

# THE WESTSIDE TYPE N BUFFER CHARACTERISTICS, INTEGRITY AND FUNCTION (BCIF) PROJECT

Changes in Stand Structure, Buffer Tree Mortality and Riparian-Associated Functions 10 Years After Timber Harvest Adjacent to Non-Fish-Bearing Perennial Streams in Western Washington

[bc\\_cmer\\_bcif\\_westside\\_20201013.pdf\(wa.gov\)](#)

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# BCIF Study: Purpose/Objectives

## Purpose:

- Evaluate effectiveness of Westside prescriptions for non-fish bearing perennial streams (Type Np)

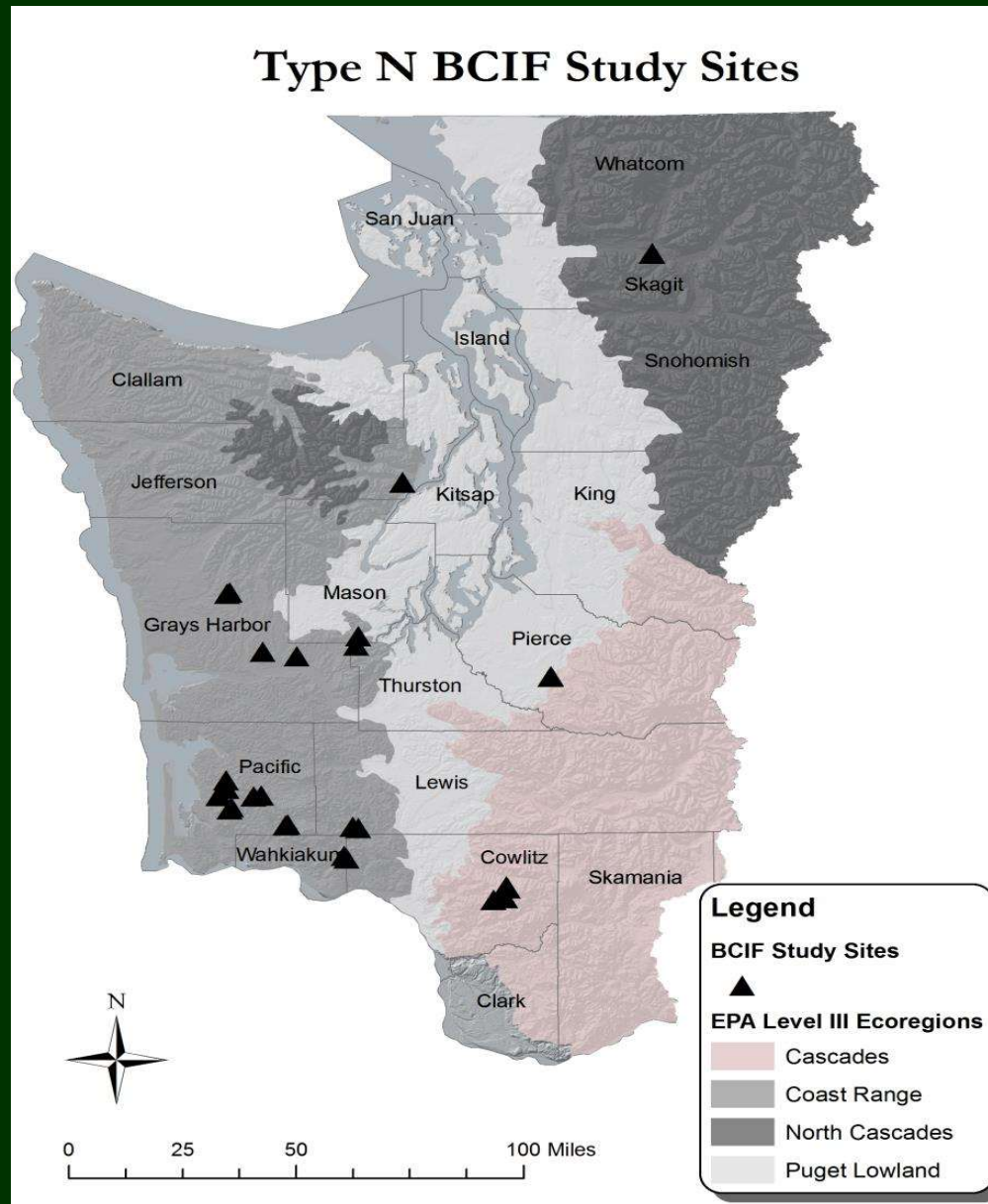
## Objectives:

- Magnitude and duration of change in riparian stands/functions
  - riparian stand structure
  - tree fall / wood recruitment
  - shade
  - soil and stream-bank disturbance

## Design:

- Post-harvest study at the harvest-unit scale
- Random sample of Forest Practice Applications
- 10 year post-harvest timeframe

