etc.).

- Supportive information (forested ecosystems only): Record stand age and how age was estimated. Include tree core data (species, ring count, etc.), where applicable. If the stand is younger than 250 years, record estimated veteran tree age, and sph.
- Photos: Take photos in each of the cardinal directions, of the representative vegetation, and of the tree crown.

Operability Observations

Take notes about the confirmed AREC location. Is the AREC located in an operable area? Is the area harvestable or not? Is the AREC already located within a reserve? Is the AREC located near established protected areas? Is the AREC location impeding access to current or future development? Are there any safety issues?

Field assessment is complete. Ensure all data are collected, and consider the next steps when back in the office (see Section 5).

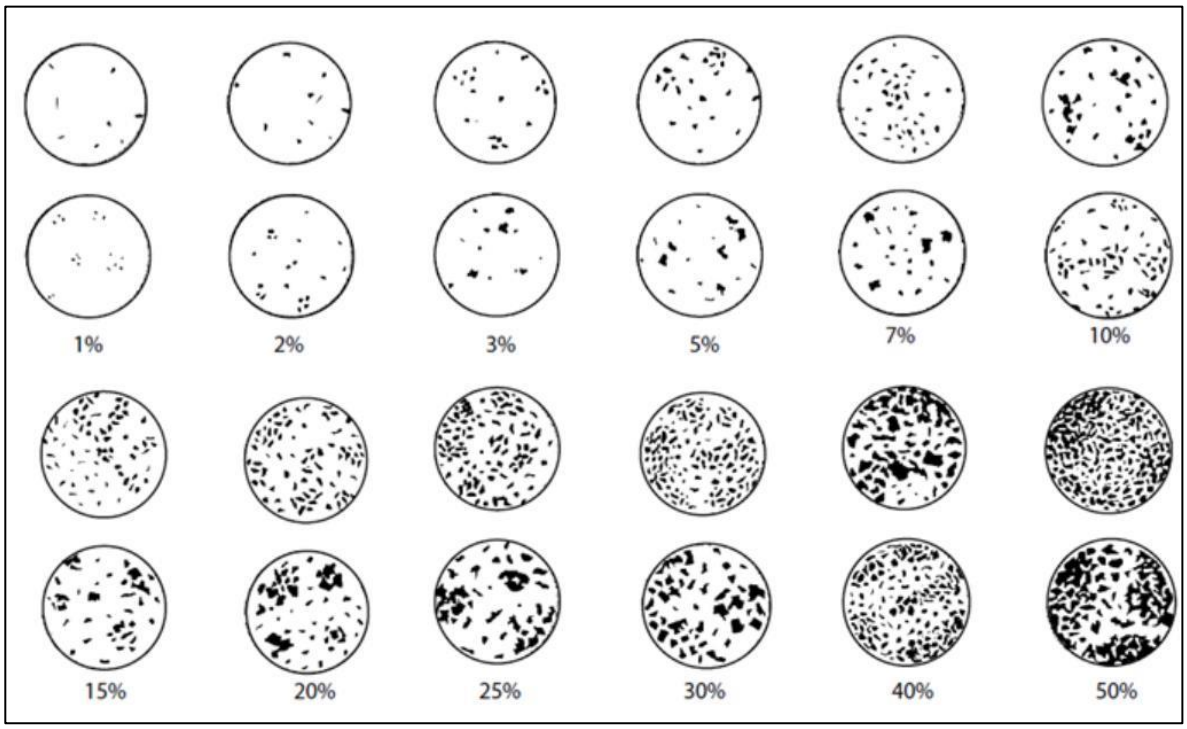


Figure 2: Visual representations of foliage percent estimates – from LMH 25 (BC Ministry of Forests and Range and BC Ministry of Environment, 2010)

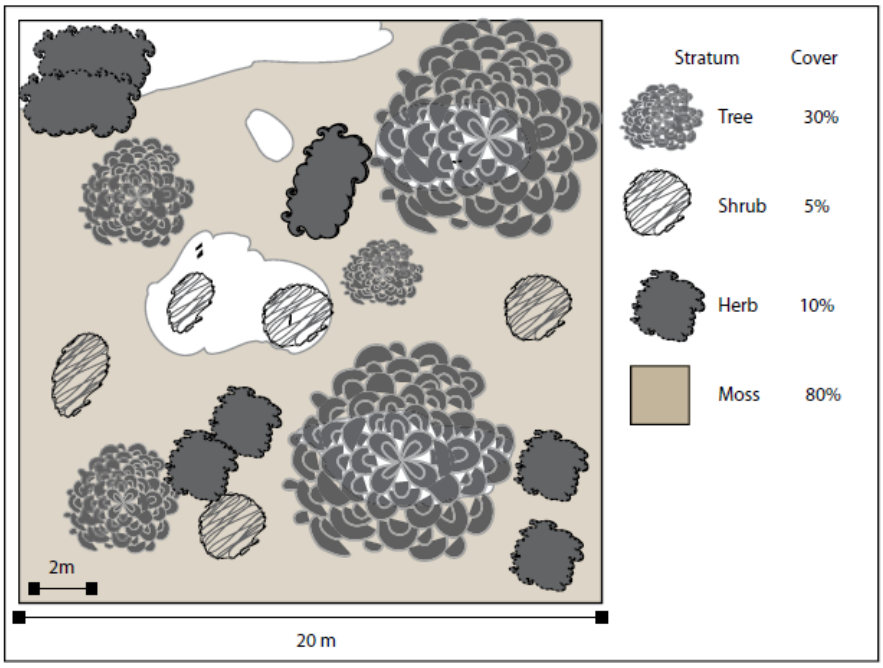


Figure 3: Bird's eye view of example vegetation stratums in a plot – from LMH 25 (BC Ministry of Forests and Range and BC Ministry of Environment, 2010)

