## Partial Harvesting and silvicultural treatments in Castor

Partial harvesting is a generic term for describing a silvicultural system that uses a harvesting method other than clear-cutting. Example partial cutting systems can include: variable retention, various thinning regimes, single tree selection and shelterwood. Often these silvicultural treatments are prioritized to happen before clear-cutting since they are associated with a commitment to enter the stand independently from the generic priority set by the forest landscape model.

In the past, a common method for simulating a partial cutting treatment in forest landscape models required the analyst to:

1. Set a residual growing stock (m3/ha) amount or percent removal and based on this value estimate the merchantable volume to be left in the stand
2. Assign the newly formed stand the forest attribution (age, volume, height) that matches the age of the stand when the yield curve is at the merchantable volume determined in 1. (above).

This method has the advantage of allowing for simplistic manipulations of yield curves and thus doesn’t necessarily require a new yield curve to be developed (saving time in yield curve development and in the modeling accounting). However, this may or may not be representative of the merchantable volume following the entry of the silvicultural treatment. The major limitation of this method is that the post treatment forest structure will often be biased. For instance, an 80-year-old even-aged fir stand with 22 m2/ha that is partially cut to leave a residual of 8 m2/ha basal area will have stand level attribution (e.g., height, age, and quadratic mean diameter) immediately after entry that’s equivalent to the pre-entry attribution (e.g., commercial thinning). The only metrics that will change in the residual stand are the merchantable volume and number of stems per ha. For other types of partial-cutting systems where uneven-aged stand types are involved the post-entry attribution may be greater than the pre-entry attribution (e.g., thinning from below) or less than the pre-entry attribution (e.g., thinning from above). Conversely, the method described above would arbitrarily reduce the stand level attribution to an earlier stage in the stands development under the assumption that similar volumes would release at the same rate – which isn’t true.

To move beyond the method described above, castor will use a curve transition following any partial cutting treatment that maintains a continuous cover forestry objective. Silvicultural systems like group selection system and variable retention will be simulated within castor by applying a zone (landcover) constraint at the spatial scale of the harvesting unit or block.

### Curve transition approach

To develop a partial cutting treatment in castor there are a series of options for conducting the transition of curves. Namely the analyst needs to determine:

1. What areas/pixels/stands will be receiving the treatment? (e.g., a raster assigning a silvicultural system, a module that modifies the state of the silvicultural system)
2. What are the characteristics of the stand that makes it eligible for entry (e.g., age > 80 years, basal area >= 28 m2/ha or height >= 19 m)?
3. What is the new yield curve to transition into? (e.g., transition to natural origin stand following fire, keep the same curve or no transition, transition into a curve that accounts for the release of the residual forest)
4. What is the next silvicultural system to follow? (e.g., clearcut after first entry, keep the same silvicultural system into perpetuity)
5. Should the age be reset to zero? (e.g., yes, no)