# Study Sites



# Westside Type Np Riparian Prescriptions

## Suite of Treatments Applied on Stream Network Scale

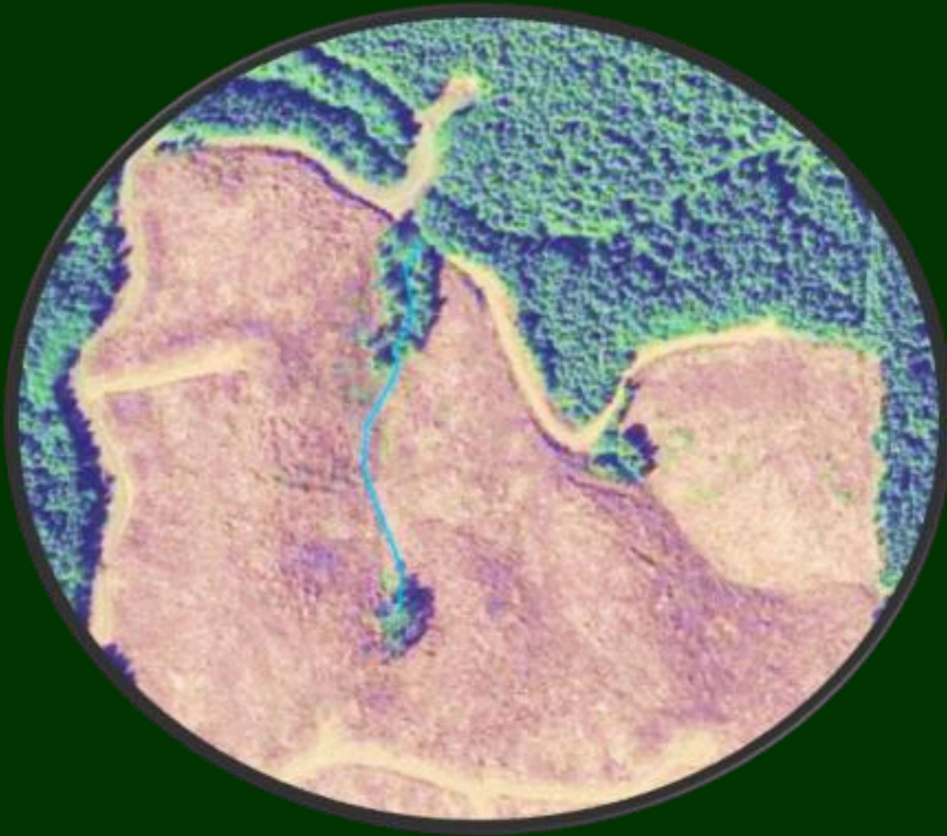
- 50 ft no-harvest RMZ buffers ( $\geq 50\%$  of stream length)
- Sensitive site buffers (seeps, springs, perennial initiation points)
- Unbuffered clear-cut harvest (remainder of stream network)

## Functional Resource Objectives

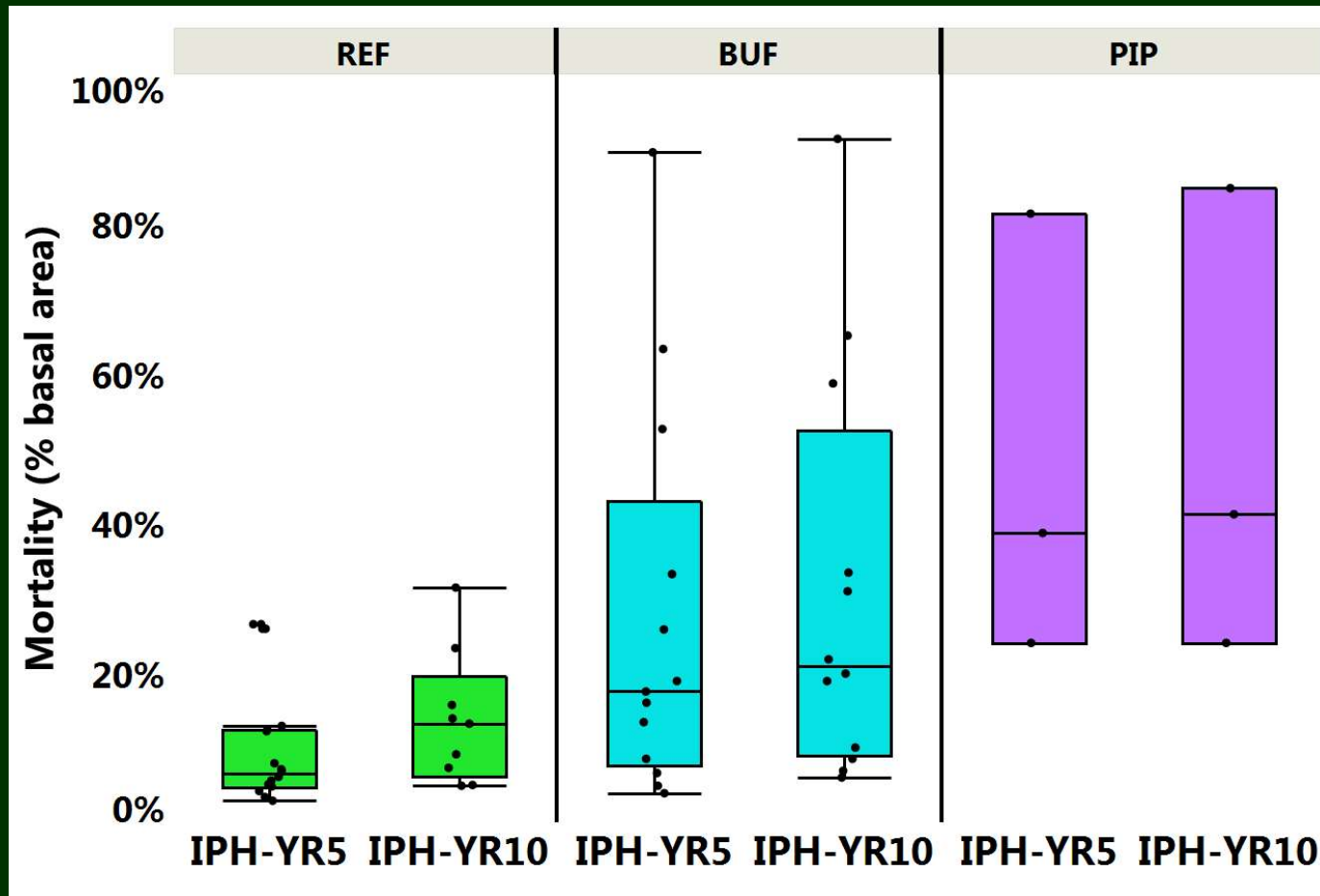
- Shade/cool water
- Wood/nutrient recruitment
- Minimize soil disturbance