5. Next Steps

Report the confirmed AREC observation to the appropriate BCTS contact. Provide all field data, including GPS or iPad tracks, plot data, photos, SAR Field Observation Form (or similar), and additional notes. Consult with any existing AREC management guidelines within the Business Area and Ministry region, such as local BMPs or SOPs, to develop a stand level management option. If necessary consult with a qualified registered professional. BCTS will submit details of the confirmed AREC to the BC Conservation Data Centre using the Incidental Observations submission process, where applicable.

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Appendix A

Table 3: GBRO (2016) Red-Listed Plant Communities within NDT4

GBRO Area	BEC unit*	English Name
Central/North Coast South Central Coast	IDFww/04	Douglas-fir / Douglas maple / Hooker's fairybells
South Central Coast	IDFdw/Gs02	Nuttall's alkaligrass - foxtail barley

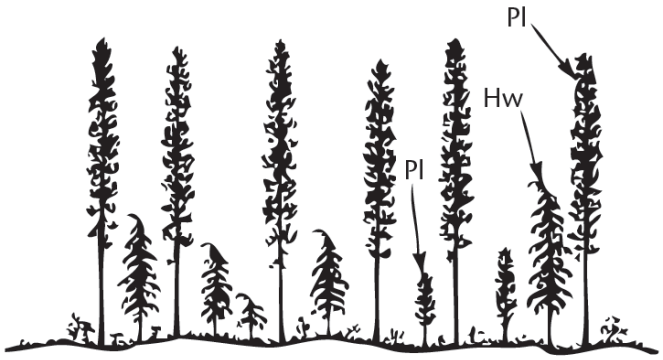
Appendix B

A summary of definitions referred to in STEP 2-A.2. The following definitions, examples and diagrams have been quoted from the Field Manual for Describing Terrestrial Ecosystems 2nd Edition (2010). Examples are not always characteristic of NDT4.

Mid Successional Status - includes ***Maturing Seral***, ***Overmature Seral***, and ***Young Climax*** stands, as per the following:

"***Maturing Seral:***
Community of early-successional tree species that have generally gone through an initial natural thinning due to species interactions such as within-stand competition for light or root-growing space, or a community where mid-successional species dominate. Very open stands may not go through a stem exclusion phase but could have a succession of understorey plant species occurring.

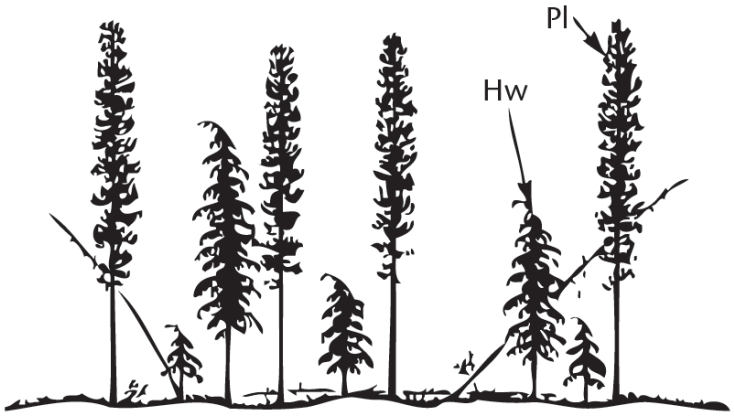
- Trees of mature age (generally 60–140 years old).
- Generally two cohorts: one in the overstorey and a younger one in the regeneration layer, usually of species with greater shade tolerance, but may include a component of species that are the same as the overstorey (e.g., fluvial cottonwood stands).
- Includes stands subject to frequent stand-replacing disturbances where regeneration to another cohort may be limited or absent, but where the stand has matured through natural thinning and development of the community, and the expected regeneration for the climate and ecosystem is to another, more shade-tolerant species.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.



Maturing seral stand

Overmature Seral:
Community where the seral overstorey species of the main upper canopy are dying.

- Usually > 140 years old.
- Typically with a secondary tree canopy consisting of more shade-tolerant species, or some of the same species as those dying; some individuals belonging to the secondary cohort may have entered the main canopy.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.

