

**Findings Report for the  
Extensive Riparian Vegetation Monitoring-Remote Sensing Pilot Study**

**RSAG  
September 13, 2017**

**1. Does the study inform a rule, numeric target, performance target, or resource objective?**

No, the study does not inform any specific rule, numeric target, performance target, or resource objective. However, this pilot project is the first step in developing a tool that has the potential to assess riparian conditions through status and trends monitoring, which could inform riparian rules.

**2. Does the study inform the Forest Practices Rules, the Forest Practices Board Manual guidelines, or Schedules L-1 or L-2?**

No, the study does not directly inform the Forest Practices Rules or the Board Manual.

The Extensive Riparian Vegetation Monitoring-Remote Sensing Pilot Study (i.e., Remote Sensing Pilot) was conducted at the request of TFW Policy to answer their questions concerning the use of remote sensing to conduct riparian extensive (status and trends) monitoring and its capacity for evaluating riparian function.

The Remote Sensing Pilot study evaluated the relative effectiveness, accuracy, and cost of using LIDAR and aerial imagery to assess riparian stand conditions. The study developed, evaluated, and recommended a suite of remote sensing tools that could be implemented for a proposed future state-wide riparian vegetation monitoring; a component of the Extensive Riparian Status and Trends Monitoring Program (see CMER Work Plan Sections 5.2.8.4 and 5.3.3).

**3. Was the study carried out pursuant to CMER scientific protocols (i.e., study design, peer review)?**

No. However, the pilot study followed CMER protocol (e.g., internal review), but was not submitted for ISPR at this time. CMER decided to defer ISPR because the pilot study findings (remote sensing tools) will be evaluated by ISPR when, and if, Policy decides to conduct the proposed future state-wide riparian vegetation monitoring component of the Extensive Riparian Status and Trends Monitoring Program.

**4. What does the study tell us? What does the study not tell us?**

What does the study tell us?

The study compared the effectiveness of LIDAR and optical imagery (e.g. NAIP) for assessing a suite of riparian stand metrics. The study concluded:

- LIDAR is the most appropriate remote sensing technology for establishing a baseline assessment of riparian forest stand conditions that will allow for long term monitoring.
- LIDAR is the most efficient tool for hydrological mapping of stream location which is essential for identifying and assessing the location of riparian stands. Optical technologies, such as satellite and aerial imagery, even when collected in stereo, are not suitable for this task due to poor quality of ground models generated by such data when compared to LIDAR capabilities.
- LIDAR is most suitable for mapping the height, basal area and DBH of riparian forests because it captures both the structural characteristics of the riparian stand and complex terrain of the landscape. These characteristics also play a role in vegetation class determination.
- Imagery works well at distinguishing conifer forests from hardwood forests, but is poor relative to LIDAR for characterizing the other stand metrics.

What does the study not tell us?

The study did not address the following:

- No wall-to-wall LIDAR data is yet available for Washington State. Moreover, future repeat collection of LIDAR data for the same sites, as needed to track changes over time, is also unknown. Consequently the cost of LIDAR data is unknown on a statewide basis.
- It does not provide an inventory of riparian vegetation conditions.
- It does not assess the availability of LIDAR for forests on FFR lands.
- It does not evaluate the sensitivity, limitations, and performance of remote sensing models for assessing riparian characteristics across the range of forest types on FFR lands.
- Stand age and species composition were not characterized.
- How the remote sensing metrics relate to specific resource objectives or performance targets relevant to evaluating the effects of the riparian prescriptions.

##### **5. What is the relationship between this study and any others that may be planned, underway, or recently completed?**

Extensive Riparian Vegetation Monitoring has the potential to provide the spatial context (i.e. amount and distribution of different stand conditions across the landscape) for understanding and assessing the implications of effectiveness and validation study findings which will facilitate FFR Policy and the Forest Practices Board in making decisions.

The pilot study was the remote sensing tool development phase of the Extensive Riparian Vegetation Monitoring Program. It was based on a literature synthesis that was completed in November, 2015.

A follow up to this pilot project is focused on assessing the large scale application of LIDAR models identified in the Extensive Riparian Vegetation Monitoring – Remote

Sensing Pilot Study in the Mashel watershed. Specifically, the previous project recommended that additional research address the number of models and the spatiotemporal reusability of models needed to extrapolate these models to other forest types in Washington State. To perform such work, a scoping implementation pilot will need to identify potential LIDAR acquisition areas that capture the ecological diversity most representative of the state, the temporal availability of such data, the list of LIDAR-compatible riparian forest extensive monitoring metrics and the additional field protocols to collect any new metrics to drive the LIDAR-based models.

As a pilot, this study was designed to evaluate the feasibility of using remote sensing techniques for monitoring riparian forest across all FP HCP lands in Washington State. Additional research to address the number of models and the spatiotemporal reusability of models will need to be undertaken to extrapolate these models to other forest types in Washington State, which will also need to take into consideration permanent plot establishment and re-measurement on a five-year (or more) basis in those additional forests. The pilot developed models at a cell level, as the project scales up, investigations of how to best aggregate these cells to forest stand types should be addressed.

The next phase of this program is to conduct an implementation pilot which will address the practicability of the application of remote sensing at a state level. The study would:

- assess the availability of LIDAR coverage across the state,
- evaluate the remote sensing tool's performance in different forest types by region,
- evaluate tool performance for assessing change over time, and
- identify the optimum suite of tools (cost effectiveness, accuracy) for conducting state-wide riparian status and trend monitoring

If Policy and the Board prioritize this project, we recommend that baseline conditions capturing these characteristic for riparian forests are established from LIDAR data, with the understanding that the models developed are temporally, location and data sensitive. Other technologies, such as stereo satellite or aerial imaging and the developments in analyzing these data sources should continue to be followed as a potential alternative for long-term monitoring in place of multi-date LIDAR data. These data could be used to compare and monitor the trends in the riparian forests when utilizing the LIDAR-based baseline.

Extensive Riparian Vegetation Monitoring is a long term undertaking and will require a long term budget strategy that funds the ongoing monitoring (e.g. annually or periodic survey) well into the future.

**6. What is the scientific basis that underlies the rule, numeric target, performance target, or resource objective that the study informs? How much of an incremental gain in understanding do the study results represent?**

Not applicable.