

Key K2 Questions by Model(s)

June, 2010

TACA - related questions

1. **What is the regeneration success of each key species over time?** It would be useful to have the answer in a table of species that includes a ranking for regeneration/establishment, success and shows when each becomes vulnerable to different degrees.
 - a. Species of interest include Fd, Py, Pl, Lw, Cw, Bl, Sx, Pw, At, Act, Ep, Yc, Pa (white barked pine)
 - i. Should investigate the potential to explore these and other species (including non-native) in TACA (e.g. Jeffery pine, other provenances of Douglas-Fir (though this is very hard to model), Ponderosa Pine (though prob. not much data in BC on growth characteristics, except info may be available in the states). Pl and Fd have wide distributions and much data is available on its variability
 - b. The species could be grouped by BEC variant and then into wet, dry, mesic categories for each (these can later be aggregated for use in the landscape model)
 - i. We should use the new 2006 version of BEC (as there are currently no stocking standards for this and this table could help inform options)
 - c. The table should include a “when” component – ranked risk of mortality (low, mod, high) to help decide *when* the spp. should be planted – e.g., use four time points for the same output: present, 2020, 2050, 2080.
2. **Here can we push some species?**
3. **Which species will go be able to go where and what is their ability to adapt?**
4. **Are there non-native species that would be useful to explore? (e.g. Jeffrey pine)**
5. **Can we develop a ranked list of species by ecosystem that may be best able to adapt, as a resource or tool for managers?**
 - a. This can be done with TACA (regeneration probabilities but not for what will happen later)2 steps: a) risk to regeneration failure and b) long term productivity
 - b. This can be used to develop a new set of stocking options
6. **Can we explore detailed information that will inform regeneration success (and growth over time of species - slope, elevation, aspect?** Maybe at the stand level, but at the landscape level this would have to be broader (Same as 7 below).

FORECAST related questions

NOTE – some of these may also need to be modeled with DYNAPLAN to answer completely.

7. **Can we explore detailed information that will inform regeneration success (and growth over time of species - slope, elevation, aspect)?** Maybe at the stand level, but at the landscape level this would have to be broader (Same as 6 above).
8. **How will adaptive strategies be applied at the stand level to leave structure – can we model several scenarios and compare?**
9. **Can we characterize a risk to mature stands – mortality related to drought and other related influences? Which stands are most vulnerable (and when) – so we can allocate harvesting priorities over time.**
 - a. Its very difficult to make the mortality call, but risk can be ranked using expert opinion, based on the various stress from the models. If we want to do this, it would be a next step of exploration...i.e. making calls about mortality
 - i. We could run a few scenarios that we think are possible where we assign mortality based on stress and what we know now about existing disturbance agents, to see what happens (at landscape level) and where over time
 - ii. Then we can identify target stands to harvest (there is lots of complexity here...what size stands, how much of a stands, etc?). Its complicated, but we need to ask questions on stands at risk (by age class, composition) and put into risk categories
 - iii. First pass could inform a scenario and *then* we introduce a rule
 - iv. Simplest approach is to introduce a rule whereby after a certain level of stress over a certain amount of time, certain spp. die. (we would need forest health people to help determine the stress level)
 - v. Stress index can help inform about mortality and also help inform some targeted harvesting to pick off lower performing stands
 - b. We could list stands by risk category
 - i. By species age, and Biogeoclimatic location.
 - ii. Need to create risk categories, i.e., what constitutes High, Medium and Low risk
 - iii. Begin with moisture stress from the models.
 - iv. At risk to what? Will require expert opinion – e.g., Armillaria, Beetles...to propose levels of mortality.
 - v. The idea being these will help inform management scenarios – i.e., target high risk stands at some point.
10. **How does climate change influence insects, rusts and diseases in different stands?**
 - a. How do we make assumptions for these?
 - b. How do we incorporate uncertainty?

- c. How does climate change impact insect life cycles and synchronicity with host phenology and how quickly will the insects adapt?
- d. What are the key disturbance mechanisms (beyond fire) that will hit the key tree species of concern:
 - e.g. Fd – Armillaria, phellinus, bark beetles, budworm, tussock moth.
 - e.g Pli – bark beetles, rusts, gall, stalactiform etc., pitch moth, dothistroma and other blights, mistletoes, root collar weevil and terminal weevil.

Can we look at historical trends for susceptibility to different bugs? How useful is this?
- e. What about other abiotic disturbances?
 - i. Increased extremes in wind, snow, and ice storms.
 - ii. Especially if they become a vector for other impacts – insects etc.
 - iii. What about the impacts of early and late frosts on regeneration of trees in conjunction with phonological cycles that are out of sync with climate change.

DYNAPLAN related questions

11. Can we maintain (or increase) AAC over time?

- a. **Do we also want to look at harvest flow by tree species (or age/size classes) as some sort of value characterization?**
- b. What will drive timber flow over time?
- c. What happens to timber flow if we wait to harvest the existing pine?

12. How will the size and nature of the THLB change over time? Where will we harvest, when and how?

13. If we manage more yellow pine in lower elevations, can we get enough of it to make it a valued species? What are the economic considerations here? (It seems there is not enough yellow pine to make it economically valuable).

- a. Should we be looking at other alternatives such as more drought resistant Douglas-fir or other (different strains of Py)?

14. How much native (undisturbed) habitat is out there now? (as a starting point)

15. How will adaptive strategies applied at the stand level to leave structure influence habitat and biodiversity over time?

- a. What if we are totally reactive and clearcut and salvage with minimum legal obligations for retention and reserves?
- b. What if we have a strategy where we have a higher level of reserves and retention,

- i. With a salvage strategy?
- ii. With a pre-emptive harvesting?
- c. When we model this how do we distribute this retention?
 - i. We decided to take another look at the Tolko retention strategy with a few folks like Dennis and others.

16. How will the cumulative footprint of natural disturbance and harvesting disturbance and management impact habitat and biodiversity over time?

17. How will disturbances be influenced by climate change and how will this influence patterns and structures across the landbase? – many other questions are related to this.

- a. How will natural disturbance influence structure and composition of stands and structure and patterns cross the landscape?
- b. How will harvesting (and associated management activities) influence structure and composition of stands and patterns across the landscape.
- c. With different harvesting strategies – salvage, pre-emptive harvest of susceptible stands.
- d. How does natural disturbance overlap with harvesting and influence it (salvage)?

18. What will happen to the broadleaf component across the landscape?

- a. Extent?
- b. How likely will it be able to reach old age – for habitat.

19. What might be the impact of fuel management activities on habitat and biodiversity at the landscape level?

- a. Are we actually reducing the risk of fires under the more severe climate change scenario?
 - i. For Habitat and Species?
 - ii. Or for people and property, timber values and other values?
- b. What if we undertake these fuel management activities but it doesn't help with extent, impact and intensity of fire – are we wasting money and having a large impact on habitat?

20. Do fires that have high impacts on people also have high impacts on habitat and wildlife? If not, should we differentiate?

21. How will the “Climate Change Adaptive Harvesting Strategies” impact habitat and biodiversity over time

- a. Log susceptible stands
- b. Follow extensive disturbance with extensive salvage.

22. If we develop mortality scenarios, can we look at ECA limits that occur w/in a (or some) watershed(s)?

a. Will water questions be a driver?