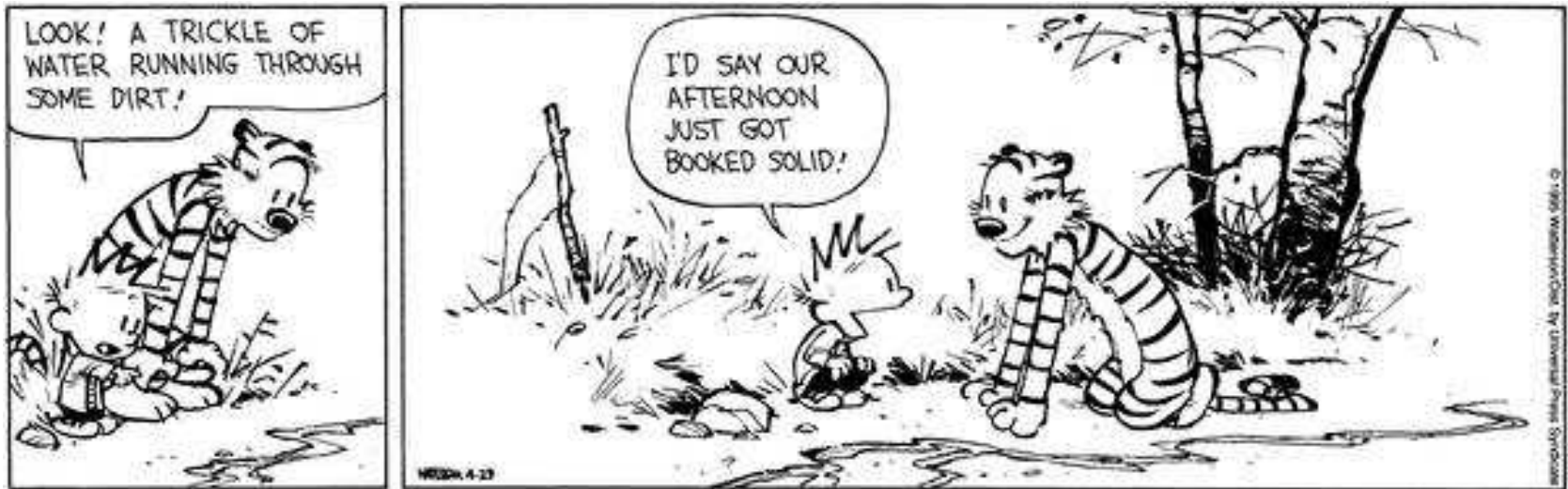


# Routine effectiveness evaluations for streams, wetlands, watersheds



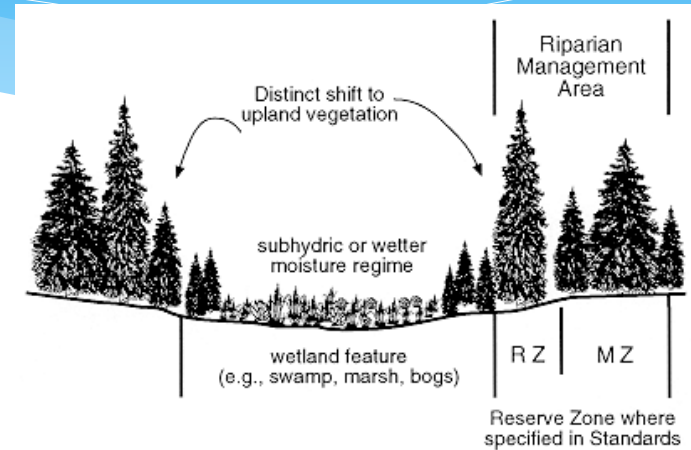
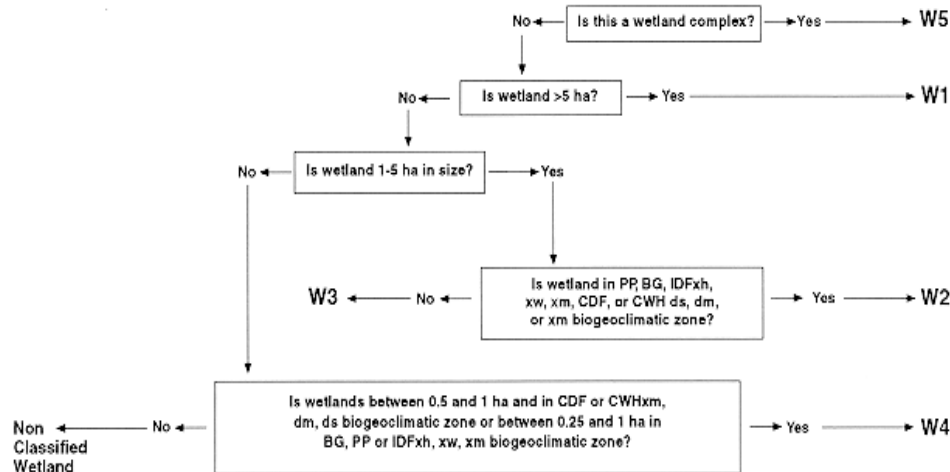
Lisa Nordin, M.Sc., R.P.Bio.  
Aquatic Resource Stewardship Evaluation Officer  
Resource Planning and Assessment Branch

# Forest and Range Practices Act (FRPA)



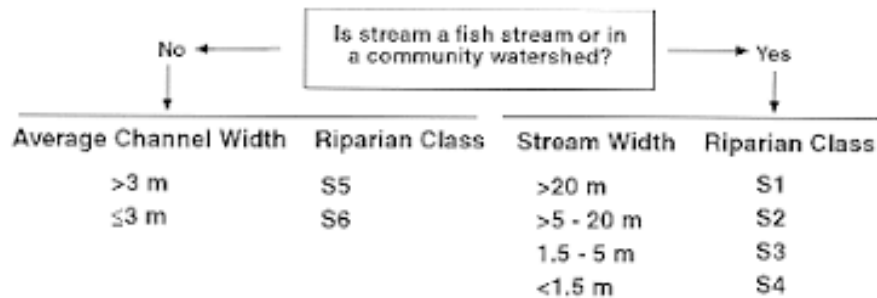
- FRPA s. 149 (1) gives authority for (FPPR) regulations/objectives for 11 resource values including water, fish, wildlife and biodiversity.
- FRPA s. 150.5 gives authority for (FPPR) regulations around classifying streams and wetlands, including setting reserve and management zones and the activities within them. Different riparian management areas for different classifications of streams and wetlands.

# Wetland riparian management under FRPA/FPPR



| Riparian class | Reserve zone width (m) | Management zone width (m) | Total RMA width (m) |
|----------------|------------------------|---------------------------|---------------------|
| W1*            | 10                     | 40                        | 50                  |
| W2             | 10                     | 20                        | 30                  |
| W3             | 0                      | 30                        | 30                  |
| W4             | 0                      | 30                        | 30                  |
| W5*            | 10                     | 40                        | 50                  |

# Stream riparian management under FRPA/FPPR



Riparian Classes of Streams and Watercourses (Forest Practices Code of British Columbia Act, 1995).

| Riparian Class         | Average channel width (m) | Reserve zone width (m) | Management zone width (m) | Total RMA width (m) |
|------------------------|---------------------------|------------------------|---------------------------|---------------------|
| S1 Large rivers        | ≥100                      | 0                      | 100                       | 100                 |
| S1 Except large rivers | >20                       | 50                     | 20                        | 70                  |
| S2                     | 5≤20                      | 30                     | 20                        | 50                  |
| S3                     | 1.5≤5                     | 20                     | 20                        | 40                  |
| S4                     | <1.5                      | 0                      | 30                        | 30                  |
| S5                     | >3                        | 0                      | 30                        | 30                  |
| S6                     | ≤3                        | 0                      | 30                        | 20                  |

☐ Fish stream or community watershed

☐ Not fish stream and not in community watershed

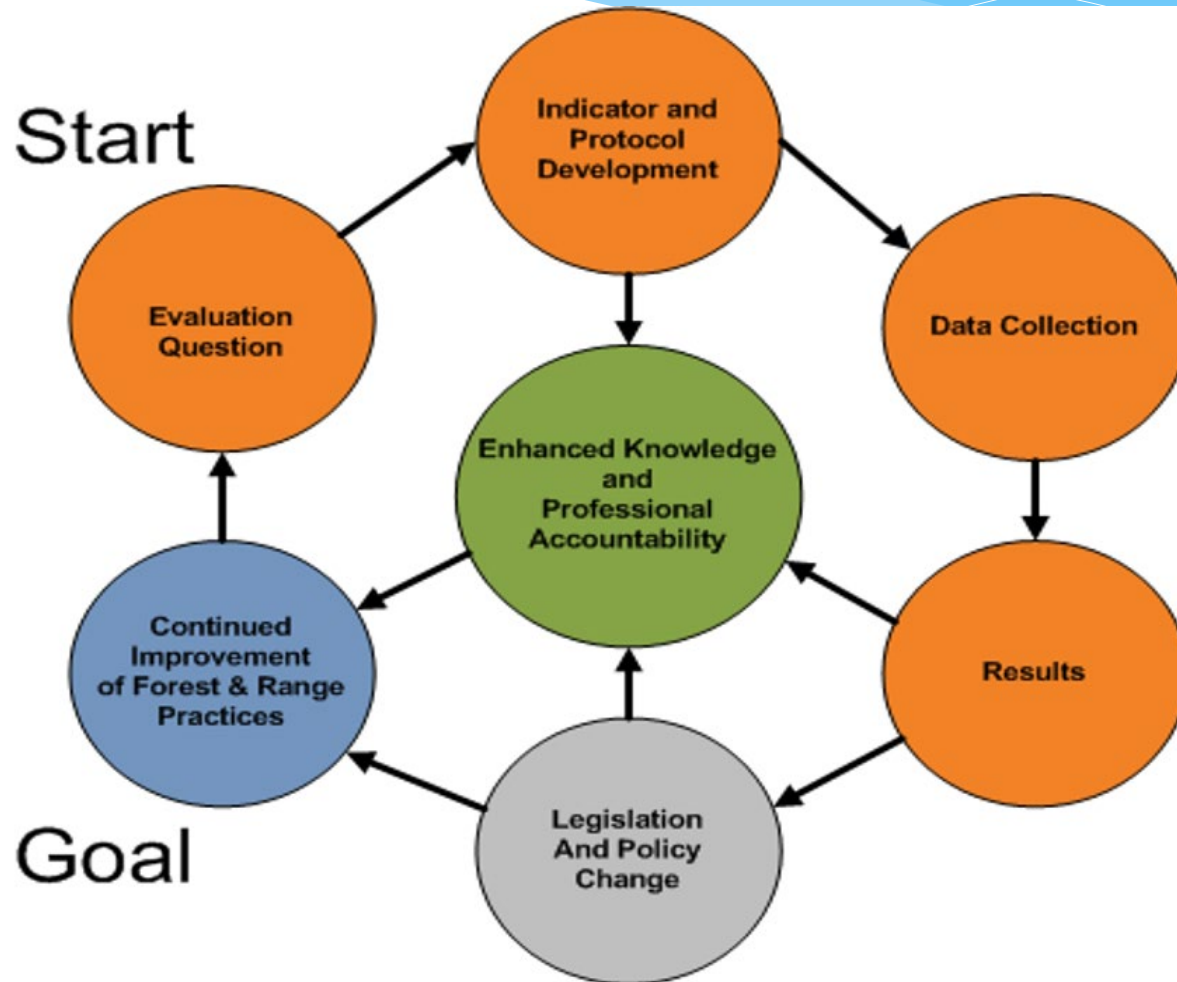
# Why do we monitor?



