SOurce STream (headwater) PROtection from forest practices: what are the costs and benefits, and how best to do it? SOSTPRO

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Water JPI
WaterWorks2015 Cofunded Call
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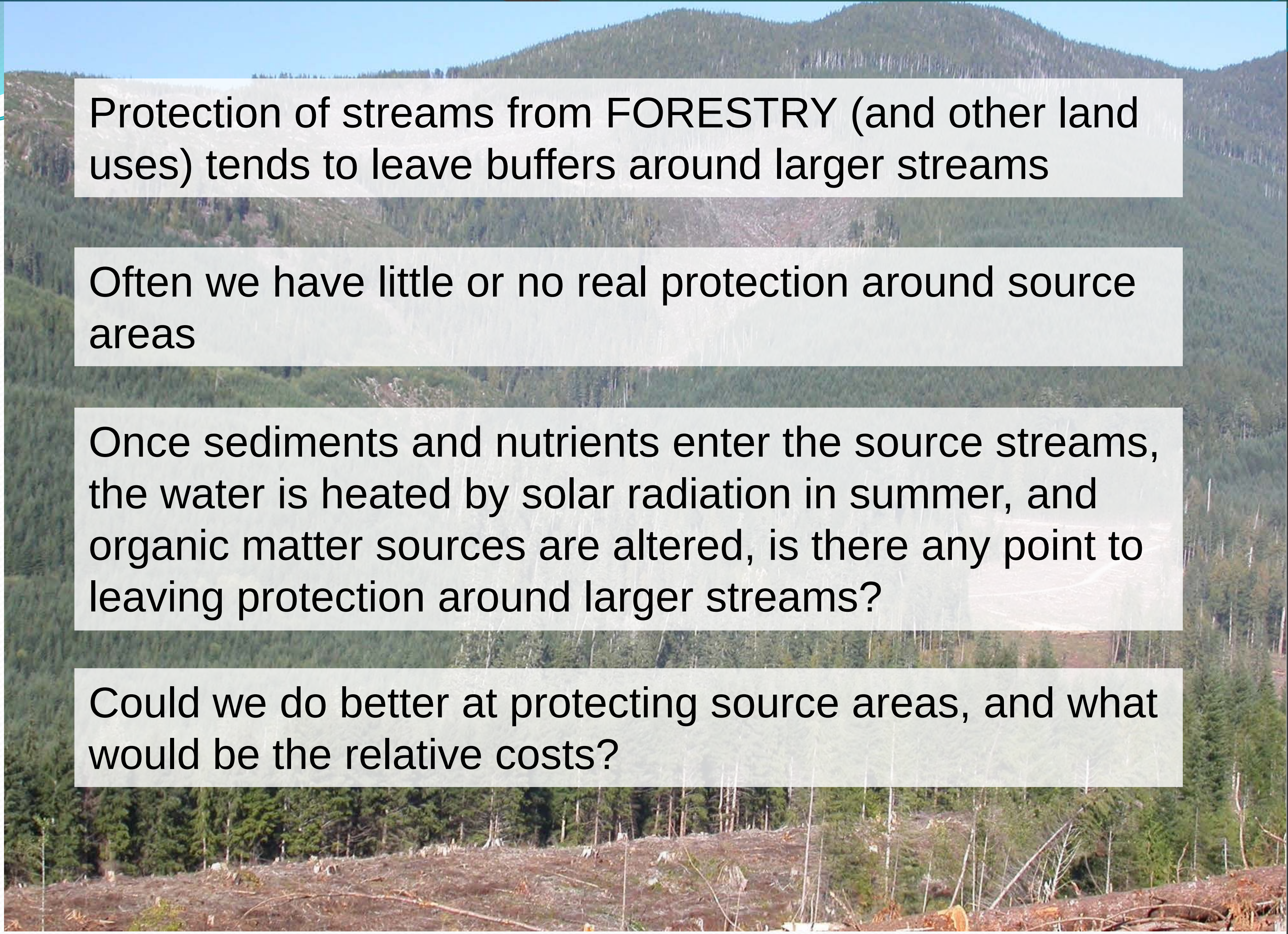


Protection of streams from FORESTRY (and other land uses) tends to leave buffers around larger streams

