

# Forest & Range Evaluation Program



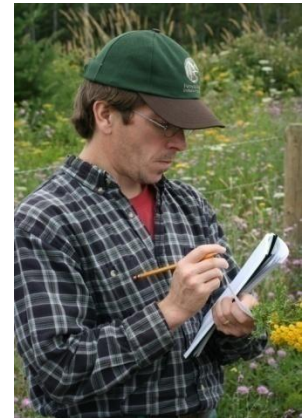
## Riparian Management Effectiveness & the “Fish” Value

Post-Harvest Assessments of  
Riparian, Stream, & Fish Habitat Conditions

**Peter J. Tschaplinski**  
Ministry of Environment



**FREP**  
Forest & Range  
Evaluation Program



# **Forest and Range Practices Act “Values”**

**Water** (e.g., “water quality”)

**Fish** (e.g., “fish-riparian”)

**Biodiversity** (e.g., “stand-level biodiversity”)

**Wildlife**

**Soils**

**Cultural Heritage**

**Forage**

**Timber**

**Visual Quality**

**Resource Features** (e.g., karst)

**Recreation**

# **Effectiveness Evaluation Objective for the “Fish” Value**

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

- includes all aquatic ecosystems and adjacent riparian areas**
- focus has been on streams**

# Questions and Concerns on BC Riparian Management Standards and Practices

- Issues predate FRPA; extend back to FP Code era
- Stream classification system:
  - Fish-bearing and non-fish bearing streams are managed differently
  - Fish-bearing streams > 1.5 m wide receive no-harvest streamside reserves plus a management zone where practices can vary
  - Smallest fish-bearing streams and non-fish bearing tributaries have management zones only
- Concerns raised in late 1990s, mainly about small streams
- Lack of information on what kinds of riparian practices were being implemented
- How much vegetation was being retained, where, and how often?
- No systematic, post-harvest information was available

# BC Stream Classification System

Riparian class	Fish bearing status	Average channel width (m)	Riparian Reserve Zone (no harvest) width (m)	Riparian Management Zone width (m)	Total width (m) of Riparian Management Area (RMA)
S1 large	Fish bearing	> 100 m (for 1 km stream length)	0	100	100
S1		> 20	50	20	70
S2		> 5 to ≤ 20	30	20	50
S3		1.5 to ≤ 5	20	20	40
S4		< 1.5	0	30	30
S5	Non-fish bearing	> 3	0	30	30
S6		≤ 3	0	20	20

# Small Streams Issues and Initiatives

- Two International Symposia held at UBC to review recent research on the importance of small streams (2002, 2007)
- Concerns raised in 1999-2000 by DFO field staff on levels of riparian tree retention along small fish-bearing class S4 streams
- Evaluation of Prince George District Manager's Policy on S4 Streams – inter-agency adaptive management study
- Interagency Central Interior Plateau S4 Stream Study – 2000-2001

# Central Interior Plateau S4 Stream Study

- Federal, provincial, forest industry interagency study
  - Conducted in 2000 in 6 forest districts
  - Covered 2989 cutblocks harvested between 1996 and 1998
  - 47,800 ha of harvesting
  - All class S4 streams within or adjacent to cutblocks were sampled
  - Only 72 streams found; most managed conservatively with riparian retention well exceeding RMA Guidebook minima
  - 68 % of sites received no-harvest buffers although none were mandatory
- Assessments based partially on measurements, and partially on professional opinion, by consensus, achieved in the field
- Could not extend results of the study to other regions of the province
- Needed to see how outcomes varied provincially
- Needed to develop a more systematic evaluation protocol based on indicators, observations, measurements and estimates that could be applied consistently throughout BC

# Developing and Testing Indicators & Methods for FP Code/FRPA Effectiveness Evaluations

- MOF: D. Hogan, P. Tschaplinski
- DFO: E. Maclsaac
- MOE: R. Thompson, A. Witt
- Forest Practices Board: S. Chatwin, K. Edquist
- Consultant Geomorphologist: S. Bird
- Consultant Biologist: D. Tripp
- UBC: J. Richardson