# Treatments

BUF	50 ft no-cut buffer on both sides of stream	13
PIP	Perennial initiation point buffer (56 ft radius)	3
CC	Unbuffered clear-cut harvest to the edge of stream	8
REF	Reference unharvested 2 <sup>nd</sup> growth riparian forest	14



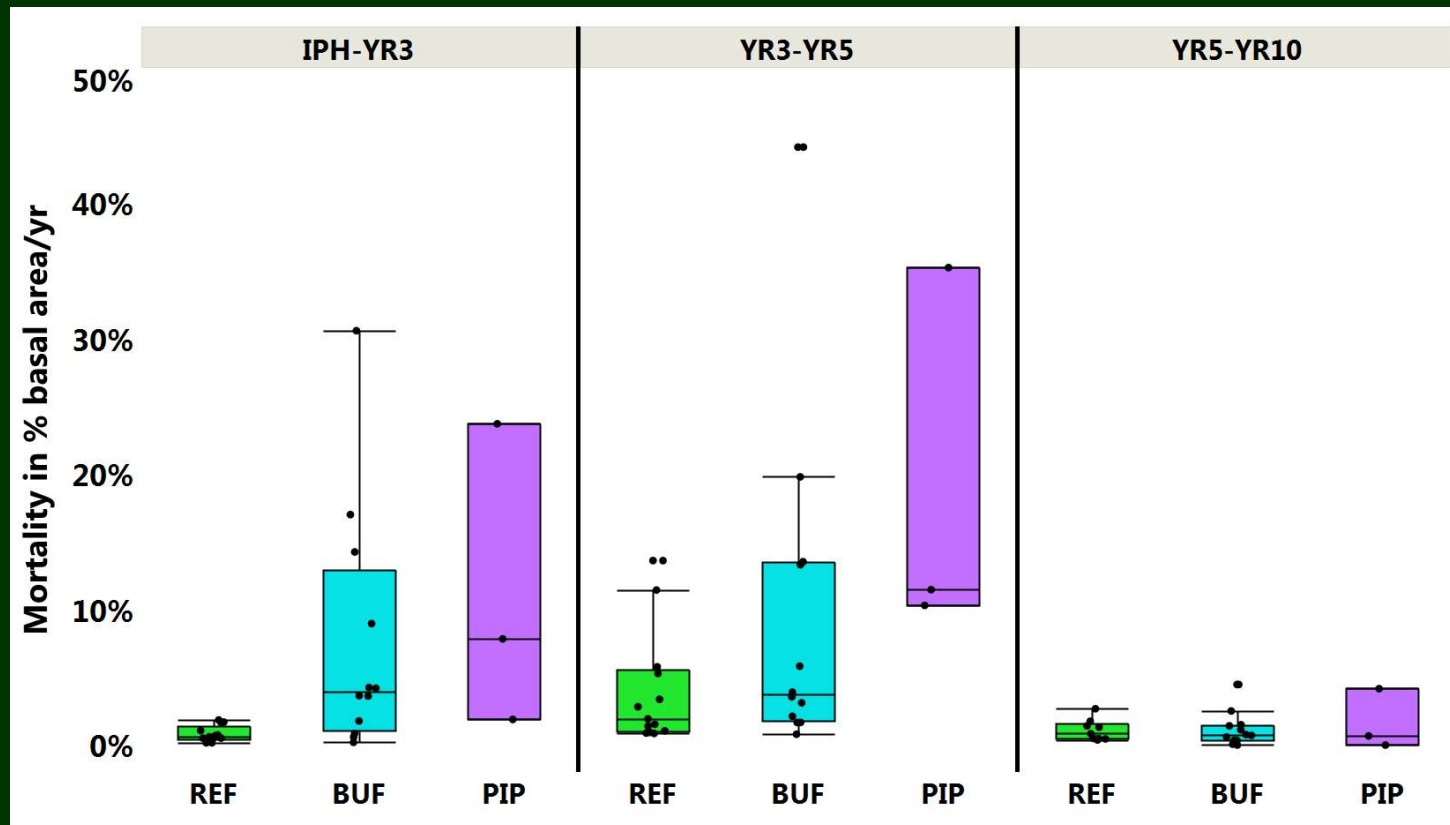
# Cumulative Tree Mortality



Mortality gradient: REF < BUF < PIP

Extensive variability among sites within treatment groups