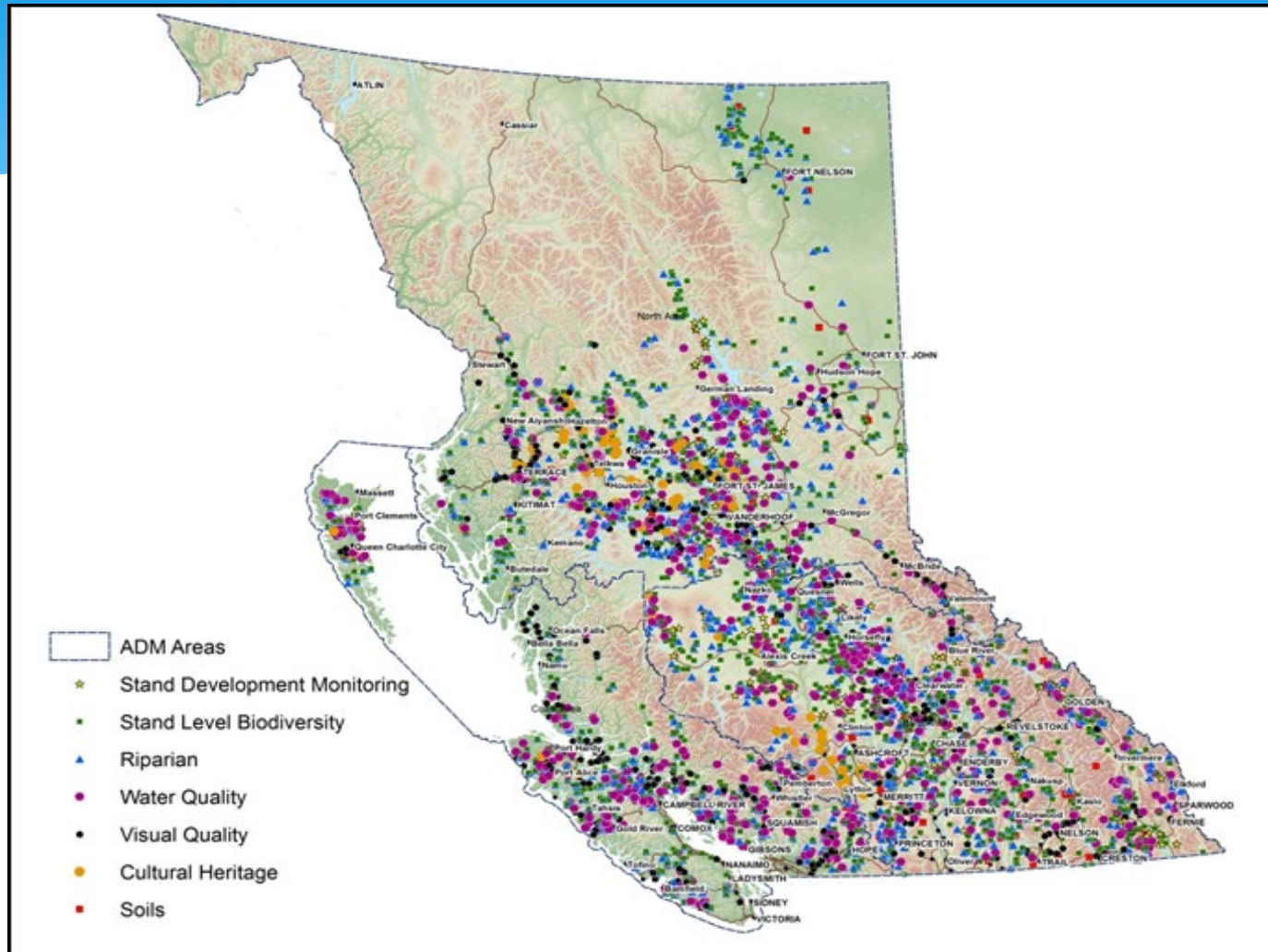
- FPPR s.8. Objectives set by government for water, fish, wildlife and biodiversity within riparian areas. In part...**to conserve, at the landscape level, the water quality, fish habitat, wildlife habitat and biodiversity associated with riparian areas.**
- Effectiveness monitoring evaluates operational outcomes where a licensee is in compliance with approved results or strategies.
  - Uses “routine” level assessments to conduct timely, credible and appropriate evaluations – by district staff/contractors
  - Provides recommendations to licensees (practices) and regulators (legislation and policies)
  - Communicates results and recommendations to stakeholders in a timely and appropriate manner

# Effectiveness Evaluation Question

Are riparian forestry and range practices effective in maintaining the structural integrity and functions of streams, wetlands and other aquatic resource features over both short and long terms?



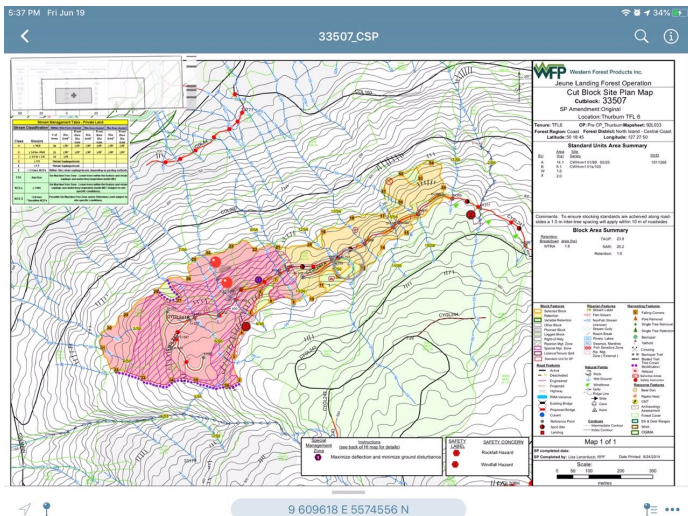
# FREP sample sites



2006-2021: Riparian: streams 2994; wetlands 34

# Sample site selection

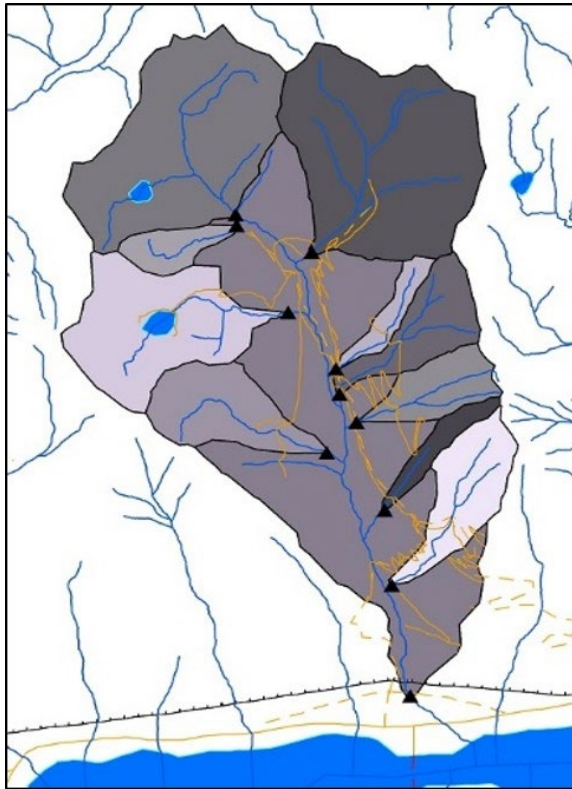
## Random – for reach level results



- \* Every year, **cutblocks** are randomly selected in each Forest District. Time of harvest = 1-3 yrs prior.
- \* Stream and wetland sample sites are within 2 RMAs of a randomly-selected block.
- \* Larger fish streams given preference when there is more than one stream in a block
- \* Sample reach length is the greater of 100m or 30x Ch width
- \* 30 sites needed over past 5 years

# Sample site selection

## Targeted



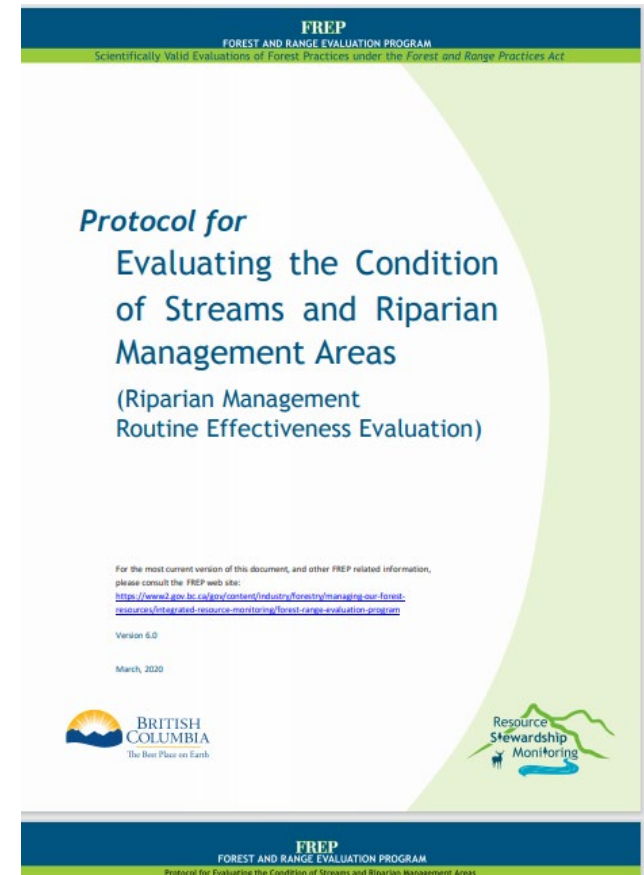
- \* Optional. Complete random sites first to meet min req. for effectiveness monitoring for a sample population.
- \* Targeting sites for watershed evaluation might involve sampling at the lowest reach of sub-catchments in a watershed of interest.
- \* Other reasons for targeting sites might be to sample an area of particular interest/concern, or to review performance by a specific forest licensee.

# Riparian/stream assessment



# What does the riparian/stream protocol evaluate?

- Indicators that reflect form and function of a stream and its riparian area. Both physical and biological components are included.
- Developed in 2005 based on results from research projects in different areas of the province along with expert input.
- The outcome of the assessment is based on the number of negative responses given to 15 main indicator questions.



# What is measured?

Site assessments vary, with modified indicators based on stream morphology (riffle-pool, cascade-pool, step-pool, non-alluvial channels) and fish use

1. Channel bed disturbance
2. Channel bank disturbance
3. LWD characteristics
4. Channel morphology
5. Aquatic connectivity
6. Fish cover diversity
7. Moss abundance & condition
8. Fine sediments
9. Aquatic invertebrate diversity
10. Windthrow frequency
11. Riparian soil disturbance/  
bare ground
12. LWD supply/root network
13. Shade & microclimate
14. Disturbance-increasers/  
noxious weeds/invasive  
plants
15. Vegetation form, vigour,  
& structure

# Each main indicator response is based on answers to sub-indicator questions

Q#1: Is the channel bed undisturbed? Yes/No  
(riffle or cascade pool streams)

- 1) Does **<50%** of reach have active sediment wedges or mid-channel bars?
- 2) Does **<50%** of reach have active multiple channels and/or braids?
- 3) Does **>50%** of the reach have lateral bars?