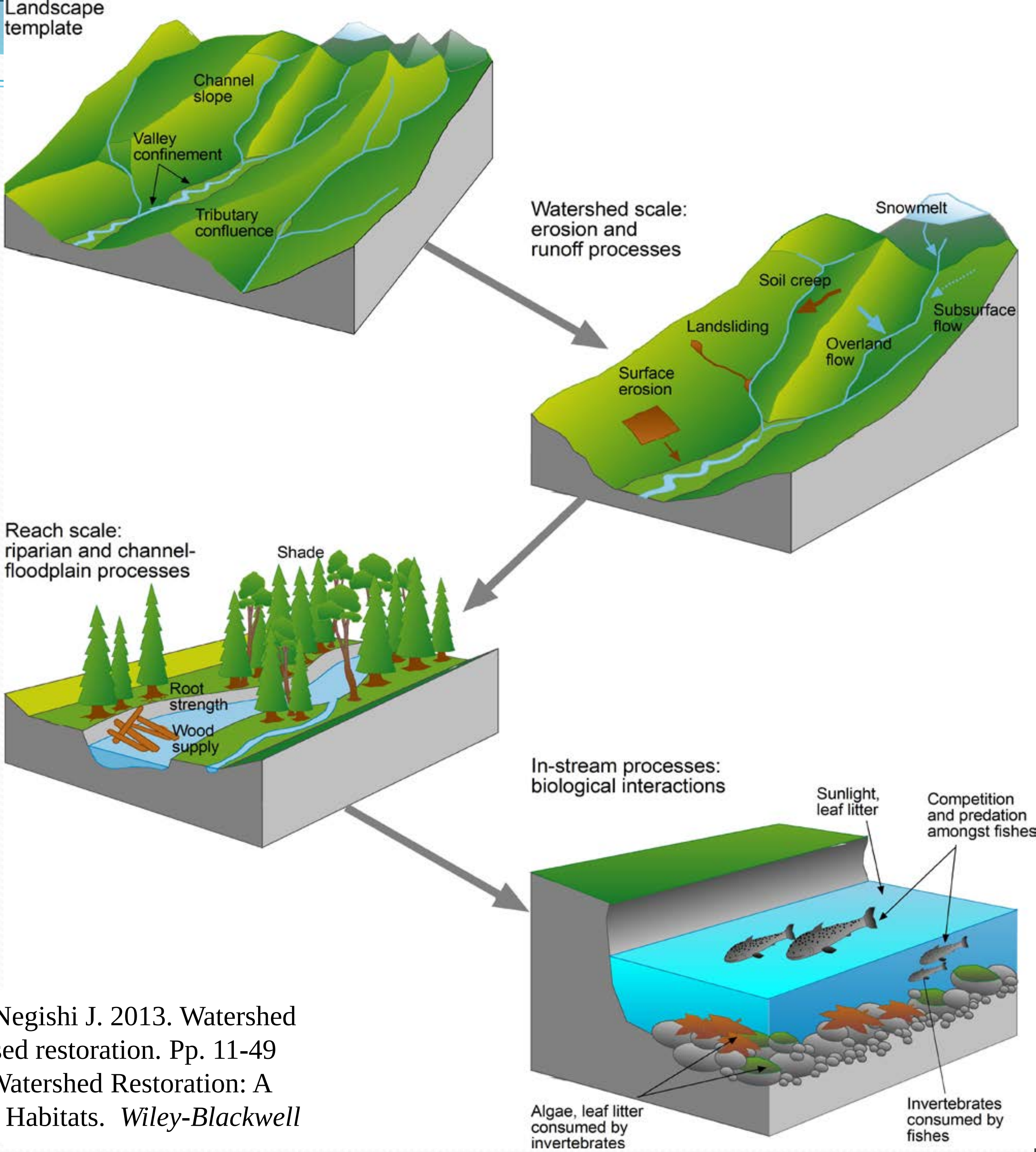
Often we have little or no real protection around source areas

Once sediments and nutrients enter the source streams, the water is heated by solar radiation in summer, and organic matter sources are altered, is there any point to leaving protection around larger streams?

Could we do better at protecting source areas, and what would be the relative costs?