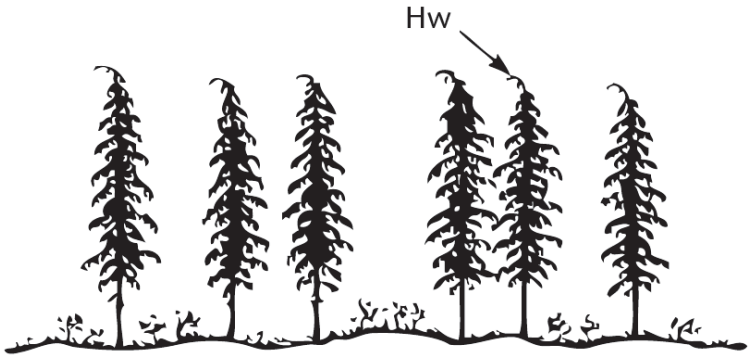


Overmature seral stand

Young Climax:

Community contains tree species typical of the climax expected for the site, but the proportional composition and structure expected at later climax stages has not developed; understorey seral species are usually still evident. This stage may follow the development and death of a stand of seral species or may develop from climax species regeneration on a recently disturbed site.

- In cases where climax tree species are the initial cohort, stands can be young (<30 years); this often occurs in wetter climates where stand-replacing fires are infrequent.
- Includes previously recognized Young Climatic Climax and Young Edaphic Climax stages.
- Examples: young subalpine fir – Engelmann spruce stand in a wet subalpine climate; young ponderosa pine stand in a dry climate where it would be the fire-maintained climax species; 50-60 year old hybrid white spruce stand 'released' from canopy of 100 year old lodgepole pine killed by mountain pine beetle."

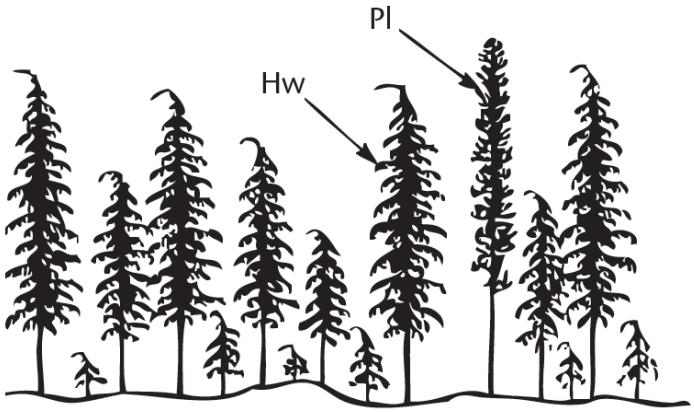


Young climax stand

Late Successional Status - includes ***Maturing Climax***, and ***Old Climax*** stands, as per the following:

"***Maturing Climax:***
Community composed of species in proportions more or less typical of late succession for the site; the stand has undergone natural thinning, and vertical structure has developed, but lacks the complex structure typical of old forests.

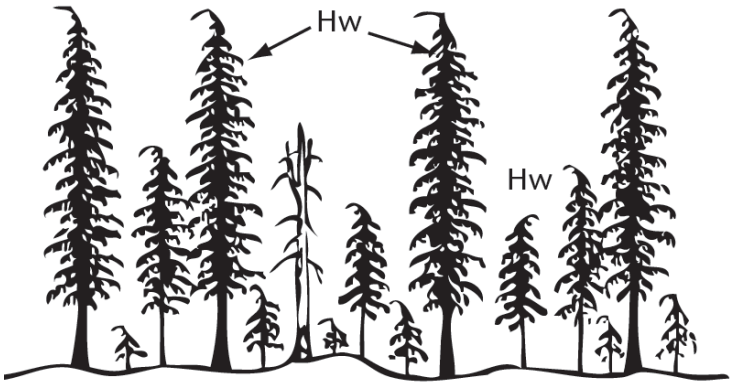
- Differs from [Young Climax] in having a typical mature forest understorey herb and shrub community; stands are developing continuous diameter and height class distributions of climax tree species; seral species may still exist.
- Stands are at least 80–120 years old, but usually older.
- Includes previously recognized Maturing Climatic Climax and Maturing Edaphic Climax stages.
- Examples: mature western redcedar – western hemlock forest with component of Douglas-fir in canopy; mature hybrid white spruce on high-bench floodplain with a developing understorey of multiple cohorts of spruce regeneration.



Maturing climax stand

Old Climax:
The plant community is composed of species expected to be present in the climax stand; vertical structure is well developed; live-tree decay is evident and tree death has led to canopy gaps and large woody debris on the forest floor; often with well developed and distinct epiphytic communities.

- Occasionally, very long-lived seral species (e.g., Douglas-fir) are present, as a minor component of stand, but their removal would not cause a significant change in the growth or establishment of the climax trees.
- Differs from MC in having better-developed vertical and horizontal structure and a more or less continuous age and height class distribution of climax tree species.
- Stands are at least 250 years old, but often much older.
- Examples: very old coastal forests, including subalpine mountain hemlock – amabilis fir or hypermaritime western hemlock – western redcedar – yellow-cedar – shore pine; western redcedar – Devil's club forest with epiphytic stubble-lichens in interior rainforest climate.