# Indicator & Methods Development

- Initiated in May 2003 with FII funding
- List of 15 primary indicators developed from an initial compilation of 61 potential indicators
- Four categories covered:
  - Channel, Biological
  - Channel, Physical
  - Riparian, Biological
  - Riparian, Physical

# Stream Channel Morphology, LWD, and Riparian Processes in BC's BEC Zones

- Dan Hogan, MOF Research Branch
- synoptic surveys, 1995 – present
- 88 streams, 10 forested BEC Zones
- stream channel morphology parameters, LWD processes and function by channel type (riffle-pool, cascade pool, step pool, etc.)
- coverage included both unharvested and harvested watersheds/sites
- key empirical data on baseline stream/riparian conditions used for environmental indicators development

# Resource Stewardship Monitoring

- Needed relatively simple measures
- Obtained relatively quickly at a large sample of sites (e.g., at 80 % of sites in a given area)
- Cover as many sites as possible
- Identify visible impacts
- Relate to regulatory standards & practices
- Identify a subset of sites for more detailed assessments if deemed necessary (e.g., for ambiguous results)

# Stream-Riparian Indicators

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

# Evaluation Approach

- Assess physical and biological conditions in streams and their riparian areas with RSM checklist covering 15 indicator-questions
- Site assessments vary, based on stream morphology and fish use
- 114–120 measurements, estimates, and observations are required to complete a stream-riparian assessment based on 38–60 specific indicators
- Each main question answered “Yes = OK” or “No = problem”
- Roll-up score = overall site condition

# Roll-up Scoring System

Number of “No” Indicators out of 15:

- |  |            |
|--|------------|
| 1. Properly Functioning Condition  | 0 - 2 No's |
| 2. Properly Functioning, with Limited Impacts (old “at Risk” category)   | 3 - 4 No's |
| 3. Properly Functioning, with Impacts (intermediate; old “at High Risk”) | 5 - 6 No's |
| 4. Not Properly Functioning  | > 6 No's   |

# The Concept of “Properly Functioning Condition”

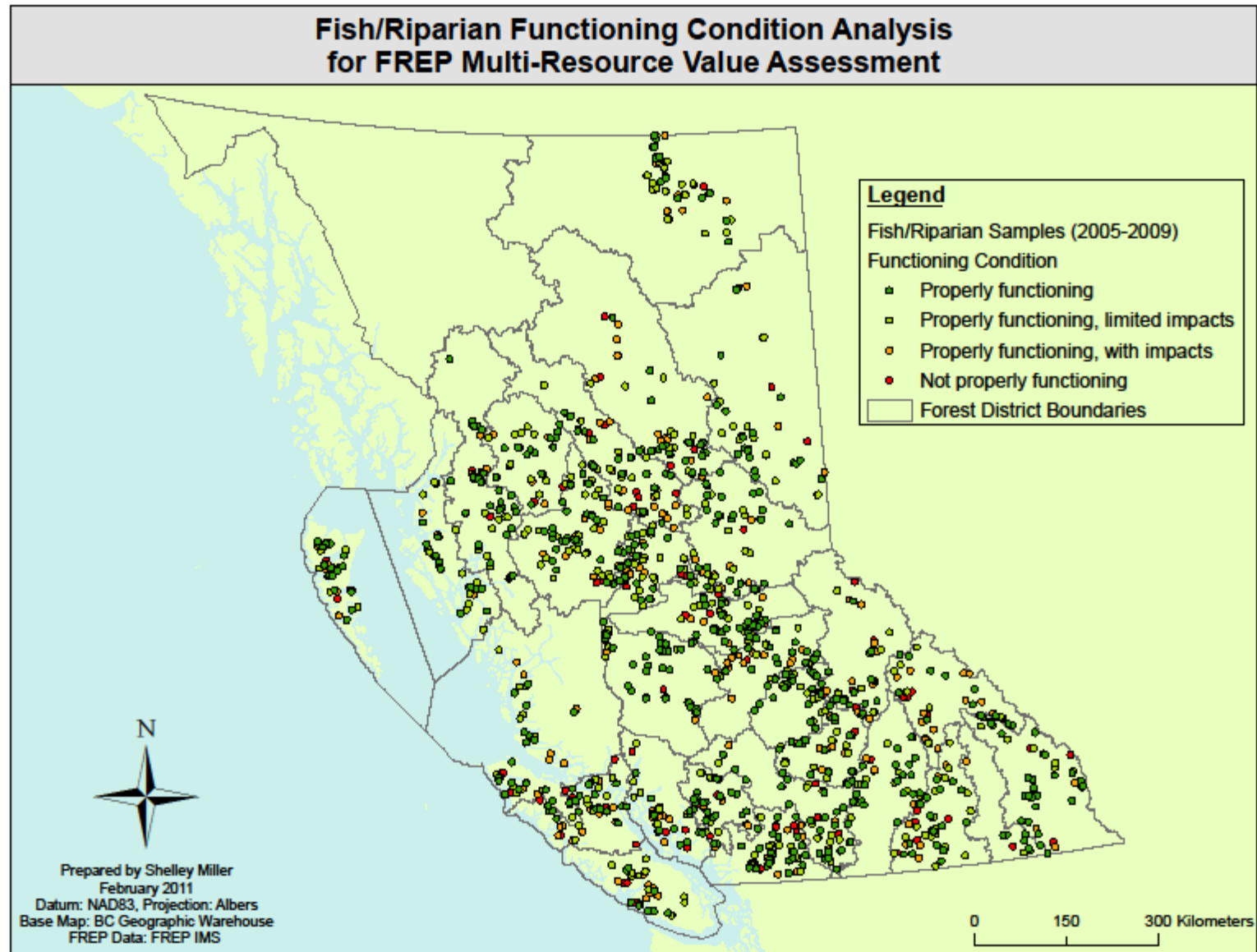
**Defined as the ability of a stream, river, wetland, or lake and its riparian area to:**