# Post-Harvest Tree Mortality Rates

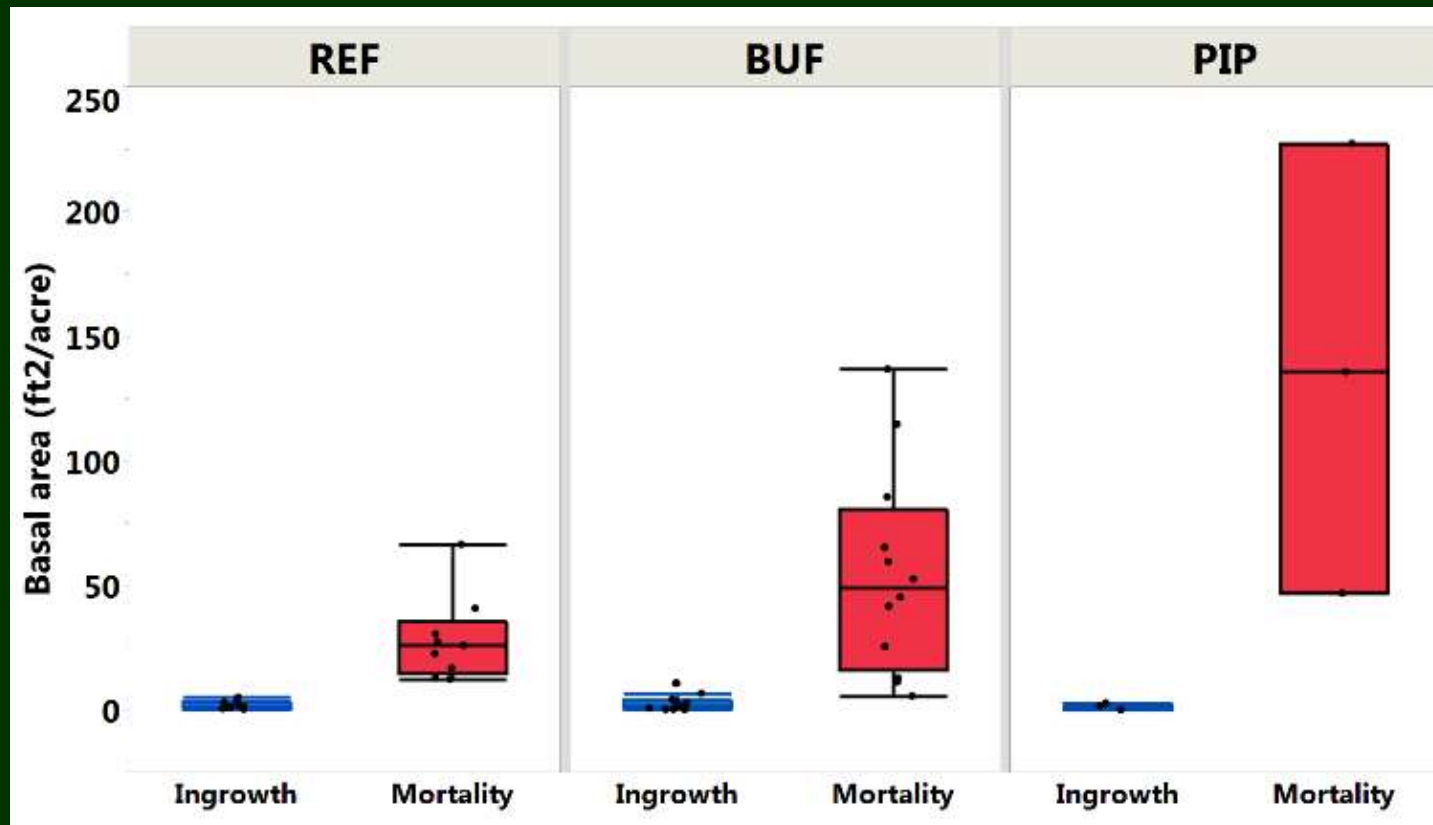


Lower mortality in REF

Higher mortality in BUF and PIP buffers through year 5

Greatly reduced mortality in BUF and PIP buffers after year 5

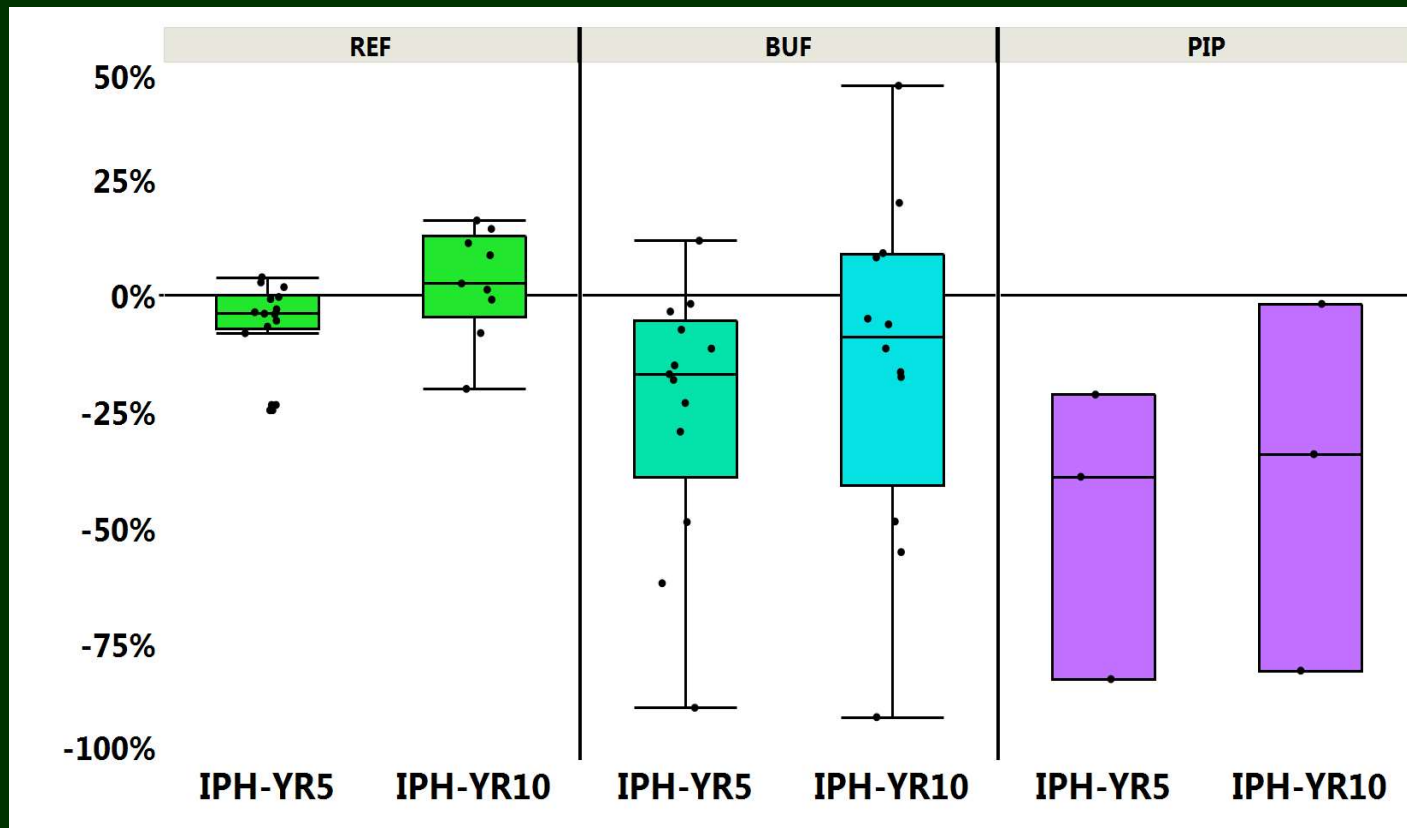
# Ingrowth vs. Mortality



Mortality exceeded ingrowth in REF, BUF and PIP  
Most pronounced difference in BUF and PIP