Old climax stand

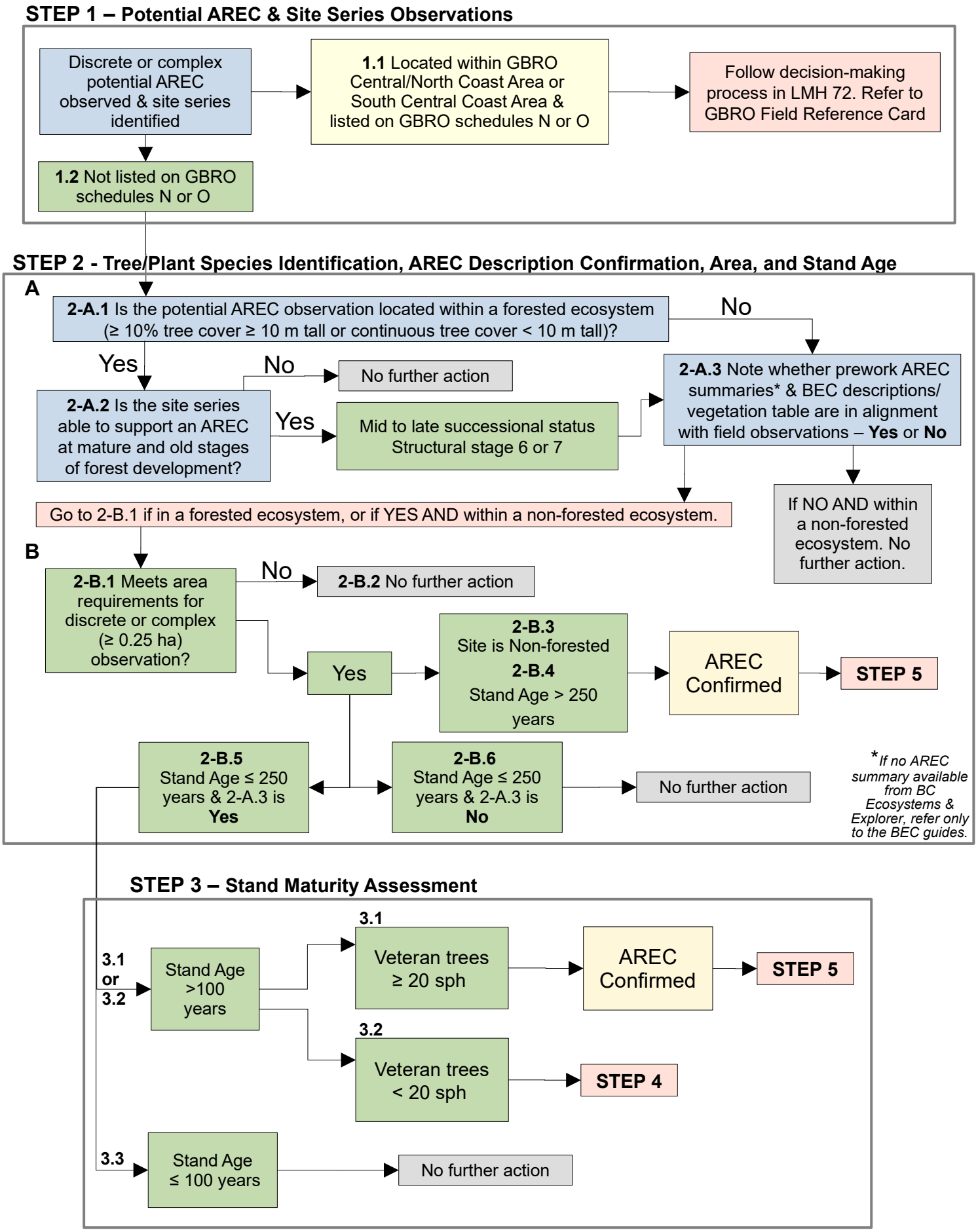
Structural Stage 6: Mature Forest - Understorey reinitiation stage:
"Trees established after the last stand-replacing disturbance have matured; a second cycle of shade-tolerant trees may have become established; shrub and herb understories become well developed as the canopy opens up; time since disturbance is generally 80–140 years for BGCs with NDT 3 and 80–250 years for NDT 1, 2 & 4."

Structural Stage 7: Old Forest - Old-growth stages:
"Stands of old age with complex structure; patchy shrub and herb understories are typical; regeneration is usually of shade-tolerant species with composition similar to the overstorey; long-lived seral species may be present in some ecosystem types or on edaphic sites. Old growth structural attributes will differ across biogeoclimatic units and ecosystems."

Structural Stage 7a: Old Forest
"Stands with moderately to well developed structural complexity; stands comprised mainly of shade-tolerant tree species in canopy and regeneration layers, although older seral trees from a disturbance such as fire may still dominate the upper canopy; fire-maintained stands may have a 'single-storied' appearance; time since stand-replacing disturbance is generally 140 – 250 years for biogeoclimatic units with NDT 3 and > 250 years for NDT 1, 2 & 4."