- (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 in streams and riparian areas so that these habitats are not lost or isolated as a result of management activity;**
- (5) maintain an adequate riparian root network or LWD supply; and**
- (6) provide shade and reduce bank microclimate change.**

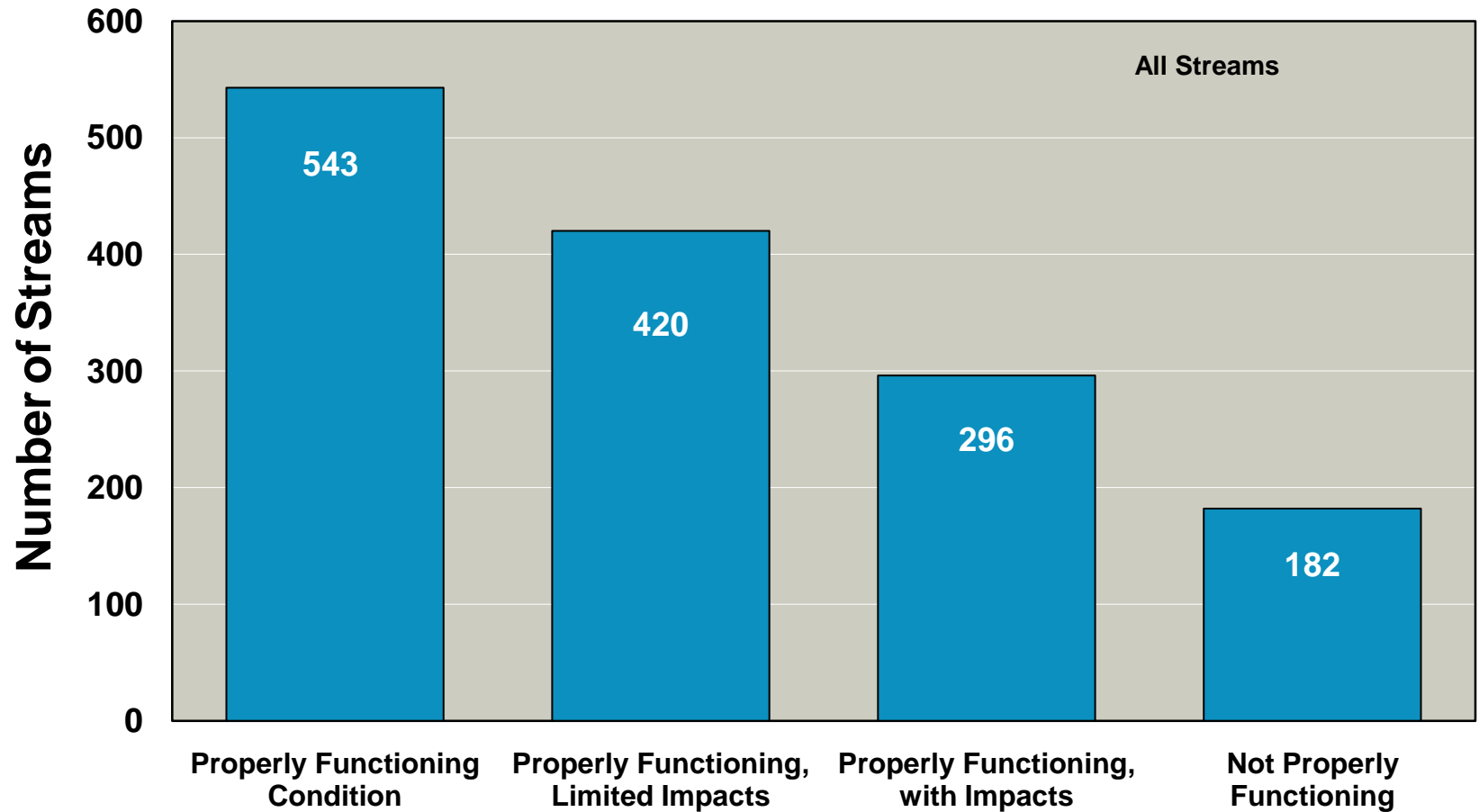
# 2005-2008 Combined Sample

Region	S1	S2	S3	S4	S5	S6	Total
CFR	3	27	44	26	54	213	367
NIFR	1	25	137	150	17	207	537
SIFR	1	32	119	93	22	270	537
ALL	5	84	300	269	93	690	1441

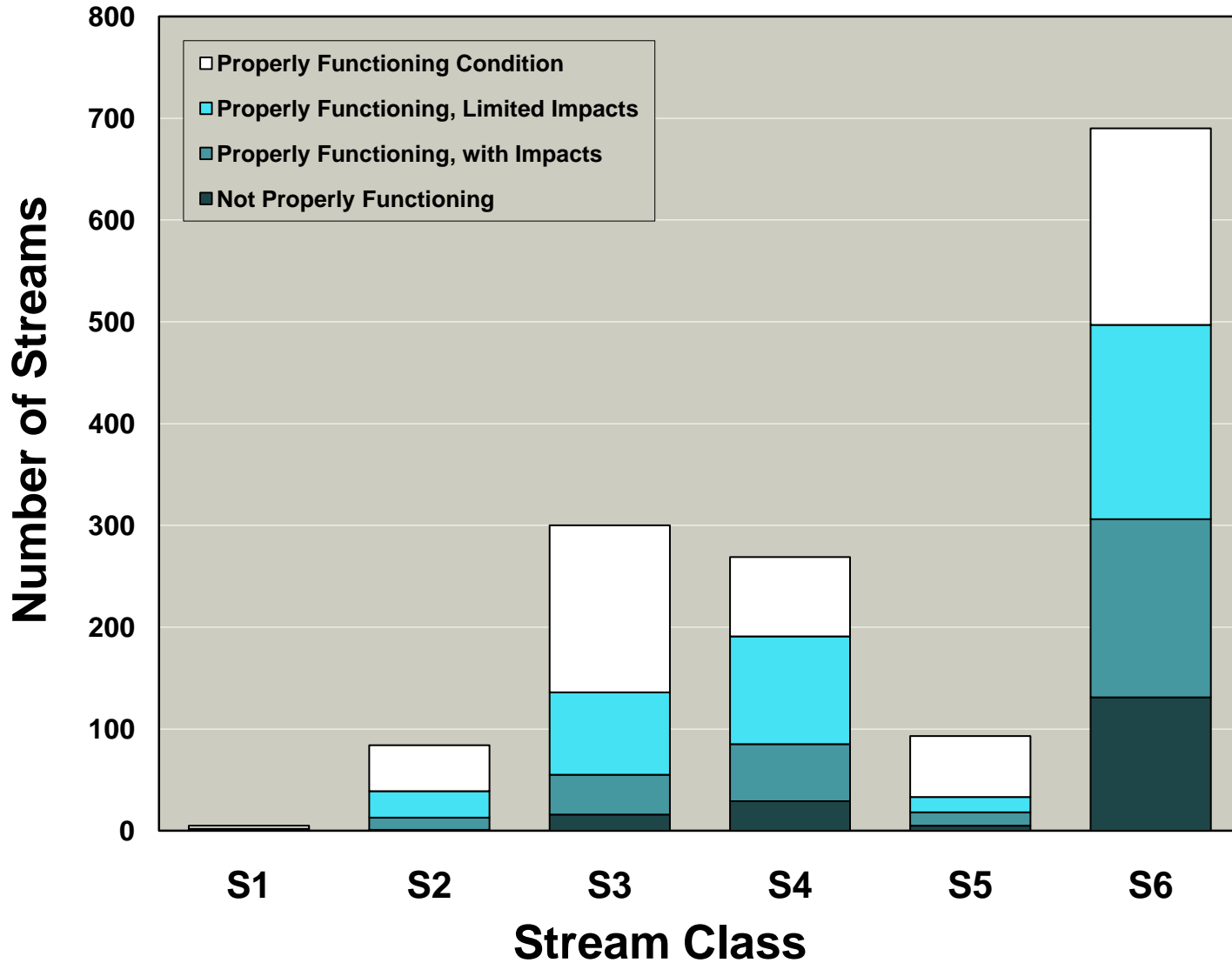
# Overall Stream-Riparian Assessment Results