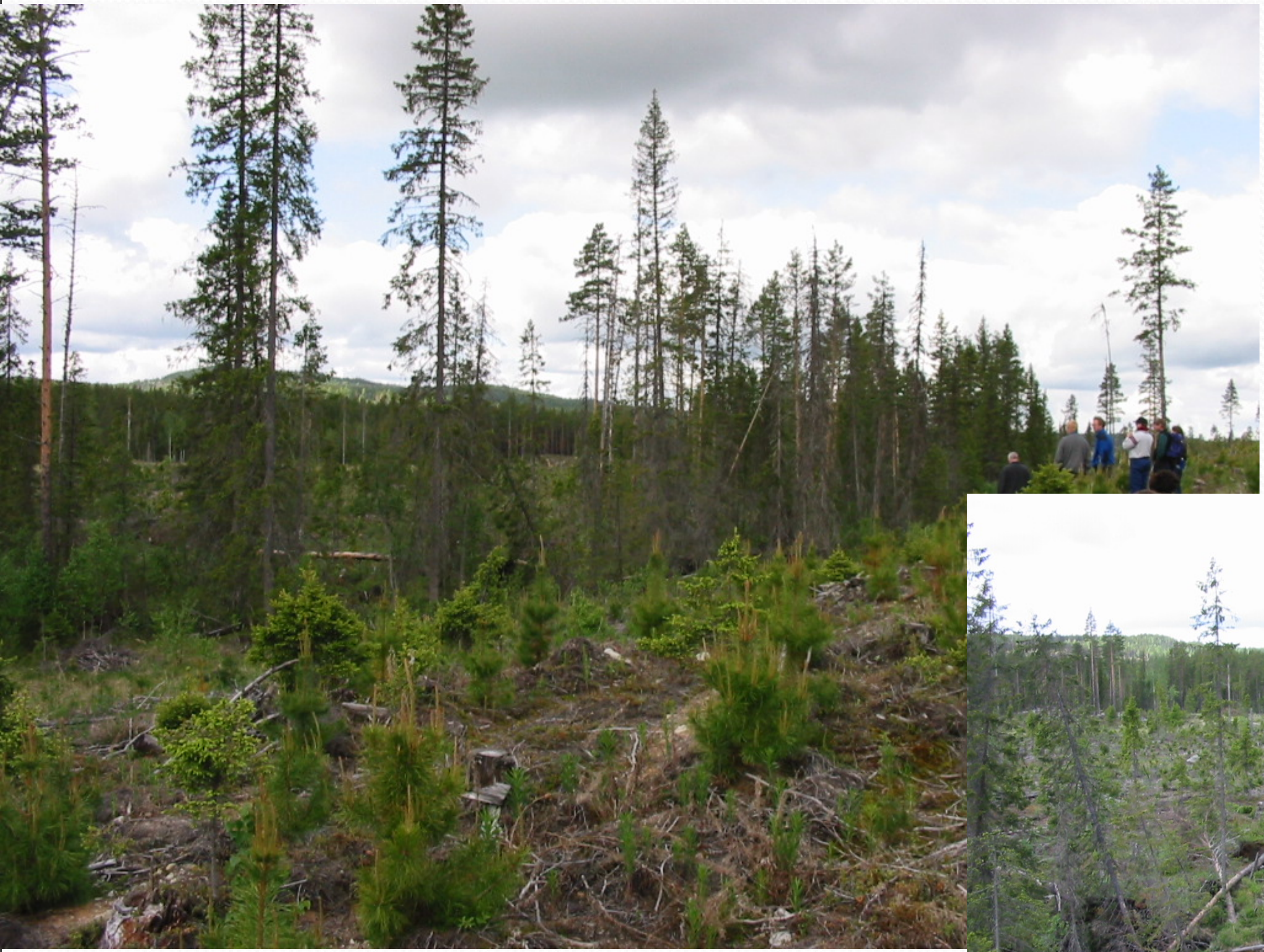
Richardson JS & Danehy RJ. 2007. A synthesis of the ecology of headwater streams and their riparian zones in temperate forests. *Forest Science* 53:131-147