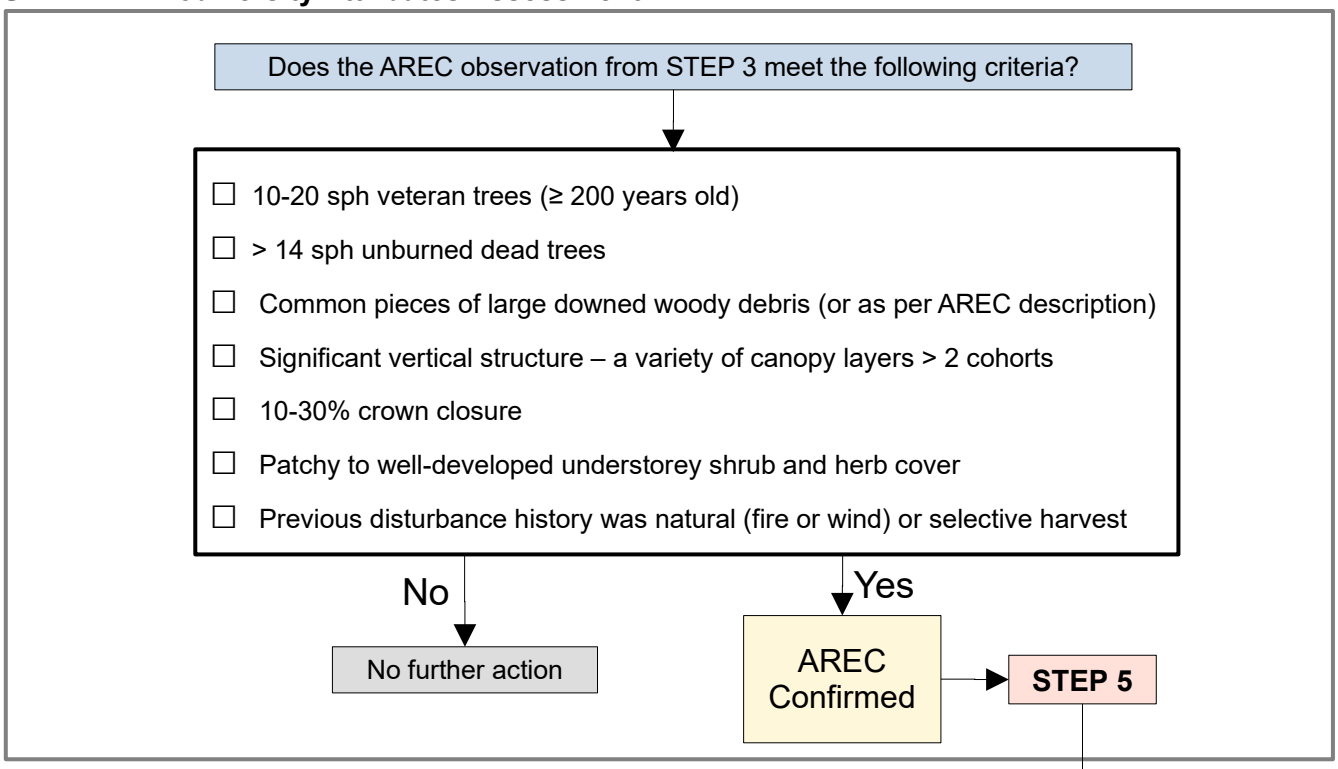
Structural Stage 7b: Very Old Forest
"Very old stands having complex structure with abundant large-sized trees, snags and coarse woody debris (size is relative to the specific ecosystem); snags and CWD occur in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species with well-established canopy gaps; time since stand-replacing disturbance generally > 250 years for BGCs with NDT 3 and > 400 years for NDT 1, 2 & 4."