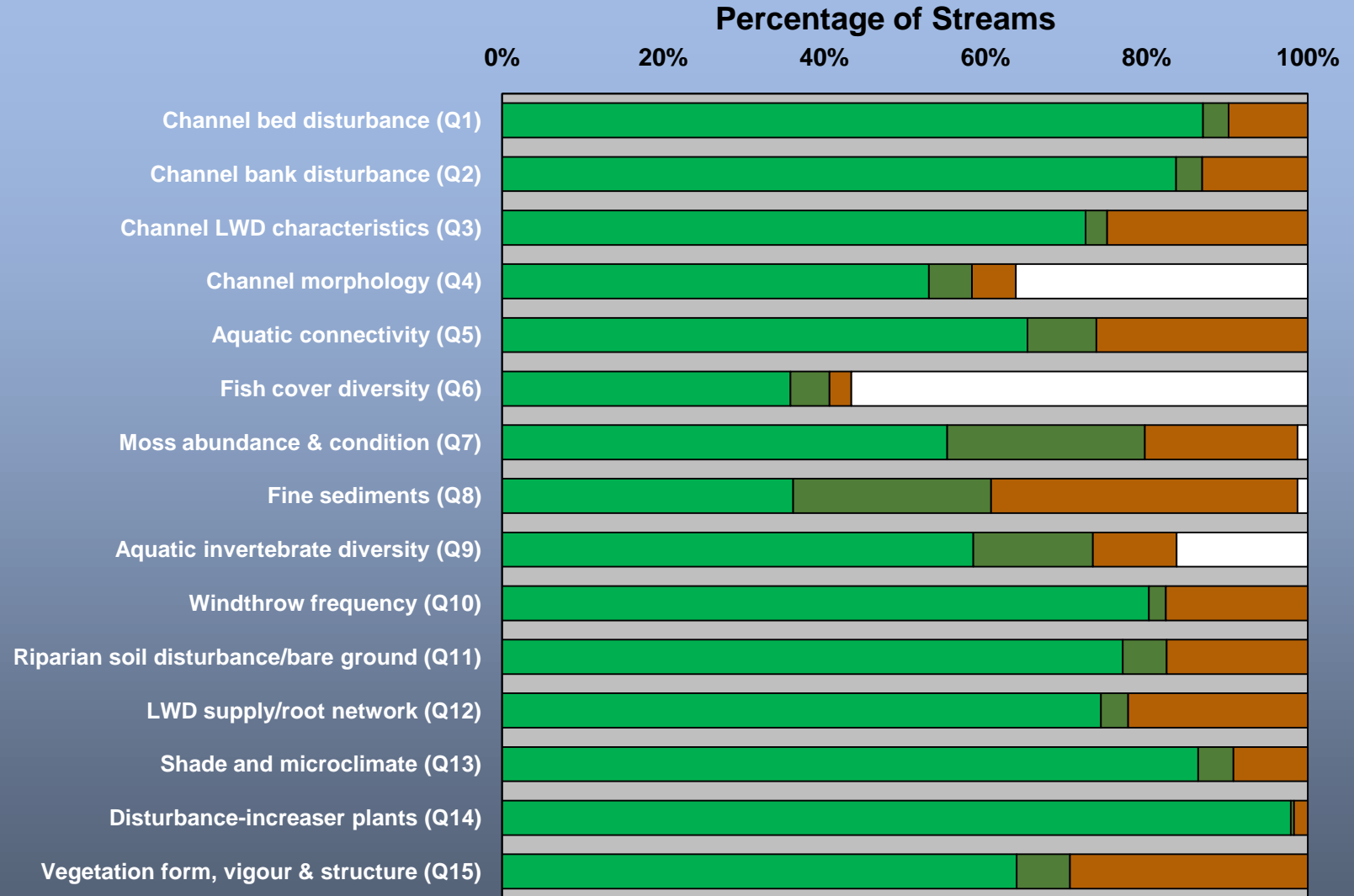
# Overall Stream-Riparian Conditions – All Streams, 2005 – 2008