If Answer “Yes” to 2 or more, circle “Yes”

# Each main indicator response is based on answers to sub-indicator questions

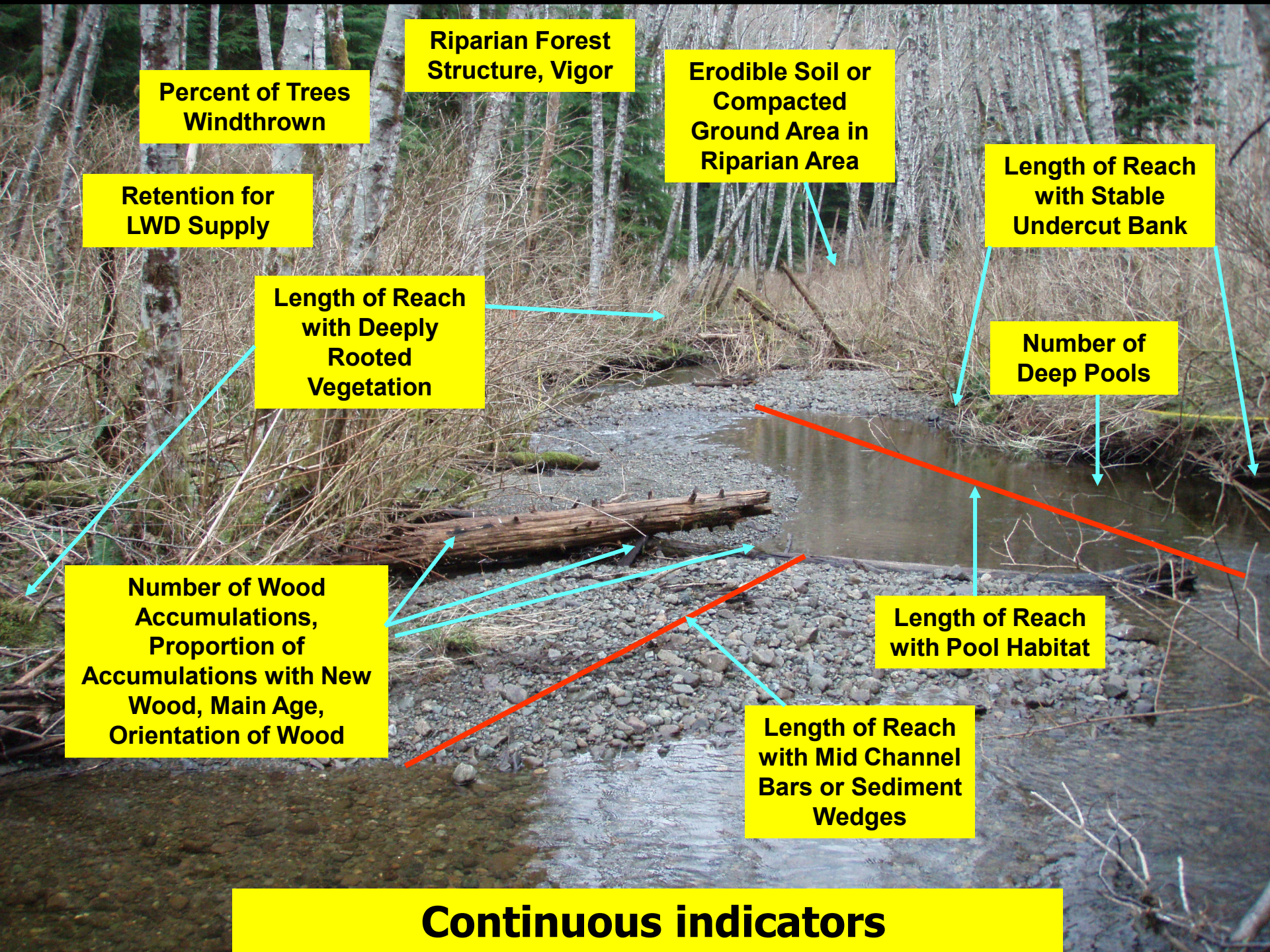
Is the channel bed undisturbed? Yes/No  
(non-alluvial streams)

- 1) Does  $>25\%$  of the channel bed length have moss on the substrate?
- 2) Do moveable sediments and/or debris deposits that completely fill the channel to the top of the banks represent  $<5\%$  of the total reach length?
- 3) Are moveable sediments widely distributed in small pockets along the whole reach, not concentrated in a few relatively large compartments?

If Answer “Yes” to 2 or more, circle “Yes”

# Moveable sediments and/or debris deposits that completely fill the channel to the top of the banks





Percent of Trees  
Windthrown

Retention for  
LWD Supply

Length of Reach  
with Deeply  
Rooted  
Vegetation

Number of Wood  
Accumulations,  
Proportion of  
Accumulations with New  
Wood, Main Age,  
Orientation of Wood

Riparian Forest  
Structure, Vigor

Erodible Soil or  
Compacted  
Ground Area in  
Riparian Area

Length of Reach  
with Stable  
Undercut Bank

Number of  
Deep Pools

Length of Reach  
with Pool Habitat

Length of Reach  
with Mid Channel  
Bars or Sediment  
Wedges

**Continuous indicators**

**Moss area in a square plot**

**% Shade on each side  
of the stream, take  
average**

**% Fines along  
a transect**

**Weeds and disturbance-  
increasers along a transect**

**Invertebrate diversity**

**Point indicators**



# How is the riparian/ stream data used?

- 114 – 120 measurements, estimates, and observations are taken to complete a stream-riparian assessment
- 38 – 60 specific indicator questions are answered that roll up to the 15 main questions.
- 15 questions answered “Yes = OK”, N/A, or “No = Problem”
- Roll-up of negative responses = overall site condition

| Number of Negative Responses<br>(out of 15 Indicator Questions) | Condition Ranking                                    |
|-----------------------------------------------------------------|------------------------------------------------------|
| 0 - 2                                                           | Properly functioning                                 |
| 3 - 4                                                           | Functioning, but at risk (limited impacts)           |
| 5 - 6                                                           | Functioning, but at high risk (intermediate impacts) |
| > 6                                                             | Not properly functioning                             |

# Functioning Condition

## riparian/streams

### **Criteria related to the ability of a stream and its riparian area to:**

- (1) withstand normal peak flood events without experiencing accelerated soil loss, channel movement, or bank movement;
- (2) filter runoff;
- (3) store and safely release water;
- (4) maintain the connectivity of fish habitats;
- (5) maintain an adequate riparian root network or LWD supply;  
and
- (6) provide shade and reduce bank microclimate change.

# Causal Factors

| “No” answer questions | Causes of “No” Answers   |                          |                          |                          |                          |                          |                          |
|-----------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                       | Current Logging          | Old Logging              | Animal Disturbance       | Roads                    | Other Impacts            | Natural Impacts          | Unknown Upstream         |
|                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

If the cause of the impact is not apparent at the reach scale, upstream sources are investigated. If unidentifiable, then Unknown Upstream is selected

| Specific Causes of “No” Answers and Proximity to Reach of Each Cause.<br>Check off each Question with a “No” answer, then beside each main specific cause that applies, record a 1 for within the reach, 2 for above the reach, and 3 for within and above the reach |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|
| Cause of “No” Answers                                                                                                                                                                                                                                                | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| OLD LOGGING                                                                                                                                                                                                                                                          |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Low retention                                                                                                                                                                                                                                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Falling and yarding                                                                                                                                                                                                                                                  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Machine disturbance                                                                                                                                                                                                                                                  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Windthrow                                                                                                                                                                                                                                                            |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Mass wasting                                                                                                                                                                                                                                                         |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Stream diversions                                                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Road/debris blockages                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Forest structure issues                                                                                                                                                                                                                                              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| CURRENT LOGGING                                                                                                                                                                                                                                                      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Low retention                                                                                                                                                                                                                                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Falling and yarding                                                                                                                                                                                                                                                  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Machine disturbance                                                                                                                                                                                                                                                  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Windthrow                                                                                                                                                                                                                                                            |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Mass wasting                                                                                                                                                                                                                                                         |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Stream diversions                                                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Road/debris blockages                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| ROADS, TRAILS                                                                                                                                                                                                                                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Encroachment on RMA                                                                                                                                                                                                                                                  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Running surface erosion                                                                                                                                                                                                                                              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other ROW erosion                                                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Mass wasting                                                                                                                                                                                                                                                         |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Crossing structure                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| ANIMAL DISTURBANCE                                                                                                                                                                                                                                                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Livestock                                                                                                                                                                                                                                                            |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Beavers                                                                                                                                                                                                                                                              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other ungulates                                                                                                                                                                                                                                                      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Humans                                                                                                                                                                                                                                                               |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| NATURAL IMPACTS                                                                                                                                                                                                                                                      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| High sediment levels                                                                                                                                                                                                                                                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Fire                                                                                                                                                                                                                                                                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Insects                                                                                                                                                                                                                                                              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Diseases                                                                                                                                                                                                                                                             |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Wind                                                                                                                                                                                                                                                                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Mass wasting                                                                                                                                                                                                                                                         |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Floods                                                                                                                                                                                                                                                               |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| OTHER IMPACTS                                                                                                                                                                                                                                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Non-logging roads, trails                                                                                                                                                                                                                                            |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Utility corridors                                                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Recreation                                                                                                                                                                                                                                                           |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Agriculture                                                                                                                                                                                                                                                          |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Mining                                                                                                                                                                                                                                                               |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Urban, industry                                                                                                                                                                                                                                                      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other                                                                                                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| UNKNOWN                                                                                                                                                                                                                                                              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |

SPECIFIC causes for EACH “No” are recorded where they occur (within and/or upstream of the sample reach)

# Riparian/wetlands



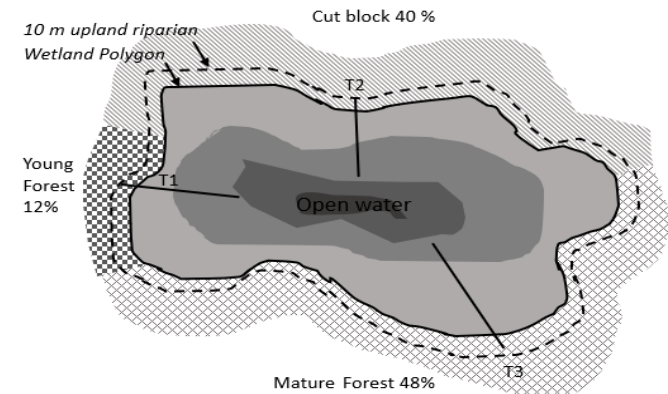
# What does the riparian/wetlands assessment evaluate?

- \* The health or functioning condition of wetland sites in or adjacent to development activities (e.g., forestry).
- \* Developed for persons with basic working knowledge of wetlands to complete (e.g., forest and range practitioners, FN guardians, consultants, land managers, or other land users.)
- \* Largely field-based indicators and attributes. Like riparian/streams, designed to provide consistency among users.
- \* Pertinent information is collected to inform on the condition of the wetland and be cost effective as a tier 2 approach for monitoring (i.e., relatively quick to use in the field (e.g., 2-4 hours)).

# Stratifying upland areas



# Sample design



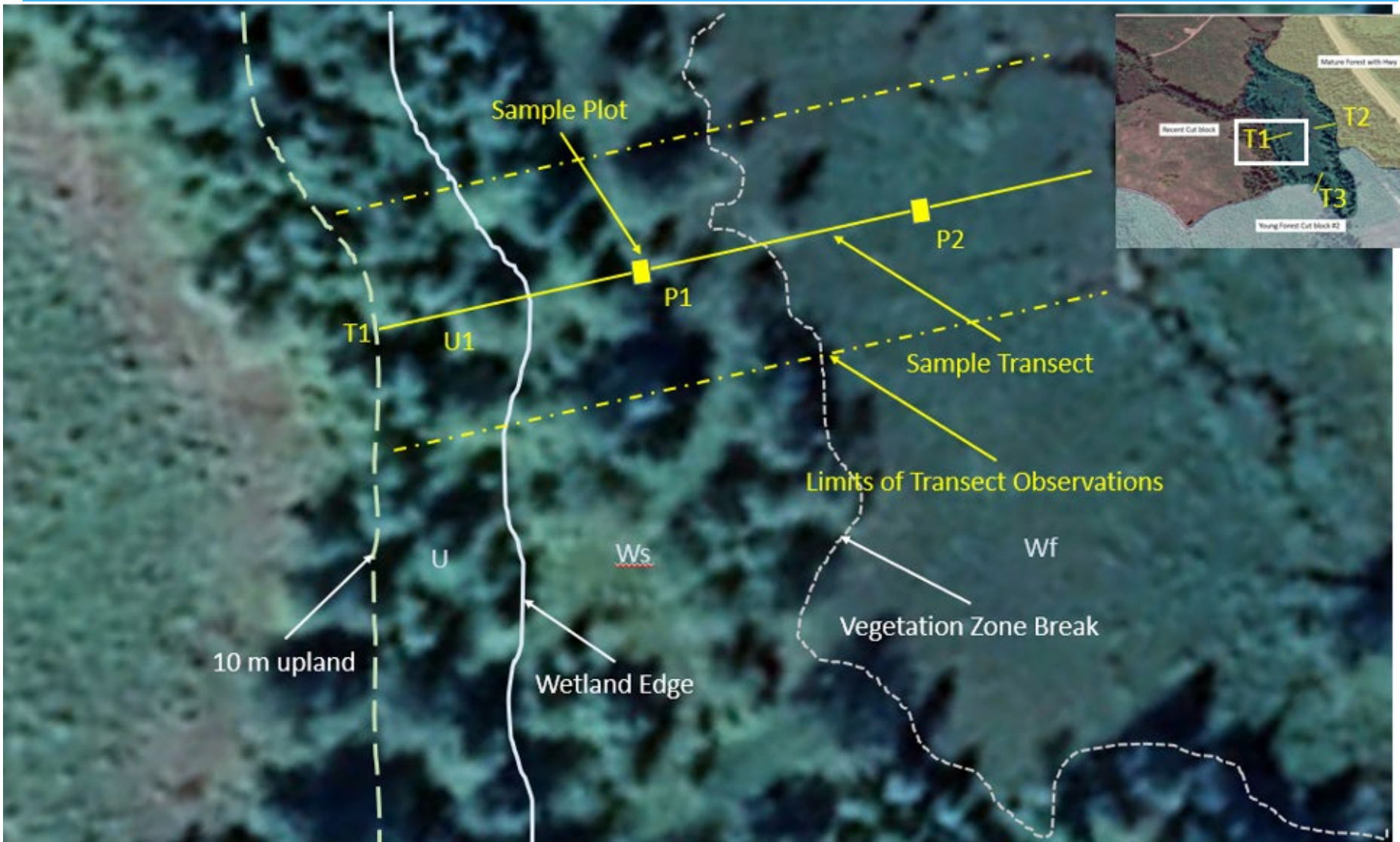
## **Transects Representing**

- T1, Young Forest = 12% of Total Wetland Assessed
- T2, Cut Block = 40% of Total Wetland Assessed
- T3, Mature Forest = 48% (6/2) of Total Wetland Assessed