At Risk Ecological Communities (AREC) NDT4 Field Reference Card p.1



At Risk Ecological Communities (AREC) NDT4 Field Reference Card p.2

STEP 4 – Biodiversity Attributes Assessment

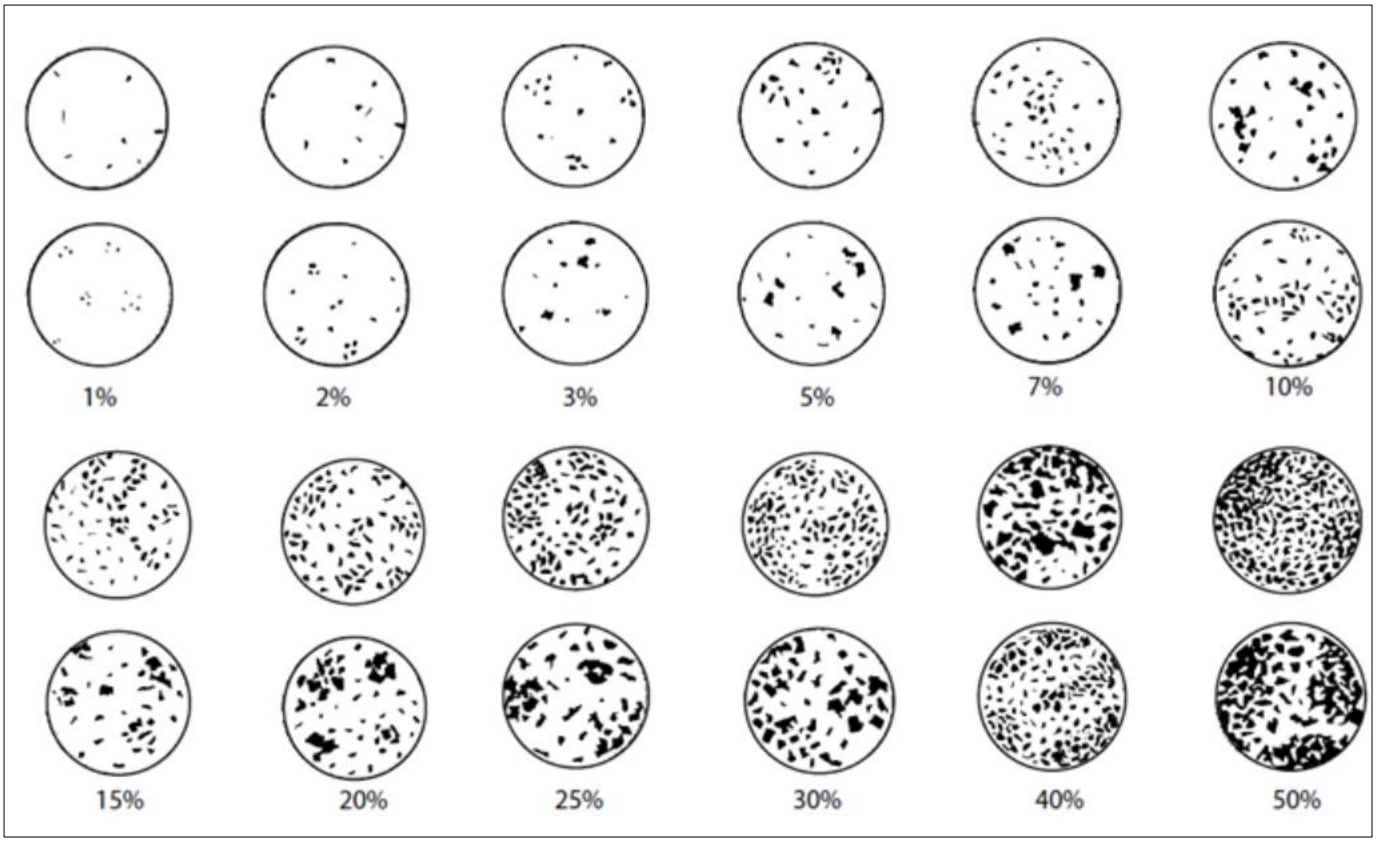


STEP 5 – Field Form & Operability Observations

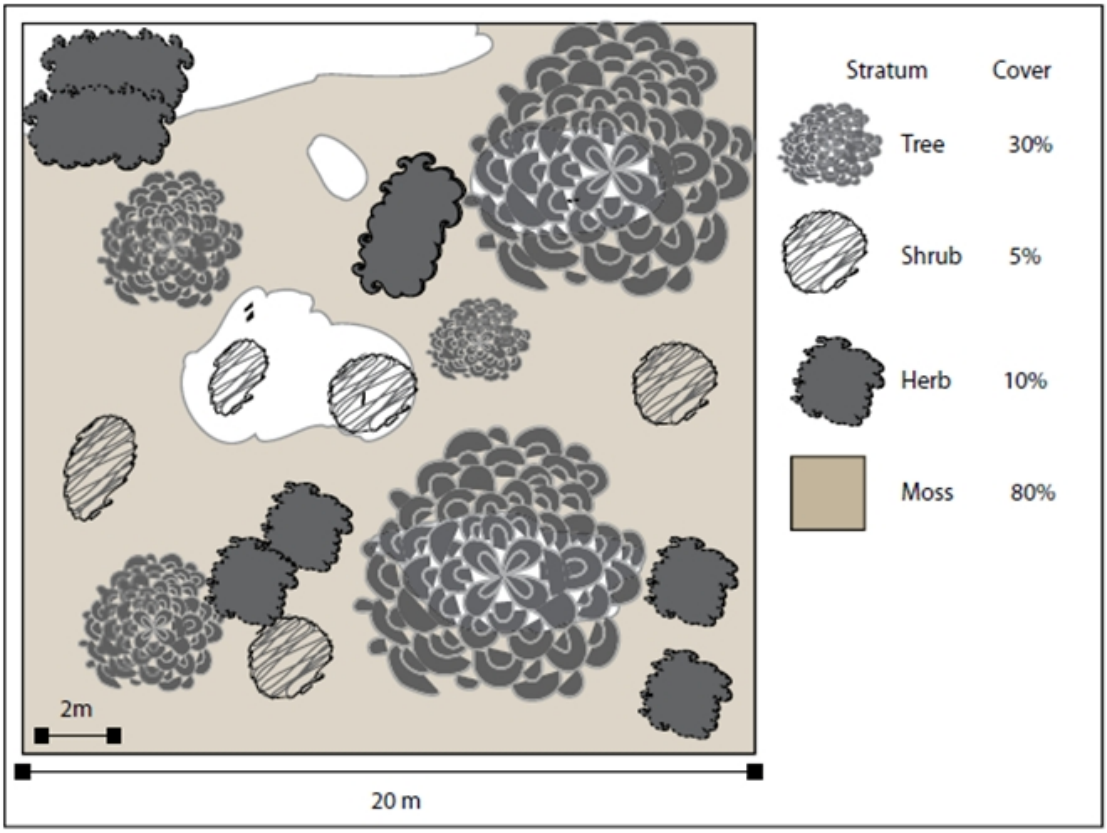
Complete the BCTS Species At Risk (SAR) Field Observation form (or similar), and take representative photos. Suggested plot size is 10 m x 10 m. Minimize edge effects by establishing plot at least one tree length into the stand from any edges. At minimum, record the following information:

Observer Details: Observer's Name, Date Observed, Location Information
AREC Observations: AREC Name, BEC unit (zone / subzone / variant / phase), site series, SMR, SNR, Area/size of AREC, List of vegetation and percent coverage (tree species, shrubs, herbs, mosses/lichens [see examples of foliage estimates for individual plants and of vegetation stratums on next page - total percent coverages by layer/stratum may not exceed 100%, but percent coverages by individual species within a stratum could exceed 100% when there are vegetation overlaps]), Answers to the questions in 2-A, Comments to support assessment (e.g., assessment completed within NDT4, which steps were completed to confirm the AREC, etc.).
Supportive information (forested ecosystems only): Record stand age and how age was estimated. Include tree core data (species, ring count, etc.), where applicable. If the stand is younger than 250 years, record estimated veteran tree age, and sph.
Photos: Take photos in each of the cardinal directions, of the representative vegetation, and of the tree crown.