# Overall Stream-Riparian Conditions by Stream Class, 2005 – 2008



# Overall Results by Main Indicator-Question, 2005 – 2008



■ Yes = Not affected  
 ■ No = Affected (non-forestry-related causes)  
 ■ No = Affected (forestry-related impacts)  
 ■ NA

# “State of Health” Summary by Stream Class and “NO” Responses

<b>Stream Class</b>	<b>Average # of NOs due to ALL CAUSES</b>	<b>Average # of NOs due to Non- Forestry Causes</b>	<b>Average # of NOs due to Forestry</b>
<b>S1</b>	<b>2.8</b>	<b>1.8</b>	<b>1.0</b>
<b>S2</b>	<b>2.6</b>	<b>1.7</b>	<b>0.9</b>
<b>S3</b>	<b>2.7</b>	<b>1.3</b>	<b>1.4</b>
<b>S4</b>	<b>3.8</b>	<b>1.3</b>	<b>2.5</b>
<b>S5</b>	<b>2.5</b>	<b>0.9</b>	<b>1.6</b>
<b>S6</b>	<b>4.2</b>	<b>0.8</b>	<b>3.4</b>
<b>ALL</b>	<b>3.6</b>	<b>1.1</b>	<b>2.5</b>

## Overall Sources of Impact for Affected Streams

<b>Major Impact Factor</b>	<b>Coast Forest Region</b>	<b>Northern Interior Forest Region</b>	<b>Southern Interior Forest Region</b>	<b>ALL</b>
<b>Roads</b> (sediment generation and transport)	81	62	65	<b>68</b>
<b>Low RMA Tree Retention</b>	59	43	44	<b>48</b>
<b>Windthrow</b>	23	33	38	<b>32</b>
<b>Falling and Yarding</b> (includes logging in-stream slash)	53	20	23	<b>30</b>
<b>Fire, Beetle Infestation</b> (non-forestry related)	17	30	40	<b>30</b>
<b>Machine disturbance: Harvesting</b>	20	23	34	<b>26</b>
<b>Livestock Trampling</b>	< 1	3	24	<b>9</b>

## Use of No-harvest Riparian Buffers

Stream Class	Percentage of Streams Buffered	Riparian Reserve (Buffer) Required (m)	Buffer Width (Distance to Harvest Edge, m)		
			Mean	± Standard Error	Sample (n)
S1	100	50	67	16.9	5
S2	100	30	42	2.5	72
S3	100	20	32	1.4	211
S4	78	0	17	1.4	179
S5	84	0	28	4.5	76
S6	56	0	11	1.0	516
ALL	74	-	20	0.8	1,059