## **Total Polygon Assessed**

= A + 10 m upland buffer – Open Water

# Zones, transects, plots



# Wetland components



# What is measured?

Indicators and attributes are associated with soils, vegetation, water.

1. Vegetative cover
2. Invasive Plants
3. Disturbance/Increaser Plants
4. Vegetation structure, form, vigor, recruitment
5. Timber or other vegetative removal
6. Over-browsing or grazing
7. Bare/compacted soil
8. Physical alteration of wetland
9. LWD processes
10. Windthrow
11. Evidence of hydrologic changes
12. Threats to water levels
13. Water Quality
14. Habitat Connectivity
15. Intactness of surface and subsurface flows

# Format similar to streams

| Question Indicator | TRANSECT SUMMARY INFO                                             | T1 | T2 | T3 | Average/<br>Weighted<br>Average | % Large non-homogenous patches | Total =<br>Weighted<br>average |
|--------------------|-------------------------------------------------------------------|----|----|----|---------------------------------|--------------------------------|--------------------------------|
| NA                 | width (m) of retention upland from wetland                        |    |    |    |                                 |                                |                                |
| NA                 | % retention (basal area) upland from wetland                      |    |    |    |                                 |                                |                                |
| 3                  | % cover disturbance/increaser plant 10 m upland from wetland edge |    |    |    |                                 |                                |                                |
| 2a                 | % invasive species in polygon                                     |    |    |    |                                 |                                |                                |
| 3                  | % disturbance/increaser plants in polygon                         |    |    |    |                                 |                                |                                |
| 1                  | % vegetation cover in polygon                                     |    |    |    |                                 |                                |                                |
| 7a                 | % bare and compacted ground in polygon                            |    |    |    |                                 |                                |                                |
|                    | % bare and compacted ground hydrologically connected upslope of   |    |    |    |                                 |                                |                                |



| T.7.3. Continuous observations: snag and coarse woody debris within wetland and 10 m upland |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |        |                                                                                                                                                                                                                                              |        |  |        |  |             |  |
|---------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--|--------|--|-------------|--|
| Softwood                                                                                    |                          |                          |                          |                          |                          | Hardwood                 |                          |                          |                          |                          |        |                                                                                                                                                                                                                                              |        |  |        |  |             |  |
| Dead                                                                                        |                          |                          |                          |                          |                          | Dead Fallen              |                          | Dead                     |                          |                          |        | Dead Fallen                                                                                                                                                                                                                                  |        |  |        |  |             |  |
| Hard →                                                                                      |                          |                          | Spongy                   |                          |                          | → Soft                   |                          |                          | Not Sampled              |                          | Hard → |                                                                                                                                                                                                                                              | Spongy |  | → Soft |  | Not Sampled |  |
| 3                                                                                           | 4                        | 5                        | 6                        | 7                        | 8                        | 9                        | 3                        | 4                        | 5                        | 6                        |        |                                                                                                                                                                                                                                              |        |  |        |  |             |  |
|                                                                                             |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |        |                                                                                                                                                                                                                                              |        |  |        |  |             |  |
| <input type="checkbox"/>                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |        |                                                                                                                                                                                                                                              |        |  |        |  |             |  |
| Check all decay classes of snags observed within 10 m upland of the wetland edge            |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |        |                                                                                                                                                                                                                                              |        |  |        |  |             |  |
| Check all Diameter Sizes observed:                                                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |        | <input type="checkbox"/> 0 < 10 cm <input type="checkbox"/> 10 < 20 cm <input type="checkbox"/> 20 < 30 cm <input type="checkbox"/> 30 < 40 cm <input type="checkbox"/> 40 < 50 cm <input type="checkbox"/> 50 cm + <input type="checkbox"/> |        |  |        |  |             |  |

| T.9. PHYSICAL AND HYDROLOGICAL ALTERATION INDICATORS |                                                                                                                                                                                                                  |                                                                                                                                          |                          |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
|                                                      | Tally of occurrences (m²)                                                                                                                                                                                        | Total                                                                                                                                    | %                        |
| 8a                                                   | % total polygon altered (pg. 32)                                                                                                                                                                                 |                                                                                                                                          |                          |
| 8b                                                   | severity of physical alteration¹ (pg. 33)                                                                                                                                                                        | <input type="checkbox"/> severe <input type="checkbox"/> moderate <input type="checkbox"/> slight <input type="checkbox"/> no alteration |                          |
| 11a                                                  | Are hydrologic changes minor or non-existent?                                                                                                                                                                    | Y N NA                                                                                                                                   |                          |
| 11b                                                  | Are recent dead trees or shrubs absent from the wetland edge that would indicate a rise in water level? (pg. 39)                                                                                                 | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>                                                               |                          |
| 11c                                                  | Upland plant or tree species are not encroaching, and the wetland is not shrinking (pg. 39)                                                                                                                      | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>                                                               |                          |
| 11d                                                  | If the wetland has a defined stream channel through it, any stream channel incision is minor or non-existent (i.e., minor impacts to adjacent vegetation) (pg. 40)                                               | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>                                                               |                          |
| 11e                                                  | Natural surface or subsurface areas are not altered by disturbance. If drainage tiles, ditches, dikes, gullies are present they are having a minor to non-existent impact to vegetation in the wetland. (pg. 40) | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>                                                               |                          |
| 12a                                                  | If an outlet structure is present, is it structurally stable (i.e. not eroding at the outlet)? (pg. 41)                                                                                                          | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>                                                               |                          |
| 12c                                                  | % of the streambank or shoreline is structurally altered (interface of open water and vegetation communities) (pg. 41)                                                                                           | _____ %                                                                                                                                  | <input type="checkbox"/> |
| 12d                                                  | % streambank with deep binding rootmass? (Lotic (moving water) only) (pg. 42)                                                                                                                                    | _____ %                                                                                                                                  | <input type="checkbox"/> |
| 13a                                                  | Does the wetland lack any signs of excessive nutrient loading such as algae mats, blooms, fish kills?                                                                                                            | <input type="checkbox"/> <input type="checkbox"/>                                                                                        |                          |
| 13b                                                  | Do basic water quality parameters (smell, colour, pH, turbidity, temperature) appear to be within a reasonable range of natural variation?                                                                       | <input type="checkbox"/> <input type="checkbox"/>                                                                                        |                          |

# How is the data used?



- \* Values are compared to pre-determined thresholds
- \* Sub-indicators are rolled up to answer indicator questions linked to variability in soils, vegetation and hydrological processes.
- \* All indicators are tallied and final scoring is reflected in 4 condition categories.

Properly functioning condition

Functioning, but at risk

Functioning, but at high risk

Not properly functioning



# Functioning Condition

## riparian/wetlands

**Criteria related to the ability of a wetland and its riparian area to:**

- \* Withstand inputs from upslope and inlets to filter runoff and improve wetland and downstream water quality;
- \* Support a variety of wildlife species, both within and directly surrounding the edge of the wetland by providing habitat niches and adequate cover through a diversity of well vegetated canopy layers, coarse woody debris, microtopography, and snags;
- \* Maintain the connectivity of fish habitats where these exist;
- \* Withstand hydrodynamic processes in terms of water input timing and quantity that is appropriate for the specific wetland's composition and trajectory; and,
- \* Attenuate flooding events without erosion or modifications to vegetation types.

| Specific Causes of "No" Answers and Proximity to Reach of Each Cause.                                                                                                                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|
| Check off each Question with a "No" answer; then beside each main specific cause that applies, record a 1 for within the reach, 2 for above the reach, and 3 for within and above the reach |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Cause of "No" Answers                                                                                                                                                                       | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| OLD LOGGING                                                                                                                                                                                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Low retention                                                                                                                                                                               |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Falling and yarding                                                                                                                                                                         |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Machine disturbance                                                                                                                                                                         |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Windthrow                                                                                                                                                                                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Mass wasting                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Stream diversions                                                                                                                                                                           |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Road/debris blockages                                                                                                                                                                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Forest structure issues                                                                                                                                                                     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other                                                                                                                                                                                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| CURRENT LOGGING                                                                                                                                                                             |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Low retention                                                                                                                                                                               |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Falling and yarding                                                                                                                                                                         |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Machine disturbance                                                                                                                                                                         |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Windthrow                                                                                                                                                                                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Mass wasting                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Stream diversions                                                                                                                                                                           |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Road/debris blockages                                                                                                                                                                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other                                                                                                                                                                                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| ROADS, TRAILS                                                                                                                                                                               |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Encroachment on RMA                                                                                                                                                                         |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Running surface erosion                                                                                                                                                                     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other ROW erosion                                                                                                                                                                           |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Mass wasting                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Crossing structure                                                                                                                                                                          |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other                                                                                                                                                                                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| ANIMAL DISTURBANCE                                                                                                                                                                          |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Livestock                                                                                                                                                                                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Beavers                                                                                                                                                                                     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other ungulates                                                                                                                                                                             |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Humans                                                                                                                                                                                      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other                                                                                                                                                                                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| NATURAL IMPACTS                                                                                                                                                                             |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| High sediment levels                                                                                                                                                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Fire                                                                                                                                                                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Insects                                                                                                                                                                                     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Diseases                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Wind                                                                                                                                                                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Mass wasting                                                                                                                                                                                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Floods                                                                                                                                                                                      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other                                                                                                                                                                                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| OTHER IMPACTS                                                                                                                                                                               |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Non-logging roads, trails                                                                                                                                                                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Utility corridors                                                                                                                                                                           |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Recreation                                                                                                                                                                                  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Agriculture                                                                                                                                                                                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Mining                                                                                                                                                                                      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Urban, industry                                                                                                                                                                             |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Other                                                                                                                                                                                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| UNKNOWN                                                                                                                                                                                     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |

Causal factors of impacts are recorded and SPECIFIC causes are identified

# Training and assessment tools– online self guided training

[Home](#) > [Farming, natural resources and industry](#) > [Evaluation Program](#) >

- \* Sustainable Forest Management Practices
- \* Timber Supply Review and allowable annual cut
- \* Forest Inventory
- \* Forest health
- Soil Conservation
- \* Old Growth Forests
- \* Forest Stewardship Plans
- Wildfire Management
- \* Forest Landscape Plans
- \* Visual Resource Management
- \* Silviculture
- \* Tree Seed
- \* Integrated Resource Monitoring
  - Integrated Monitoring Reports
- \* Forest & Range Evaluation Program
- \* FREP Monitoring Protocols
  - FREP Multiple Resource Value Assessments
  - FREP Reports & Publications
- \* **[FREP Training](#)**
  - \* [Riparian/Streams Protocol Self-Guided Training](#)
  - \* [Riparian/Wetlands Protocol Self-Guided Training](#)

[Home](#) > [Farming, natural resources and industry](#) > [Evaluation Program](#) > [FREP Training](#) >

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  - \* FREP Monitoring Protocols
    - FREP Multiple Resource Value Assessments
    - FREP Reports & Publications
  - \* **[Riparian/Streams Protocol Self-Guided Training](#)**
    - Lesson 1-

## Riparian Guided

### Routine R Evaluation

The primary goal of training in riparian we have create knowledge of the Evaluation (RRE) and practices u

At the end of the performing RRI skills more con



[Home](#) > [Farming, natural resources and industry](#) > [Forestry](#) > [Forest Stewardship](#) > [Integrated Resource Monitoring](#) > [Forest & Range Evaluation Program](#) > [FREP Training](#) >

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  - \* **[Riparian/Wetlands Protocol Self-Guided Training](#)**

## Riparian/Wetlands Protocol Self-Guided Training



The primary goal of this course is to help prepare you for field-oriented training in wetlands assessment. The field-training is rigorous and we have created this online course so that you will already have a basic knowledge of the Wetlands Management Routine Effectiveness Evaluation (WMREE) process and understand some of the terms, procedure and practices used as you undertake the field-based WMREE training.