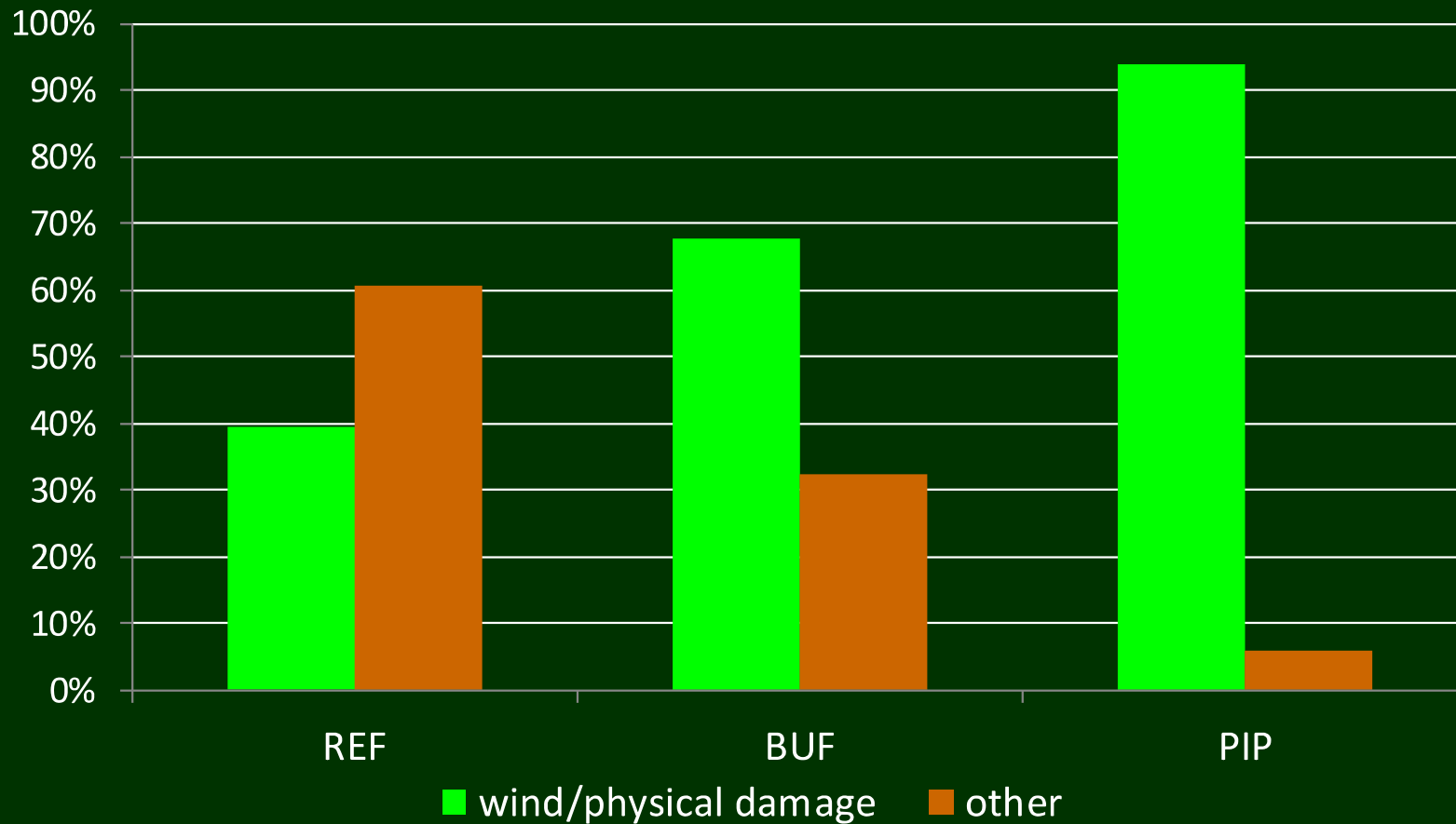
# Change in Stand Structure



Stand structure stable in REF- slight increase at year 10

Mortality in BUF and PIP resulted in decrease in basal area

# Causes of Mortality



Wind was dominant mortality agent in BUF and PIP buffers  
Suppression more important in REF stands