Operability Observations
Take notes about the confirmed AREC location. Is the AREC located in an operable area? Is the area harvestable or not? Is the AREC already located within a reserve? Is the AREC located near established protected areas? Is the AREC location impeding access to current or future development? Are there any safety issues?



Visual representations of foliage percent estimates – from Land Management Handbook 25



Bird's eye view of example vegetation stratums in a plot – from Land Management Handbook 25

At Risk Ecological Communities (AREC) NDT4 Field Reference Card p.4

A summary of definitions referred to in STEP 2-A.2. The following definitions, examples and diagrams have been quoted from the Field Manual for Describing Terrestrial Ecosystems 2nd Edition (2010). Examples are not always characteristic of NDT4.

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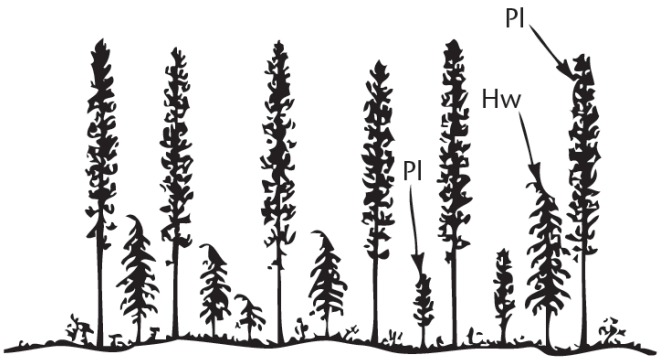
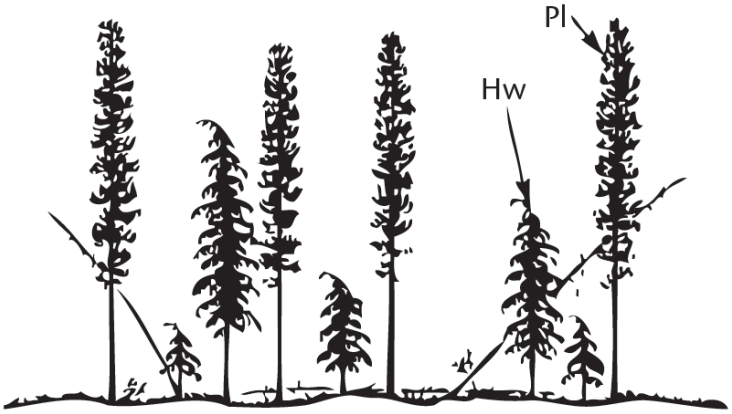
- Trees of mature age (generally 60–140 years old).
- Generally two cohorts: one in the overstorey and a younger one in the regeneration layer, usually of species with greater shade tolerance, but may include a component of species that are the same as the overstorey (e.g., fluvial cottonwood stands).
- Includes stands subject to frequent stand-replacing disturbances where regeneration to another cohort may be limited or absent, but where the stand has matured through natural thinning and development of the community, and the expected regeneration for the climate and ecosystem is to another, more shade-tolerant species.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.



Maturing seral stand

Overmature Seral:
Community where the seral overstorey species of the main upper canopy are dying.

- Usually > 140 years old.
- Typically with a secondary tree canopy consisting of more shade-tolerant species, or some of the same species as those dying; some individuals belonging to the secondary cohort may have entered the main canopy.
- Example: well-developed hybrid white spruce cohort under an older lodgepole pine canopy that is failing due to age-based mortality or a mountain pine beetle attack.



Overmature seral stand

Young Climax:

Community contains tree species typical of the climax expected for the site, but the proportional composition and structure expected at later climax stages has not developed; understorey seral species are usually still evident. This stage may follow the development and death of a stand of seral species or may develop from climax species regeneration on a recently disturbed site.

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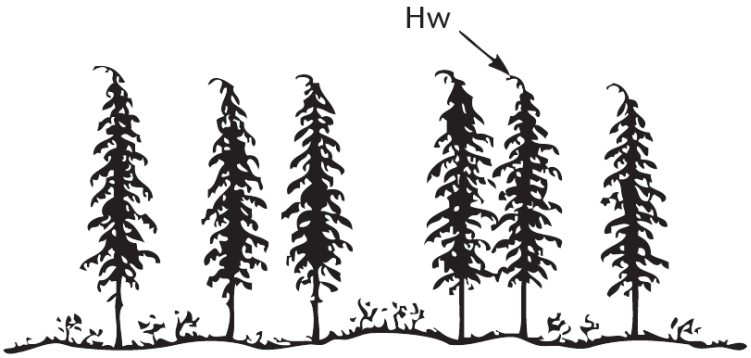
- Includes previously recognized Young Climatic Climax and Young Edaphic Climax stages.
- Examples: young subalpine fir – Engelmann spruce stand in a wet subalpine climate; young ponderosa pine stand in a dry climate where it would be the fire-maintained climax species; 50-60 year old hybrid white spruce stand 'released' from canopy of 100 year old lodgepole pine killed by mountain pine beetle."