[Expand All](#) | [Collapse All](#)

- Who Should Take This Course?**
- Learning Objectives & Format**
- How Will I Be Evaluated?**
- How Much Time Will The Course Take?**
- Course Modules**

### Forest & Range Evaluation Program



[Link to wetland protocol documents](#)

For questions about wetland training, please contact [FREP@gov.bc.ca](mailto:FREP@gov.bc.ca)

# Training and assessment tools– webinars, guidance documents

## FREP Riparian Classroom Training

2021-06-04 16:34 UTC

Recorded by  
Nordin, Lisa J FLNR:EX

Organized by  
Malkinson, Leah  
FLNR:EX

Microsoft Teams

## Wetland Health Assessment Form and Protocol

Prepared for:

The Resource Practices Branch (RPB) - Ministry of Forests, Range, Natural Resource Operations, and Rural Development (FLNRORD)

&

Ministry of Environment and Climate Change  
Technology (ENV)

Neil Fletcher

Manager, BC Wildlife Federation  
Stewardship Partnership

Project Lead: Lisa Nordin  
Project Evaluation Officer, FLNRORD



# Training and assessment tools- FREPmap

<https://governmentofbc.maps.arcgis.com/apps/MapSeries/index.html?appid=b738c13cda9e4b8d9bd6e05ff9f9d2a9>

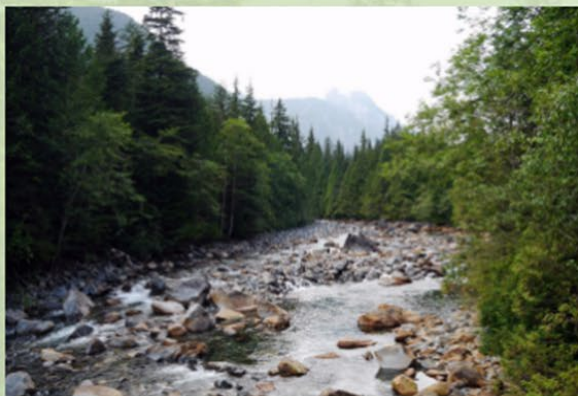
## The Forest and Range Evaluation Program - FREP Map Portal

FREP Map Portal

FREP Map



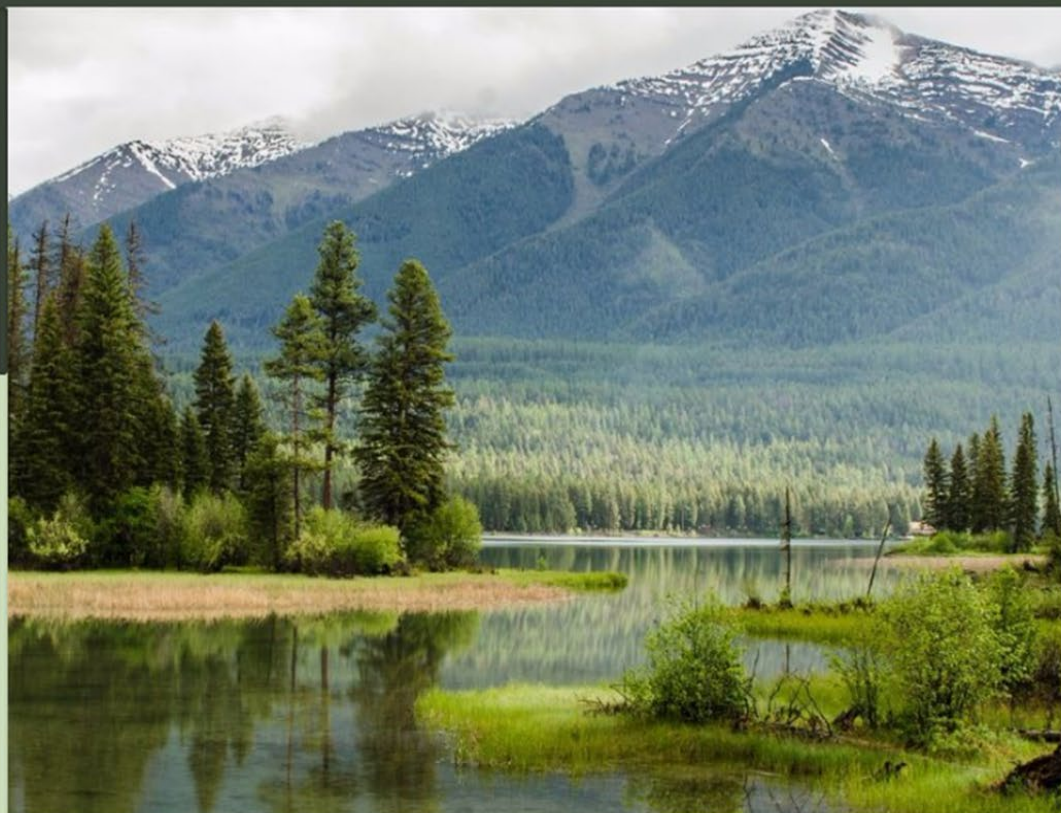
Welcome to  
The FREP Map Portal



This portal provides information and mapped datasets to the Provincial Stewardship individuals involved with the Forest and Range Evaluation Program (FREP).

### Search Box

Please use the search box function in the FREP Map to find the location of your study area, field site or site of interest.



FREP Map Portal

FREP Map



BRITISH  
COLUMBIA

## Forest & Range Evaluation Program Map



1365852



Show search results for 1365852

### Layer List



#### Operational layers



▶ ☐ FREP Riparian Data



▶ ☐ Water Quality Rating



▼ ☒ Roads



▶ ☒ Forestry Roads



▶ ☒ Openings

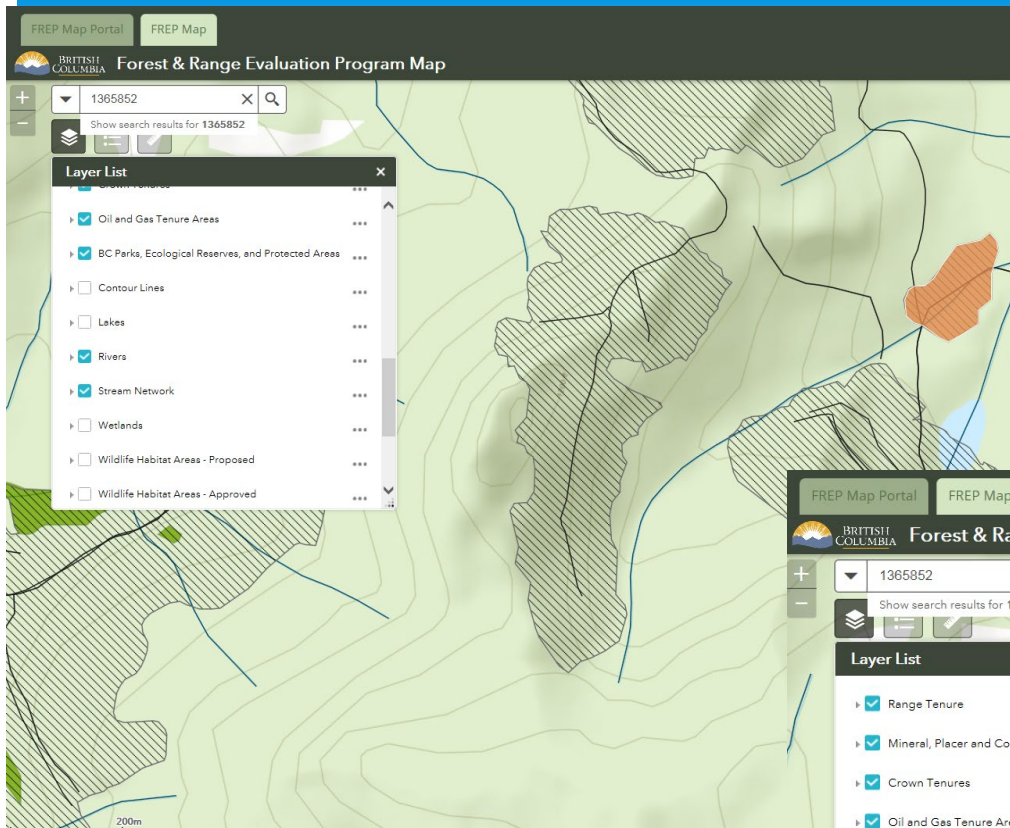
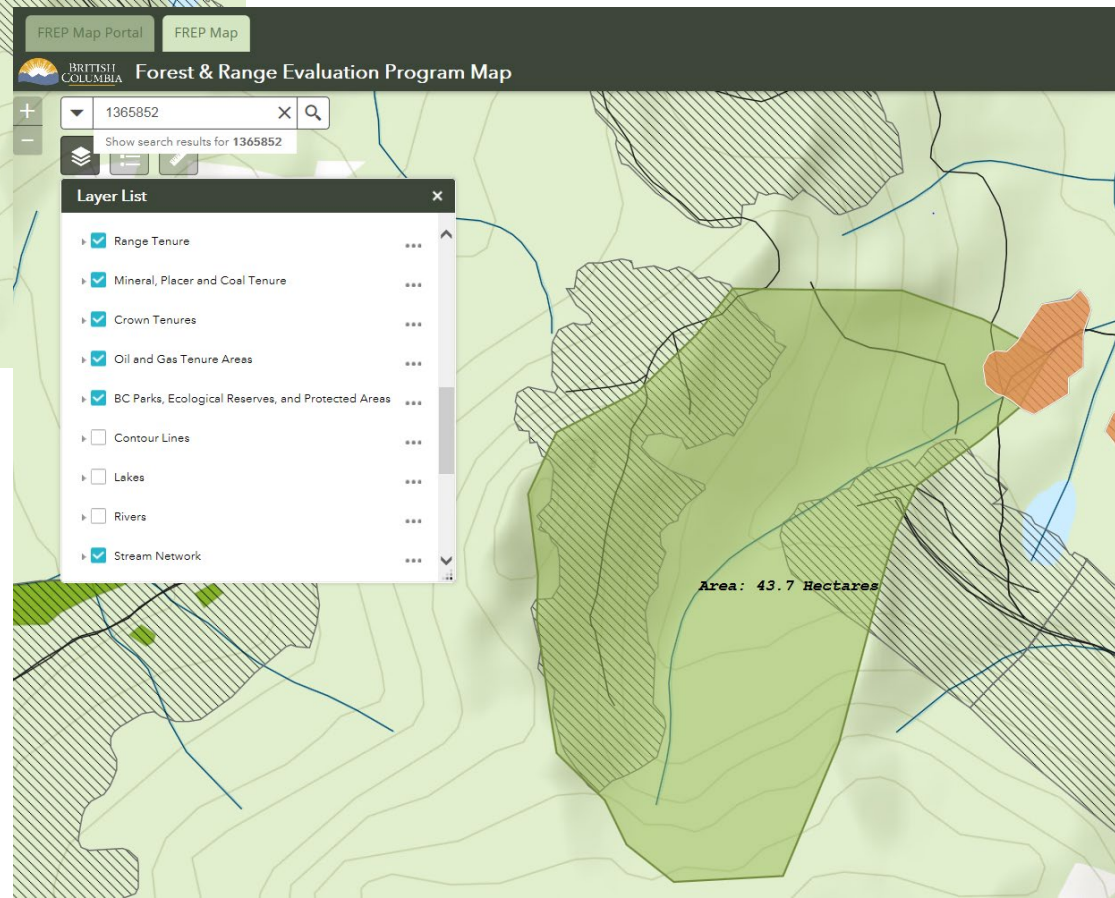