# Conifer Regeneration

## Percentage of plots with conifer regeneration

	YR 1	YR 10
REF	9.7 %	11.6 %
BUF	5.1 %	30.1 %
PIP	27.8 %	55.6 %

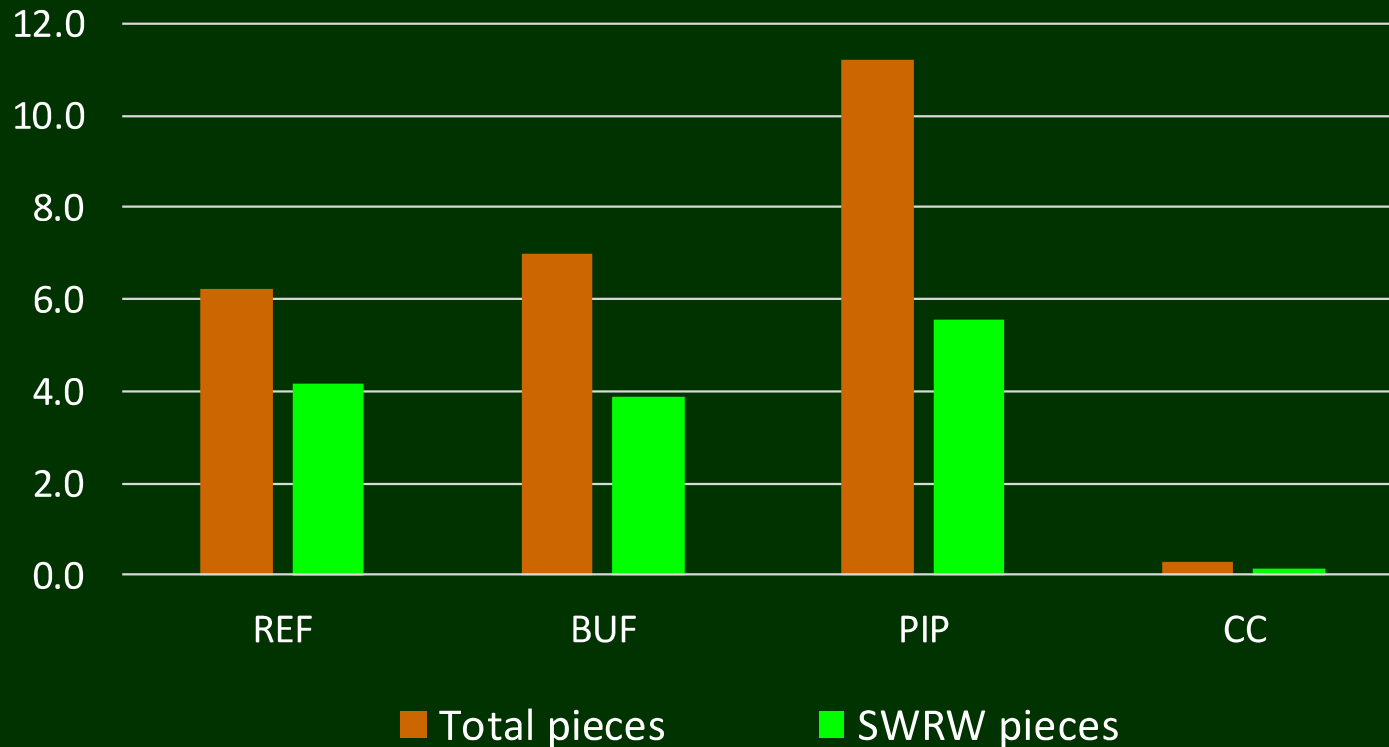
Mortality (trees/yr)	% plots
<5 %	15.7%
>5 %	66.7%

