**Adaptive Silviculture for Climate Change Study**

**Sampling Methods**

***Methods used to measure response variables***

Within each of the 16 10-hectare polygons, approximately 3-9 permanent sampling plots will be established. Initially only two plots will carried out in each polygon, and additional plots will be established, time permitting.

***Criteria for pre-treatment plot establishment and layout***

Plot locations will be randomly selected using GIS software; plot centers will be spaced at least 75m apart, and 30m from the edge of each treatment. A series of nested circular plots will be permanently established in order to quantify canopy and understory vegetation, as well as soil characteristics and coarse woody debris (CWD; Figure 1). At each plot center, the GPS coordinates, aspect, slope, slope position, surface shape, slope length, and uniformity will be collected. An 11.28 m radius plot (400 m2), known as the core tree plot, will be established to characterize the overstory vegetation; the center of this plot will be permanently marked as part of plot establishment. Three 22 m transects, extending outward from plot center and spaced 120° apart will be established. Nested 3.99 m (50 m2) radius plots will be established on each transect, 7 m from plot center. These plots will be used to count tree saplings and regeneration (Sapling/regen plots). Three 1 m2 square plots will be established between these transects at 7 m, and will be used to identify understory vegetation and to assess percent cover. A soil description will occur in a representative area occurring just outside of the core tree plot. Lastly, 10 m coarse woody debris (CWD) transects will be established along the plot transects at 12m from plot center running outwards; the beginning and end of these transects will be permanently marked, and GPS coordinates recorded. In order to minimize sampling bias, the 22 m transects will be rotated by 45° for each plot.

Photos will be taken in each of the cardinal directions, as well as an additional one or two photos which best convey plot characteristics, forest structure, and vegetation communities.

***Canopy characterization***

The core tree plot will be established to assess the tree canopy (DBH ≥ 7.5 cm and height ≥1.3m). Tree species, DBH, crown class, pathological remarks, and Tree Class (as per the cruising manual (2010), which indicates merchantability as well as any health-related issues), will be recorded for each tree (Table 2). Since the Tree Class does not differentiate between dead and down and standing dead trees, the trees will be further classified as living standing, snags, or dead and downed. Crown class will be used as a metric to assess crown health; a 1-4 classification scheme will be used to describe foliage, with class 1 indicating a crown missing many leaves, and class 4 describing a very healthy crown (Class 1: 0-25%, Class 2: 26-50%, Class 3: 51-75%; Class 4: >75%). A subset of dominant and co-dominant trees will be aged using an increment bore. Four cores will be collected in each plot, from the largest individuals, free of any health concerns, of the two leading species. The height of these trees will be measured with a hypsometer, and the coordinates will be recorded.

***Sapling and Regeneration***

The total number of live saplings (DBH ≤ 7.5 cm, and height ≥1.3 m) within each 3.99 m Regen/Sapling subplot will be tallied by species, and the average DBH and height will be estimated for each species counted. Regeneration (height ≤1.3 m) will be tallied by size class (0-30 cm, and 30-130 cm) for each species within these subplots.

***Understory Vegetation***

Shrubs, trailing woody species, forbs, graminoids, and bryophytes will be identified, and their percent cover will be estimated in the 1m2 plots following leaf-out in June.

***Coarse woody debris***

When the CWD transects intersect dead wood with a diameter ≥7.5cm, then the length along the transect (where the transect intersects the central axis of the CWD), and diameters at the intersection, small end, and large end will be measured. The length along the central axis will be recorded, and the height above ground from the lowest side of the log will be recorded at both ends. If the length of the transect runs closely along the central axis of the dead wood, best judgement will be used to determine where the intersection occurs. Furthermore, if small branches or roots extend well beyond the bulk of the CWD, best judgement will be used to determine the length and diameter that best represents this volume. The decay class will be determined at the intersection with the transect using a 1-5 scale (1 indicating recently dead, and 5 highly decomposed), however the class may be adjusted to better reflect the decay of the entire piece of CWD. If recognizable, the tree species will be recorded. The eligibility for CWD was guided by provincial standards (Government of British Columbia, 2010), where dead wood attached to live vegetation will not be considered dead and downed. Additionally, this material must be separate from the forest floor: if more than half of the material is submerged in the duff where it intersects the transect, then it will not be counted. When the tree is self-supporting, that is the angle between the main stem and the ground is greater than 45°, then this will not be counted as CWD, and instead be considered a snag. An exception to this is if the broken bole of a snag intersects the transect. If the same piece of CWD intersects the transect twice (U-shaped), then the measurements will occur as described, however, the average diameter at each intersection will be recorded, and the midpoint between the intersection will be recorded as the length along transect. If the same piece of CWD intersects the transect twice (Y-shaped) then the CWD will be measured as two separate pieces, where the first piece will have the entire length, and the second will be the shorter segment. Stumps will be included as CWD, and the decay class will be determined slightly below the broken bole. Additionally, the stumps of trees that have been fallen during forest operations will be recorded. Each piece of CWD will be tagged with a metal log tag.

***Soils***

A soil and humus form description will be conducted just outside of the core tree plot in the second phase of sampling (Soil Classification Working Group, 1998; Klinka et al. 1981; Klinka et al. 1997). Horizon, depth, moist colour, moisture, texture, structure and consistence, plasticity, coarse fragments, rooting depth, drainage, and the depth to the water table will be recorded.

***Resource Measurements***

Later in the summer, following leaf out light availability will be assessed at the center of the core tree plot using a hemispherical photo. This will then be analyzed using light detecting software (the program used will be determined at a later date)

We will explore approaches for assessing soil nutrient and moisture availability after treatments are installed.

**Figure 1. Diagram of sampling plot layout and attributes**

Works Cited

Government of British Columbia. 2020. Timber Cruising Manual.

Government of British Columbia. 2010. Land Management Handbook 25: Field Manual for Describing Terrestrial Ecosystems. BC Ministry of Forests and Range, BC Ministry of Environment.

Klinka, K., Fons, J. and Krestov, P., 1997. Towards a taxonomic classification of humus forms: third approximation. Scientia silvica, 9, pp.1-4.

Klinka, K., Green, R. N.; Trowbridge, R. L.; Lowe, I. E. 1981. Land Management Handbook 8: Taxonomic Classification of Humus forms in ecosystems of British Columbia. BC Ministry of Forests.

Soil Classification Working Group. 1998. The Canadian System of Soil Classification, 3rd edition. NRC Research Press: Ottawa, Canada.