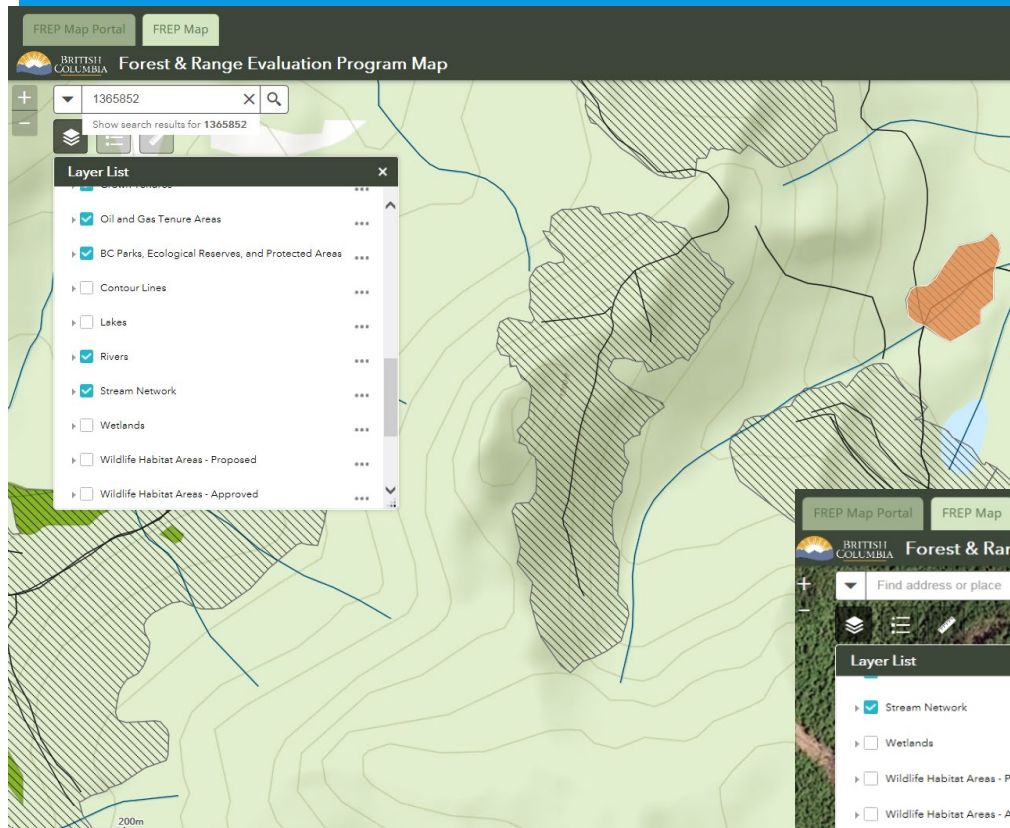
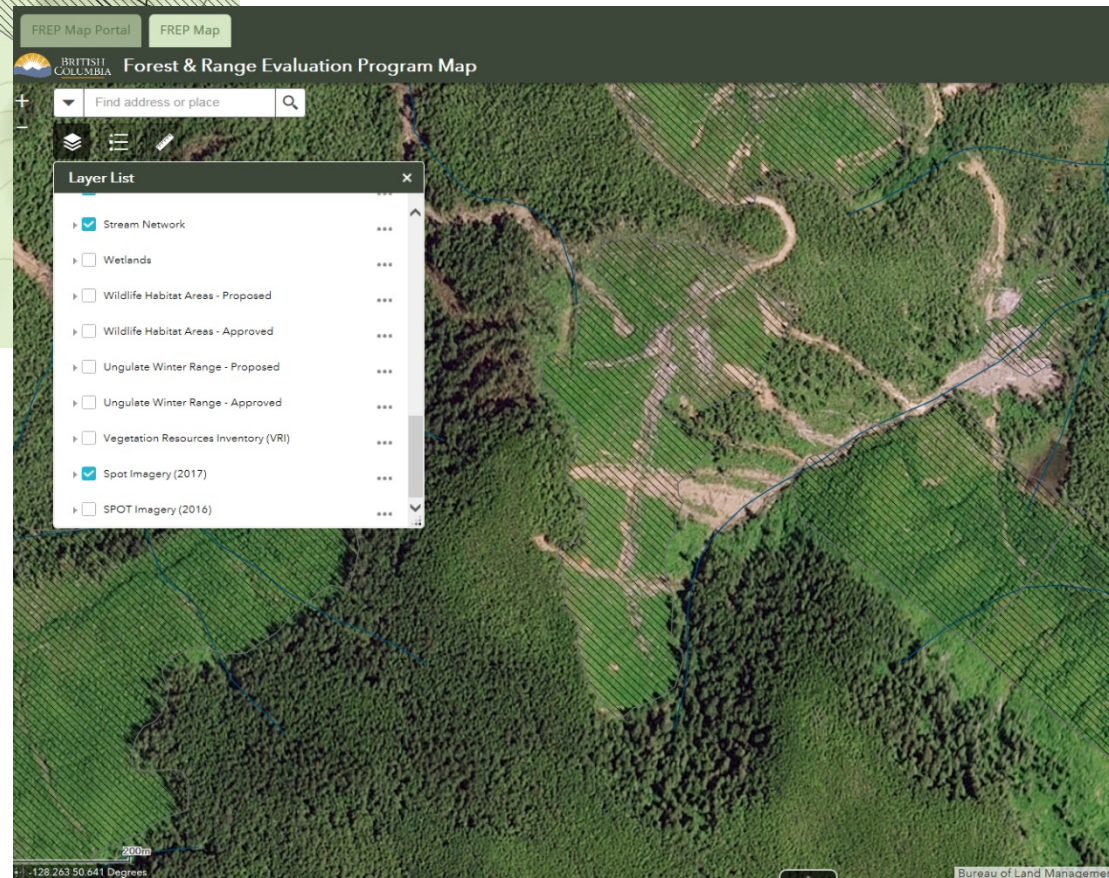
▶ ☒ Forest Cover Reserve



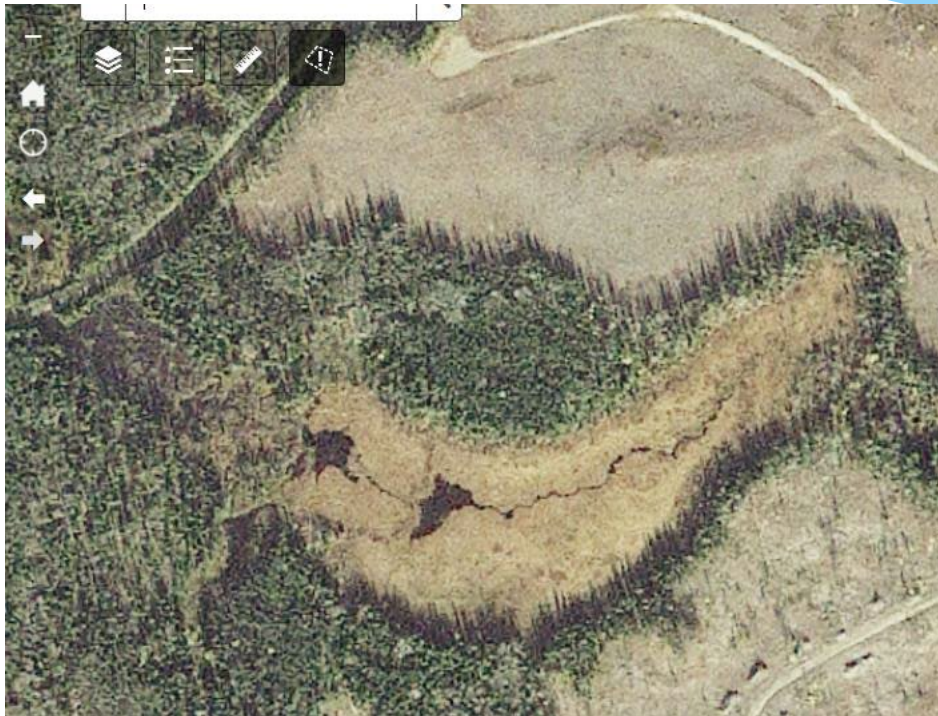
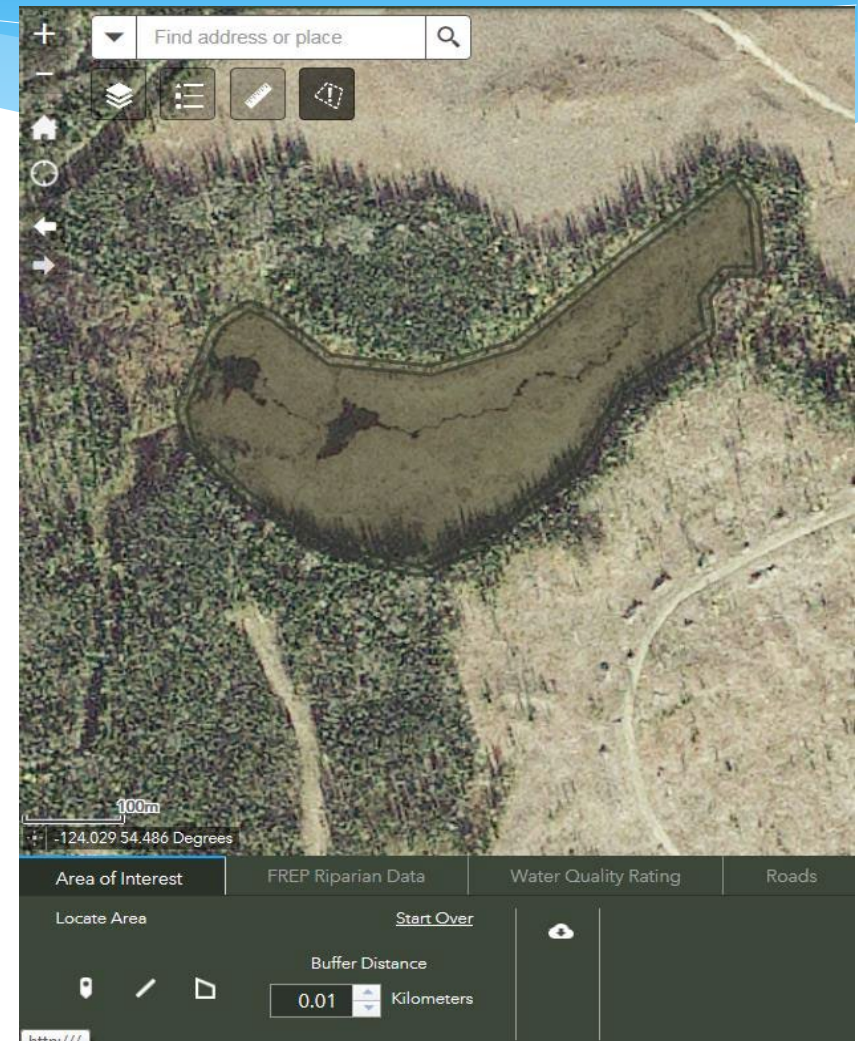
▶ ☐ Forest Cover Silviculture