Stable in REF at ~10% of plots

Large increase in BUF and PIP 10 years post harvest

Regeneration highest where mortality greatest

# Large Wood Input

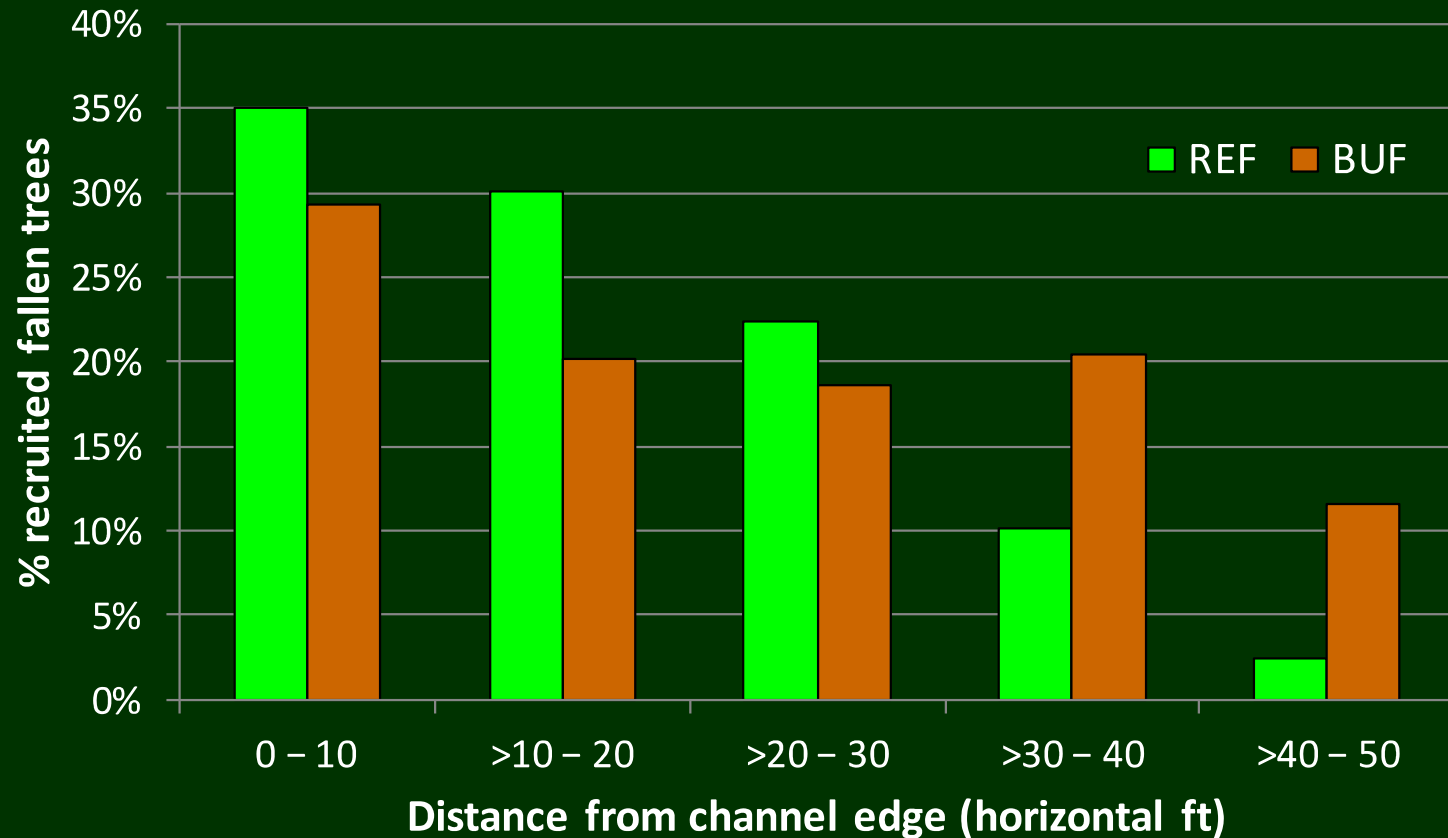


Pattern similar to mortality

Greater wood input in PIP and BUF

Over half consisted of stems with root wads

# Source Distance For Recruiting Trees



REF: Decreased recruitment with increasing distance from stream

BUF: greater recruitment beyond 30 ft- wind effect on buffer edge

# Channel Wood Cover

% plots with > 50% of surface area with wood cover

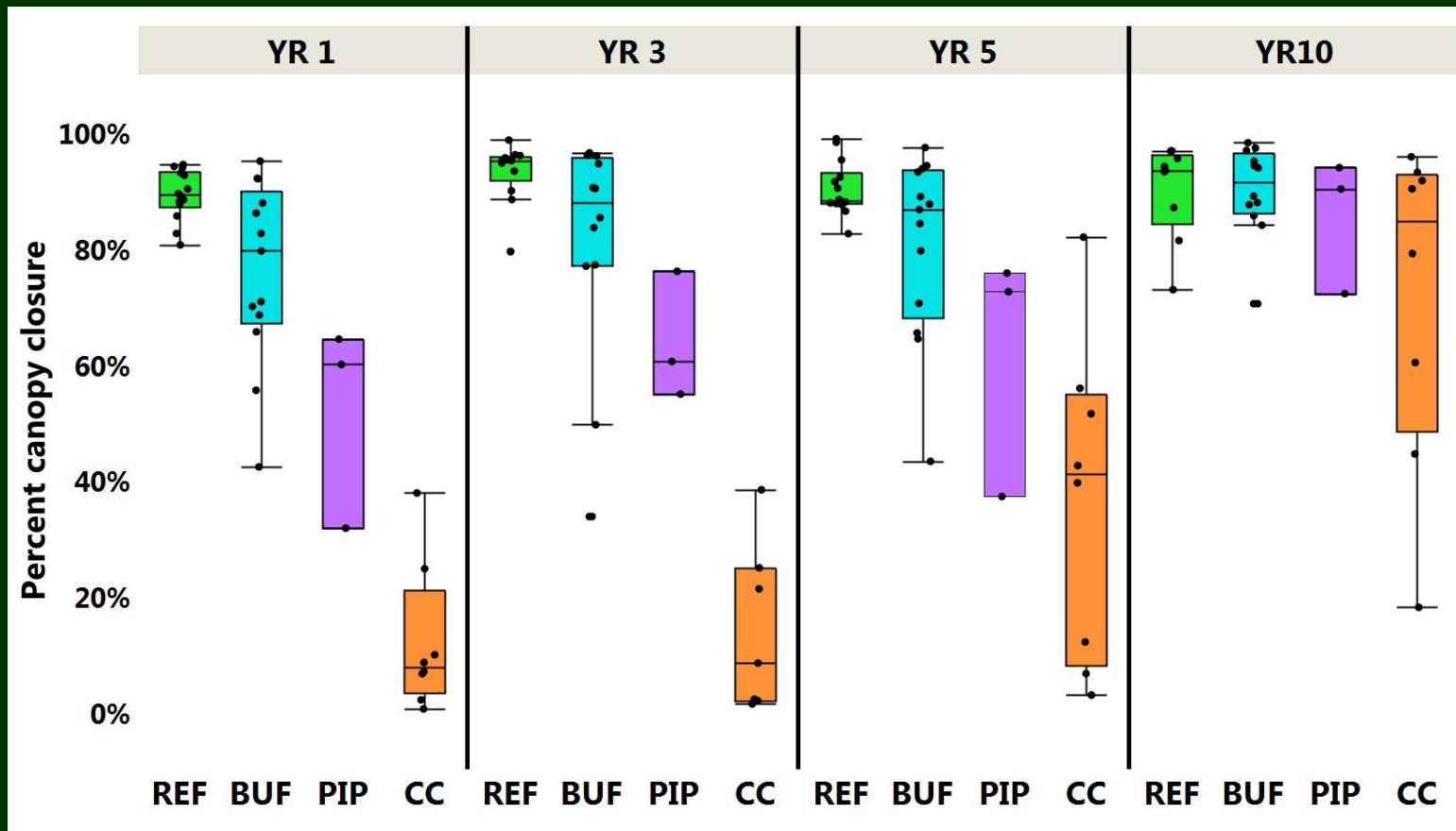
Year	REF	BUF	PIP	CC
YR 3	20.3	17.2	8.3	63.3
YR 10	20.4	23.4	19.4	35.8

Stable in REF over time

Increase in PIP and BUF (treefall)