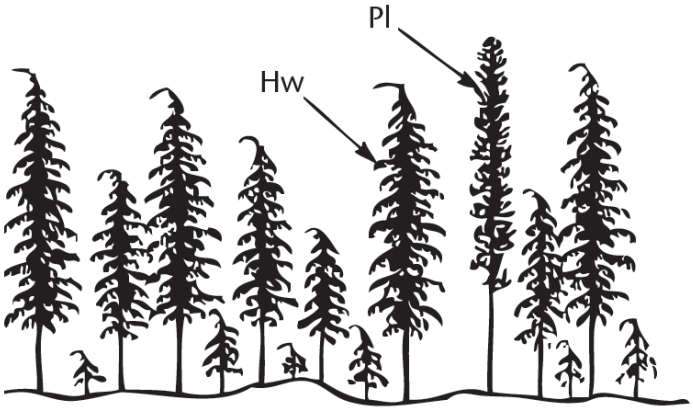


Young climax stand

Late Successional Status - includes ***Maturing Climax***, and ***Old Climax*** stands, as per the following:

"***Maturing Climax:***
Community composed of species in proportions more or less typical of late succession for the site; the stand has undergone natural thinning, and vertical structure has developed, but lacks the complex structure typical of old forests.

- Differs from [Young Climax] in having a typical mature forest understorey herb and shrub community; stands are developing continuous diameter and height class distributions of climax tree species; seral species may still exist.
- Stands are at least 80–120 years old, but usually older.
- Includes previously recognized Maturing Climatic Climax and Maturing Edaphic Climax stages.
- Examples: mature western redcedar – western hemlock forest with component of Douglas-fir in canopy; mature hybrid white spruce on high-bench floodplain with a developing understorey of multiple cohorts of spruce regeneration.



Maturing climax stand

Old Climax:
The plant community is composed of species expected to be present in the climax stand; vertical structure is well developed; live-tree decay is evident and tree death has led to canopy gaps and large woody debris on the forest floor; often with well developed and distinct epiphytic communities.

- Occasionally, very long-lived seral species (e.g., Douglas-fir) are present, as a minor component of stand, but their removal would not cause a significant change in the growth or establishment of the climax trees.
- Differs from MC in having better-developed vertical and horizontal structure and a more or less continuous age and height class distribution of climax tree species.
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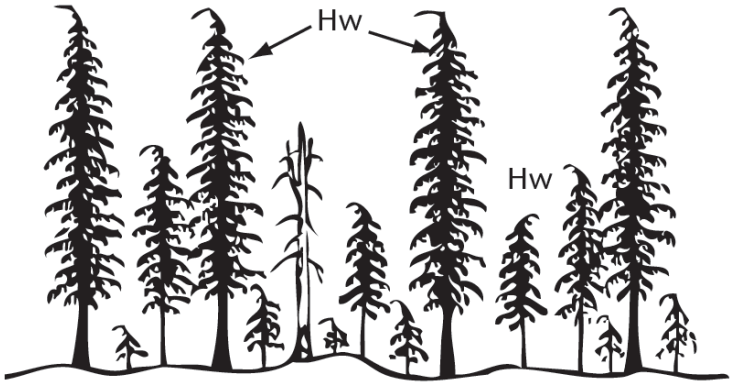

Old climax stand

Structural Stage 6: Mature Forest - Understorey reinitiation stage:
"Trees established after the last stand-replacing disturbance have matured; a second cycle of shade-tolerant trees may have become established; shrub and herb understories become well developed as the canopy opens up; time since disturbance is generally 80–140 years for BGCs with NDT 3 and 80–250 years for NDT 1, 2 & 4."

Structural Stage 7: Old Forest - Old-growth stages:
"Stands of old age with complex structure; patchy shrub and herb understories are typical; regeneration is usually of shade-tolerant species with composition similar to the overstorey; long-lived seral species may be present in some ecosystem types or on edaphic sites. Old growth structural attributes will differ across biogeoclimatic units and ecosystems."

Structural Stage 7a: Old Forest
"Stands with moderately to well developed structural complexity; stands comprised mainly of shade-tolerant tree species in canopy and regeneration layers, although older seral trees from a disturbance such as fire may still dominate the upper canopy; fire-maintained stands may have a 'single-storied' appearance; time since stand-replacing disturbance is generally 140 – 250 years for biogeoclimatic units with NDT 3 and > 250 years for NDT 1, 2 & 4."

Structural Stage 7b: Very Old Forest
"Very old stands having complex structure with abundant large-sized trees, snags and coarse woody debris (size is relative to the specific ecosystem); snags and CWD occur in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species with well-established canopy gaps; time since stand-replacing disturbance generally > 250 years for BGCs with NDT 3 and > 400 years for NDT 1, 2 & 4."