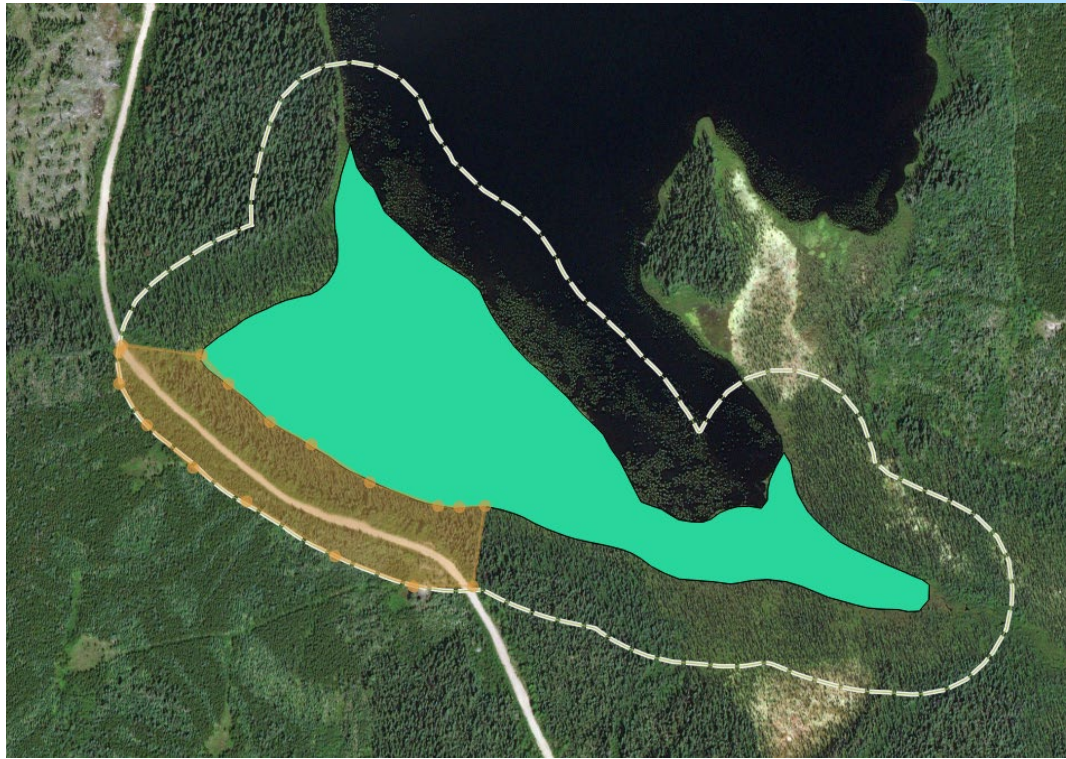




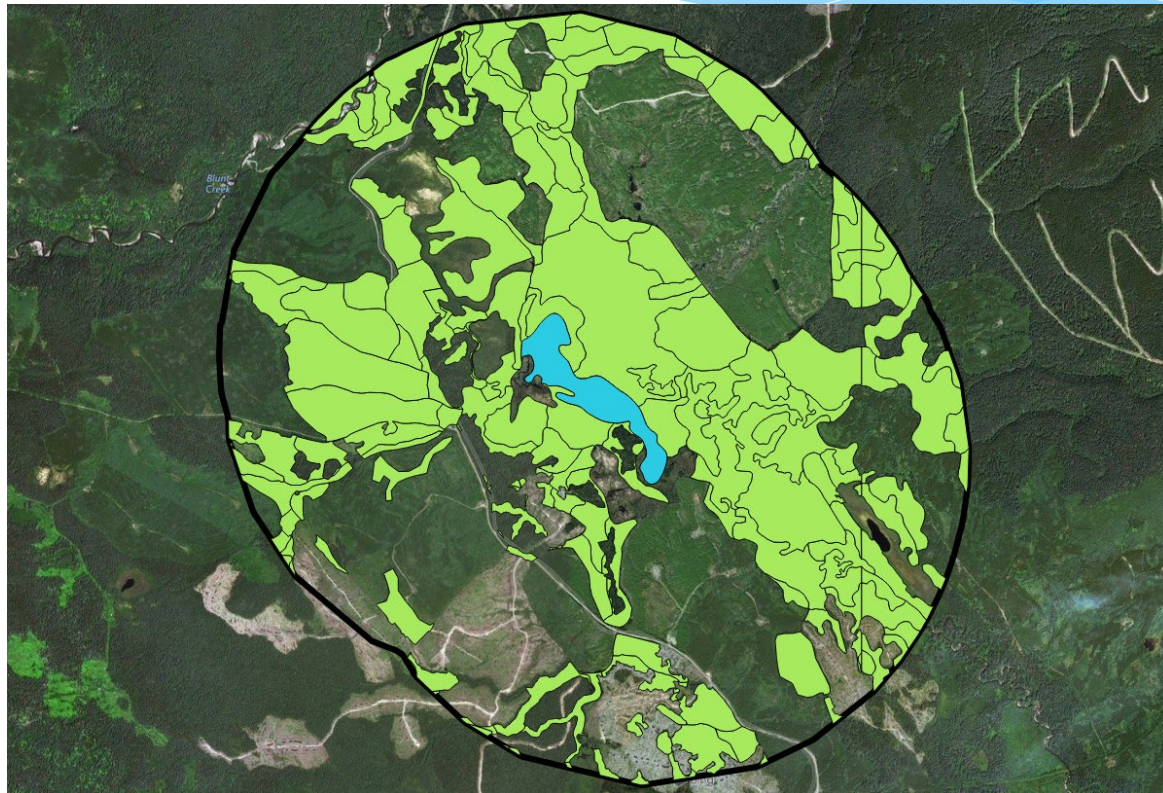
# Wetland buffer – 10 m



# Wetland buffer – 100m



# Mature and old forest within 2km



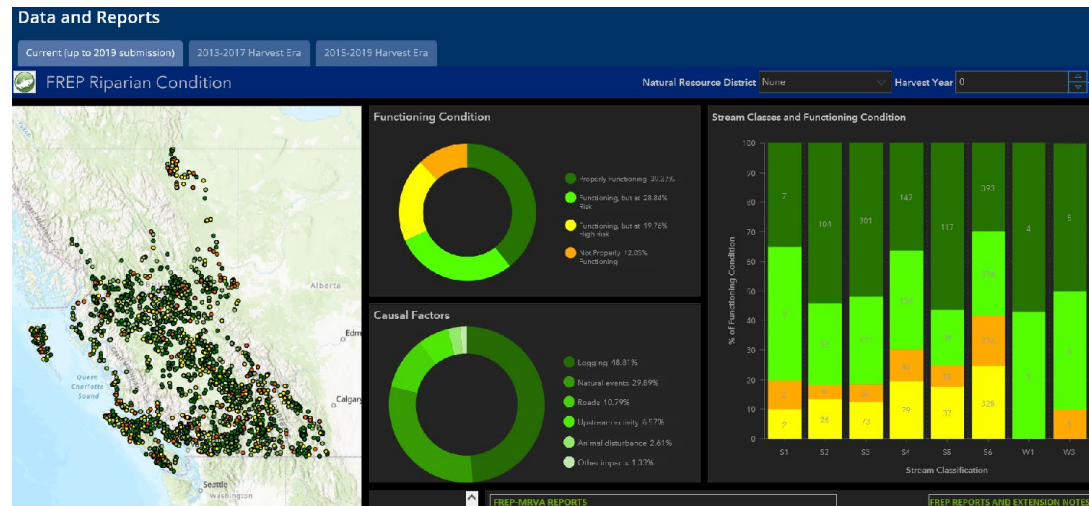
# Data Storage and Availability

- \* We are currently working on updating the FREP data storage system.
- \* Datasets are available by making a request to the value lead.
- \* Dashboard of simplified results is available online.



# Communicating results

- \* Results of assessments are submitted to the FREP database
- \* Used in district and licensee reports as well as online dashboard reporting
- \* Continuous improvement tool for forest and range licensees
- \* Science-based feedback loop into policy and regulation





# Other Assessments: Routine-Level Watershed Assessment

- \* Combination of GIS and field data to inform on the condition of a specific watershed.
- \* Sites are targeted and selected using a systematic sampling design at the “pour point” of sub-catchments.
- \* Stream attributes are collected in the field as per the riparian/stream protocol (3 dozen+ are associated with Q# 1-9)
- \* Uses disturbance layer from CE as a proxy for riparian indicators in riparian/stream protocol.
- \* Also collect information on habitat connectivity, sediments from roads, and wetland health and condition using established protocols.
- \* Reports out on functioning condition by sub-catchment; uses a weighted average for watershed.

## INTEGRATING GIS AND GROUND-BASED METHODOLOGIES WITH POUR-POINT SAMPLE DESIGN FOR ROUTINE-LEVEL WATERSHED ASSESSMENT

Lisa Nordin and Leah Malkinson

### INTRODUCTION

In 2019, the Forest and Range Evaluation Program (FREP) piloted a study with multiple objectives, one of which was to test an integrated method for effectively assessing watershed conditions that could be repeated by trained non-specialists with a working knowledge of GIS. The creation of this pilot evolved from an increasing interest in expanding stream and riparian assessments from a local scale to one that more effectively captures processes at a watershed level. Prior to this new methodology, there was only one watershed sampling protocol within FREP, which had been developed for fisheries-sensitive watersheds (FSWs). The FSW design uses stratified-random site selection derived from sections of a grid overlay of the drainage area. The overall results subsequently roll up in an additive manner by fish/non-fish stream grouping to conclude on watershed condition. The fisheries-sensitive watershed assessment includes conservative thresholds for the protection of fish

cumulative effects model output layers can assist in the identification of watersheds that might be at high risk owing to potential increases in peak flows, sedimentation, or riparian disturbance. As watershed patterns are hierarchical or “nested” it is important to understand the level of resources available for sampling before deciding on the scale of watershed for assessment. The scale does not have to align with existing mapped boundaries, such as those basins identified in current spatial layers, but if the watershed has a customized scale to meet specific objectives, additional GIS work to define the drainage boundary will have to be completed. The Freshwater Atlas and other topographic spatial layers are useful tools to help determine height of land and drainage direction if drawing a custom boundary.

### POUR-POINT DESIGN AND RATIONALE

Watersheds can be described as a patchwork of sub-catchments that together contribute to the overall

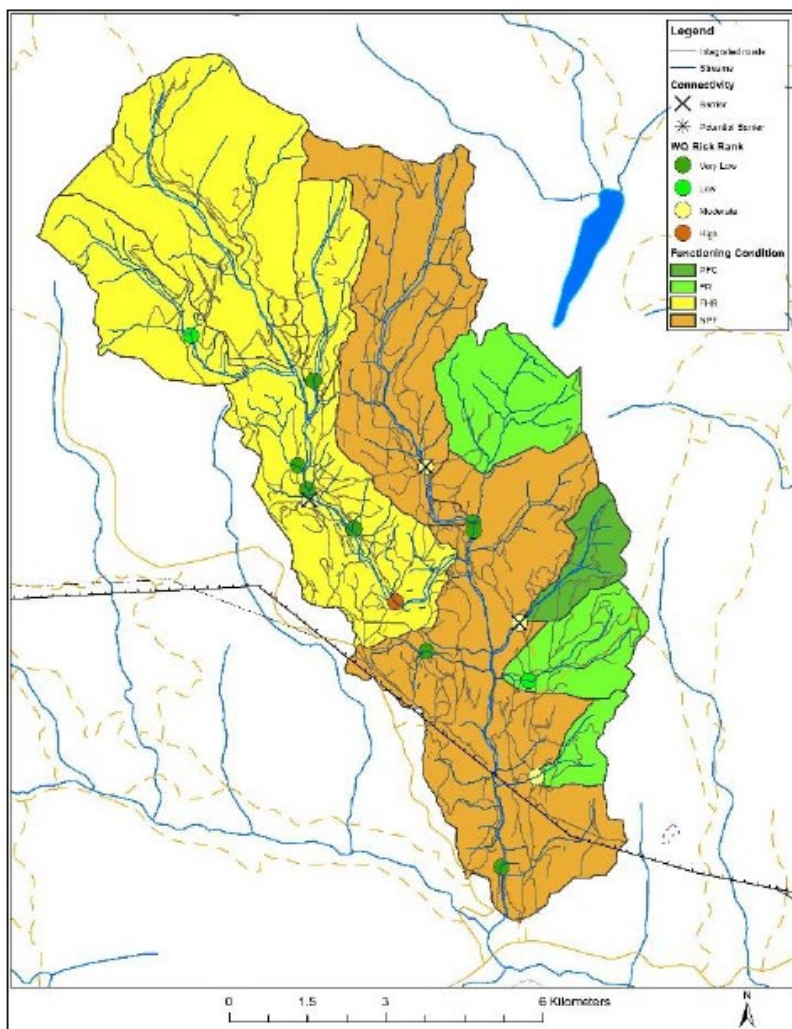
# FREP

TECHNICAL  
GUIDANCE #7

July 2020

# Routine watershed assessment output

Rock creek watershed = NPF



## FREP

REPORT # 41

FOREST AND RANGE EVALUATION PROGRAM

August 2020

### WATERSHED ASSESSMENTS IN THE KOOTENAY-BOUNDARY REGION: Combining GIS and Ground-Based Methodology with Pour-Point Design