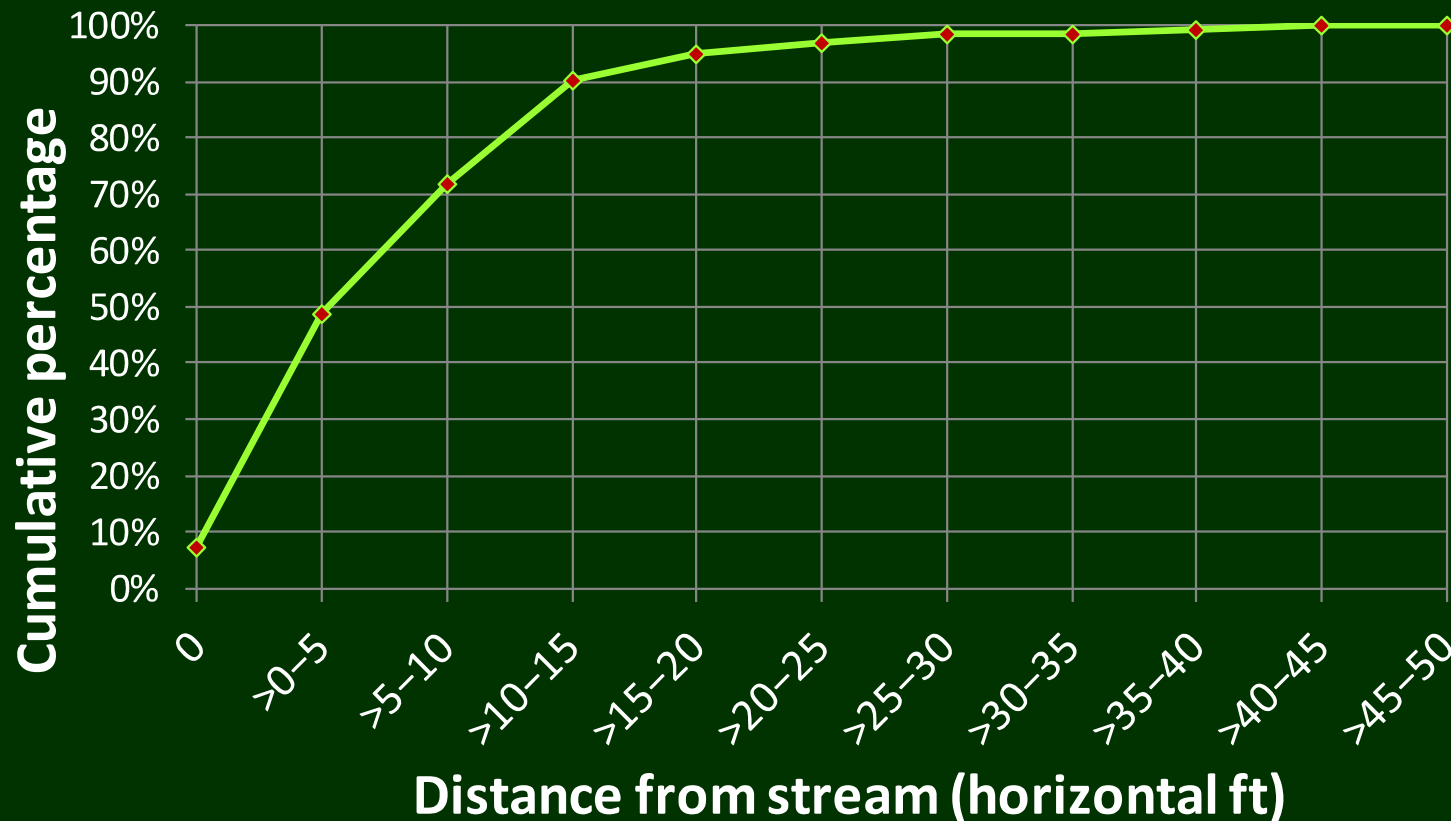
Initially high in CC decreasing over time (logging debris)

# Change in Canopy Closure



REF: Highest shade, low variability and stable over time, mean >90%  
BUF: Lower than REF through year 5, increasing after year 5  
PIP: Lower than BUF through year 5, increasing after year 5  
CC: very low after harvest, increasing after year 5

# Sediment Delivery By Uprooted Trees



Not many delivered sediment. Debris and vegetation minimized movement.  
Of those that did: 50% were within 5 ft and 90% were within 15 ft of stream



# Soil Disturbance Associated With Harvest

Metrics	BUF	PIP	CC
% of 30 ft Equipment Limitation Zone with soil disturbance	0.3%	0%	6.2%
Number of sites exceeding soil disturbance performance target (<10%)	0 of 13	0 of 3	1 of 8

Little disturbance in no-cut buffers  
6% of ELZ with disturbance in CC  
1 of 8 CC sites exceeded performance target

# Clear-cut Treatment Summary

- **Stand Structure**
  - Clear-cut harvest of merchantable trees to stream
  - Replanting with conifers
  - 40-60 year harvest cycle
- **Wood Recruitment**
  - Input of debris during harvest- broken pieces, tops, branches
  - Depletion over time
  - Little input from young trees until next harvest cycle
  - Modeling suggests decrease in wood size and abundance over time
- **Shade**
  - Initial loss of canopy shade from tree removal
  - Cover from wood debris
  - Increased growth of shrubs and saplings over 10 year period
  - ? Effectiveness of low deciduous shade for temperature?
- **Sediment**
  - Some soil disturbance during harvest
  - Little sediment delivery

# BUF & PIP Summary: Stand Structure

- Retention of all trees within 50 ft
- Greatest mortality first 5 yrs, decrease in density, basal area
- Mortality decreased, stand structure stabilized after year 5
- Stand response variable, driven by mortality due to wind
- Majority of BUF reaches (75%) had low mortality rates
- Future trajectory depends on mortality rate

Mortality Category	Number of Sites		Density (trees/acre)	% plots with conifer regeneration	Probable trajectory
	BUF	PIP			
Low (<5%/yr)	10	1	136	19%	Single cohort mature
Medium (5-25%/yr)	2	2	76	64%	Multi-cohort stand
High (>25%/yr)	1	0	7	79%	Stand initiation

# BUF & PIP Summary: Shade/Sediment

## Shade

- Initial loss of canopy shade- varies due to mortality
- RMZ buffers increased to levels similar to reference by year 10
- Increased cover from understory plants

## Sediment

- No soil disturbance during harvest
- Some delivery from uprooted trees
- Minor unless immediately adjacent to channel

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