Kevin Godbout, Weyerhaeuser Company, Director External & Regulatory Affairs

June 3, 2015

Board of Forestry Meeting

As the Board of Forestry begins to review decision matrices and summary data to inform its decision on riparian rule prescriptions, I would like to summarize our standing concerns and outline what Weyerhaeuser considers is an appropriate way to view the modeling and simulation results.

General Concerns:

- Data-related
  - Observational data were not collected for the purpose of designing buffers. If the study had the objective of designing buffers to meet the 0.3 deg C PCW, there would have been more of an effort to control for confounding variables such as treatment reach length and the number of sides harvested.
  - Variation in buffer characteristics as noted previously are a result of pre-harvest characteristics and operational variability. Consequently, confounding factors may be present.
  - Last, in terms of data limitations, this is a small dataset for the purposes of model development
- Modeling-related
  - There is not a strong science-based theory from which to develop a shade model.
  - Models were developed empirically and compared using performance criteria and other considerations. This becomes a concern due to the small number of samples in the dataset (particularly shade), where unmodeled factors can more easily affect estimates and interpretation.
  - Selection of a single model for results assessment under-represents total uncertainty.

Specific Concerns over model output:

- The post-shade model does not predict pre-harvest shade. This suggests that the post-shade model overfits the data, and estimated coefficients are exaggerated.
- Simulation results from the 'oneShade' model are highly sensitive to the form of the width variable and the handling of number of sides harvested.
- Simulation results are highly sensitive to modeling assumptions and model choice.
- There has been no validation of models on independent datasets.

Implications for BOF as they consider options:

- **Based on how the data were collected and how the models were developed, all shade-related results should be considered exploratory in nature, and should not be interpreted to impart strong science-based conclusions.**
- Consequently, there is no scientific or empirical support for using results of any single model to develop specific prescriptions.
- **An appropriate use of this analysis would be to help establish a range of options for further study or for expert-based recommendations.** Crucially, these options must take into account the demonstrated range of uncertainty in results (across models & assumptions), as well as prior scientific knowledge and practice.

- In the June 3 decision matrix and supporting material, ODF appear to have evaluated each specific prescription on the basis of a single selected model. **The selection of a single model under-represents the total uncertainty and does not illustrate the sensitivity of the results to model choice. Credibility intervals presented by ODF should therefore be considered lower bounds on estimate uncertainty. Likewise Figure 1 on page 7 (Riparian rule analysis) should be considered an upper bound on the expected temperature increase as it differs from actual riparian prescriptions as laid out in the ripstream study.**

Recommendations

- Highlight the manner in which data were collected and the inferential consequences of developing empirical models based on (small amounts of) observational data.
- Present results of multiple models to demonstrate the range of uncertainty associated with model selection. Illustrate the complete range of uncertainty in simulation results due to the use of different models and/or assumptions.
- Conduct a follow-up study to collect data necessary to design or evaluate buffers capable of meeting PCW