Prepared by:  
Lisa Nordin, M.Sc., R.P.Bio.  
Integrated Monitoring and Assessment, Resource Planning and Assessment Branch  
B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development

August 2020



Boundary Creek. Photo credit: Kristie Steele



# Results to date

- \* Small streams are left in worse functioning condition than large streams.
- \* Retention is a factor
- \* Stream location is a factor

## THE CONDITION OF SMALL STREAMS AFTER HARVESTING: A SUMMARY OF FREP DATA FROM 2006-2015

*Prepared by Lisa Nordin, John Rex and Peter Tschaplinski*

# FREP

EXTENSION NOTE #40

October 2017

## POST-HARVEST CONDITION OF STREAM CHANNELS, FISH HABITATS, AND ADJACENT RIPARIAN AREAS: RESOURCE STEWARDSHIP MONITORING TO EVALUATE THE EFFECTIVENESS OF RIPARIAN MANAGEMENT 2005-2014

*Prepared by: Peter Tschaplinski and Derek Tripp*

# FREP

EXTENSION NOTE #39

October 2017

### Key Messages for Resource Managers:

- Post-harvest monitoring of streams over a 10-year period shows that the percentage of streams in the two top-functioning categories – properly functioning condition (PFC) and functioning at risk (FR) – was 68% in the Forest Practices Code (FPC) era, 66% in the transition era, and 67% in the *Forest and Range Practices Act* era. These outcomes did not vary significantly from the FPC to the FRPA eras.
- Stream reaches in the two top functioning categories reflect forest practices that have achieved riparian management objectives under FRPA.
- Four out of five streams that were deemed not properly functioning (NPF) were small, non-fish bearing streams (class S6, 71%) and the smallest fish-bearing streams (class S4, 16%).
- Streams with the best outcomes occurred where the retention of overstorey trees were managed for windthrow; there was little or no disturbance to the stream bed, banks, and adjacent riparian area; and fine sediments from road construction and maintenance were managed.

### Lessons for Resource Managers:

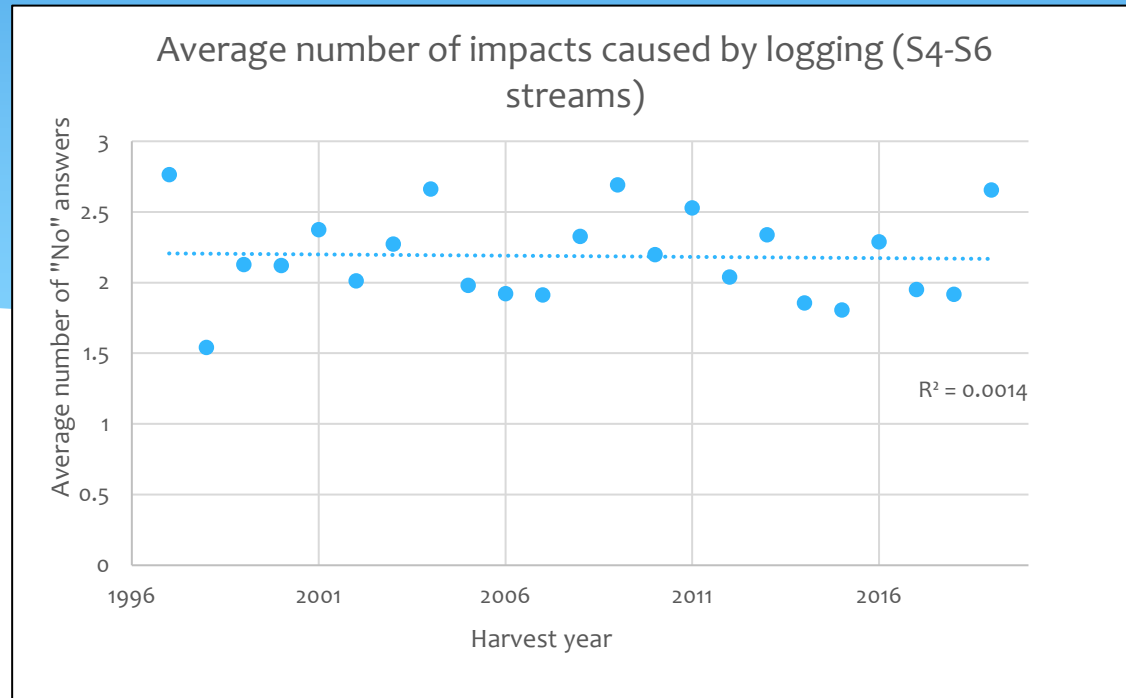
Common harvest-related activities that were observed to cause impacts to small streams were falling and retention, and windthrow.

Streams were left in better condition than S4 and S6 streams, likely because of the 20-m mandatory reserves and related operational considerations that buffer S3 channels.

Streams adjacent to the block were ranked better than those located within the block, which could be due to cross-channel disturbance and retained vegetation on one side of channel.

Stream classes, sites that were given more riparian retention had better outcomes, with more than 80% with a 10-m buffer ranked in the top two functioning categories: properly functioning condition (PFC) and functioning at risk (FR).

# Has small stream riparian management improved over time?



# Results to date

- \* Riparian management strategies vary among licensees
- \* There are good players!
- \* Good outcomes begin at the planning stage, involve multiple groups, consider timing and methods for harvest depending on site characteristics, involve training, operational monitoring and communication from senior staff to operators.



## BEST RIPARIAN MANAGEMENT PRACTICES LEADING TO GOOD OUTCOMES FOR SMALL STREAMS

Lisa Nordin and Peter Bradford

### INTRODUCTION

More than 2300 riparian monitoring assessments have been completed by the Forest and Range Evaluation Program (FREP) over the past 11 years. This data indicates that smaller-sized streams are not faring as well after harvest compared to larger streams where retention is mandatory (FREP Extension Notes #17, #39, #40). To more effectively communicate this information and increase awareness of the importance of small streams, the FREP team conducted three workshops (coast, north interior, south interior), delivered a webinar in cooperation with the BC Association

**FEATURE** ▷ BY LISA NORDIN, MSc, RPBIO AND JASON CARMICHAEL, RPF

## FREP Spotlight on Effective Riparian Management

**Effectiveness evaluations at over 11,000 post-harvest sites have been completed since inception of the Forest and Range Evaluation Program (FREP), including 2,742 associated with riparian areas assessed from 2006 to 2019. Riparian evaluations consist of main indicator questions associated with attributes that are measured, counted, or estimated in the field to give an overall condition ranking for a stream or wetland and its associated riparian area. The four**

that require specific strategies to minimize impacts from harvesting, there were many common practices around small streams that led to good outcomes. The data shows that ultimately, the avoidance of streams is one of the best practices, and planning cutblocks between streams or retaining wildlife tree patches or other retention around

to the accuracy of field-locating riparian features, mapping their location, and the use of quality georeferenced maps for equipment operators.

Some practices have evolved by identifying standardized treatments we felt were aligned with recent FREP small streams outreach. In general, this has resulted in:

# Results to date

- \* Disturbance effects can be cumulative and affect watershed functioning condition.

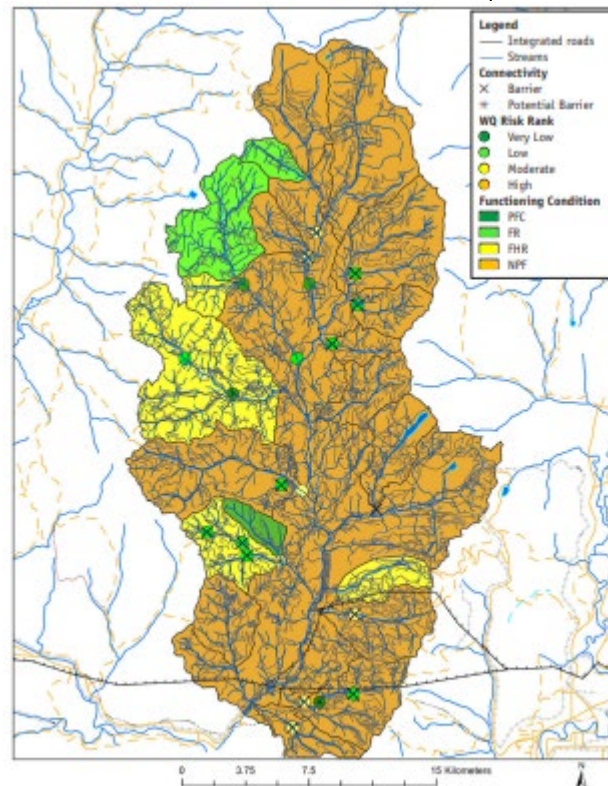


**Figure 3.** Map of Boundary sub-catchments with riparian/stream, water quality, and habitat connectivity results.

## FREP

REPORT # 41

FOREST AND RANGE EVALUATION PROGRAM

August 2020

### WATERSHED ASSESSMENTS IN THE KOOTENAY-BOUNDARY REGION: Combining GIS and Ground-Based Methodology with Pour-Point Design

Prepared by:

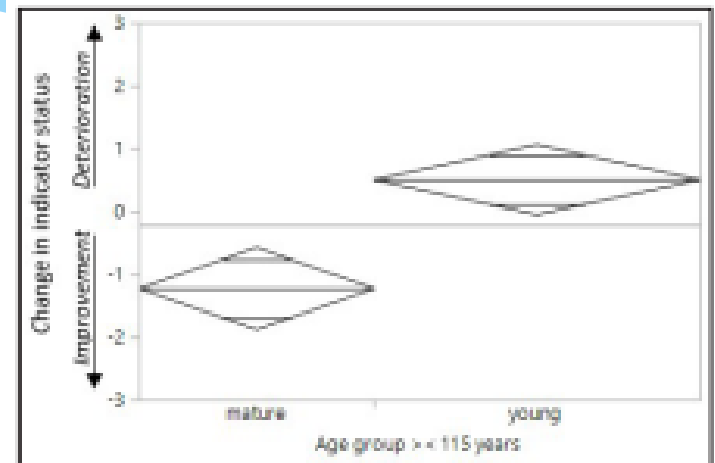
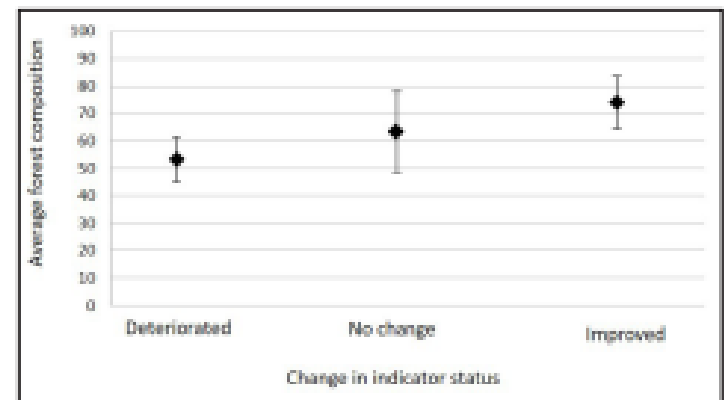
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B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development

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# Results to date

- Young, second growth riparian forests are not as resilient as older forests after new disturbance



# Thanks for listening!