## How Were Riparian Buffers Implemented?

- **Stream avoidance:** cutblocks located to exclude streams & much or all of the RMAs
- **Wildlife tree patches:** WTPs incorporated within riparian areas for multiple objectives
- **Retaining vegetation in gullied terrain from the streambank to the top of the slope break.**
- **Fixed or variable width buffers  $\geq 10$  m wide**

# Stream Response to Riparian Retention

Functioning Condition	Percent of Streams			
	Fish-bearing with Riparian Reserves (S1–S3) ( <i>n</i> = 389)	S4–S6 with Overstory & Understory Retained in first 10 m ( <i>n</i> = 497)	S4–S6 with Mainly Understory Retained in first 10 m ( <i>n</i> = 334)	Total Sample ( <i>n</i> = 1441)
<b>PFC</b>	<b>55</b>	<b>43</b>	<b>8</b>	<b>38</b>
<b>PFC-L</b>	<b>28</b>	<b>29</b>	<b>31</b>	<b>29</b>
<b>PFC-I</b>	<b>13</b>	<b>18</b>	<b>32</b>	<b>20</b>
<b>NPF</b>	<b>4</b>	<b>10</b>	<b>28</b>	<b>13</b>

# Comparing Pre-Code and FP Code Riparian-Stream Outcomes

Riparian Class		Pre-Code Percentage of Streams Equivalent to FREP NPF	Early FP Code (FP Board 1998) Percentage of Streams Equivalent to FREP NPF	Percentage of <b>FREP NPF Streams</b> (2005-2008)
Fish Bearing	<b>S1</b>	5	0	0
	<b>S2</b>	20	0.6	1.2
	<b>S3</b>	41	4.4	5.3
	<b>S4</b>	60	9.4	10.8
No Fish	<b>S5</b>	45	3.3	5.4
	<b>S6</b>	76	20.2	19.0

## **Opportunities for Continuous Improvement**

- **Many S6s and S4s already score very well with certain RMA practices**
- **Limit introduction of logging debris into channels**
- **Limit physical contact with S6 banks & bed**
  - **Fall and yard away from channels whenever feasible**
- **Retain more trees: at minimum, non-merchantable, understory, and smaller vegetation for S4s & key S6s**
- **Can reduce riparian-related NO responses to near zero**
- **Manage roads and crossings over full life cycle to limit fine-sediment delivery to streams**

# Opportunities for Continuous Improvement – Retention Management

- Much more retention implemented operationally than required by regulations – especially for small streams
- Functional outcomes directly and significantly related to buffer width and degree of basal area riparian retention
- No Retention < Understory Retention < 1-5 m buffers < 10 m buffers
- Outcome improvements declined with buffers greater > 10 m wide (not significantly different from streams with 10 m full retention)
- Retaining some, or all, larger trees within 10 m of the RMA will improve outcomes for small fish-bearing streams (S4) and tributaries (S6) connected to fish bearing streams and drinking water sources

# **Riparian Management Approaches to Consider Chief Forester's Recommendations – 2010 FREP Report**

- 1. Full wind-firm retention within the first 10 m of the RMA for:**
  - All S4 streams and perennial S5s and S6s that deliver water, nutrients, and invertebrates to fish-bearing areas and (or) drinking water sources
  - All S5 & S6 streams that transport coarse sediments and large woody debris downstream to fish-bearing areas and (or) drinking water sources
- 2. Retention, at minimum, all non-merchantable trees, understory trees, smaller vegetation and as many wind-firm trees as possible within the first 10 m of the RMA for:**
  - All other S5s and S6s (e.g., intermittent and ephemeral streams with low transport capability) directly connected to fish-bearing areas and drinking water sources
- 3. Retention, at minimum, all non-merchantable trees, understory trees, and smaller vegetation within the first 10 m of the RMA for:**
  - All other S5s and S6s (e.g., intermittent and ephemeral streams with low transport capability) not directly connected to fish-bearing areas and drinking water sources

# Next Steps



- Report on 2009 - 2010 results
- Provide results summaries & CI recommendations for Chief Forester's FREP report
- Generate topic-specific extension notes
- Mine the data to identify additional "reference" streams
- Present at workshops & international conferences