Streams receive and integrate all the influences from the landscape



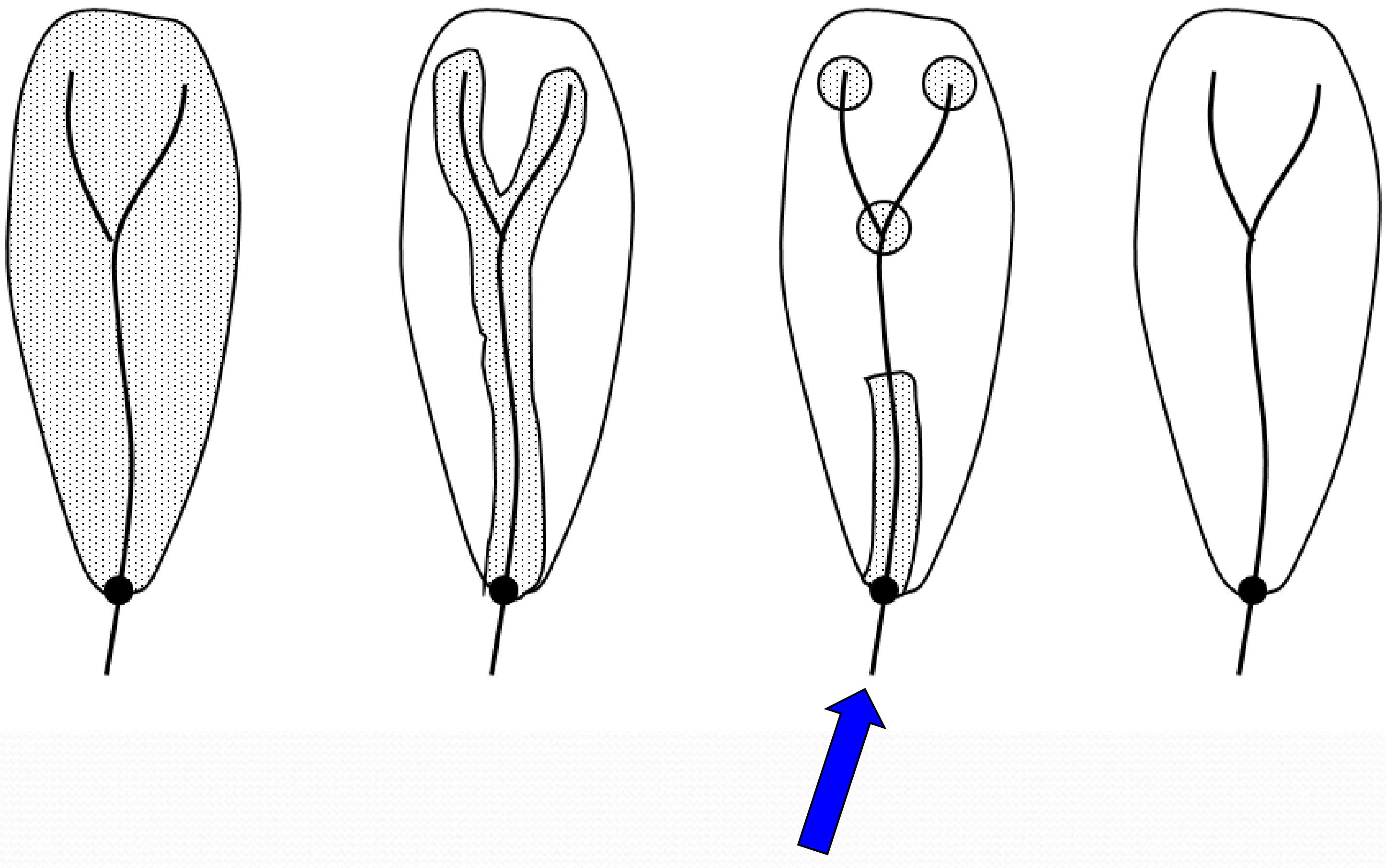
Beechie T, Richardson JS, Gurnell AM & Negishi J. 2013. Watershed processes, human impacts, and process-based restoration. Pp. 11-49 In: Roni P &T Beechie (eds.) Stream and Watershed Restoration: A Guide to Restoring Riverine Processes and Habitats. *Wiley-Blackwell*

Richardson JS, Naiman RJ & Bisson PA. 2012. How did fixed-width buffers become standard practice for protecting freshwaters and their riparian areas from forest harvest practices? *Freshwater Science* 31:232-238.



Northern Sweden

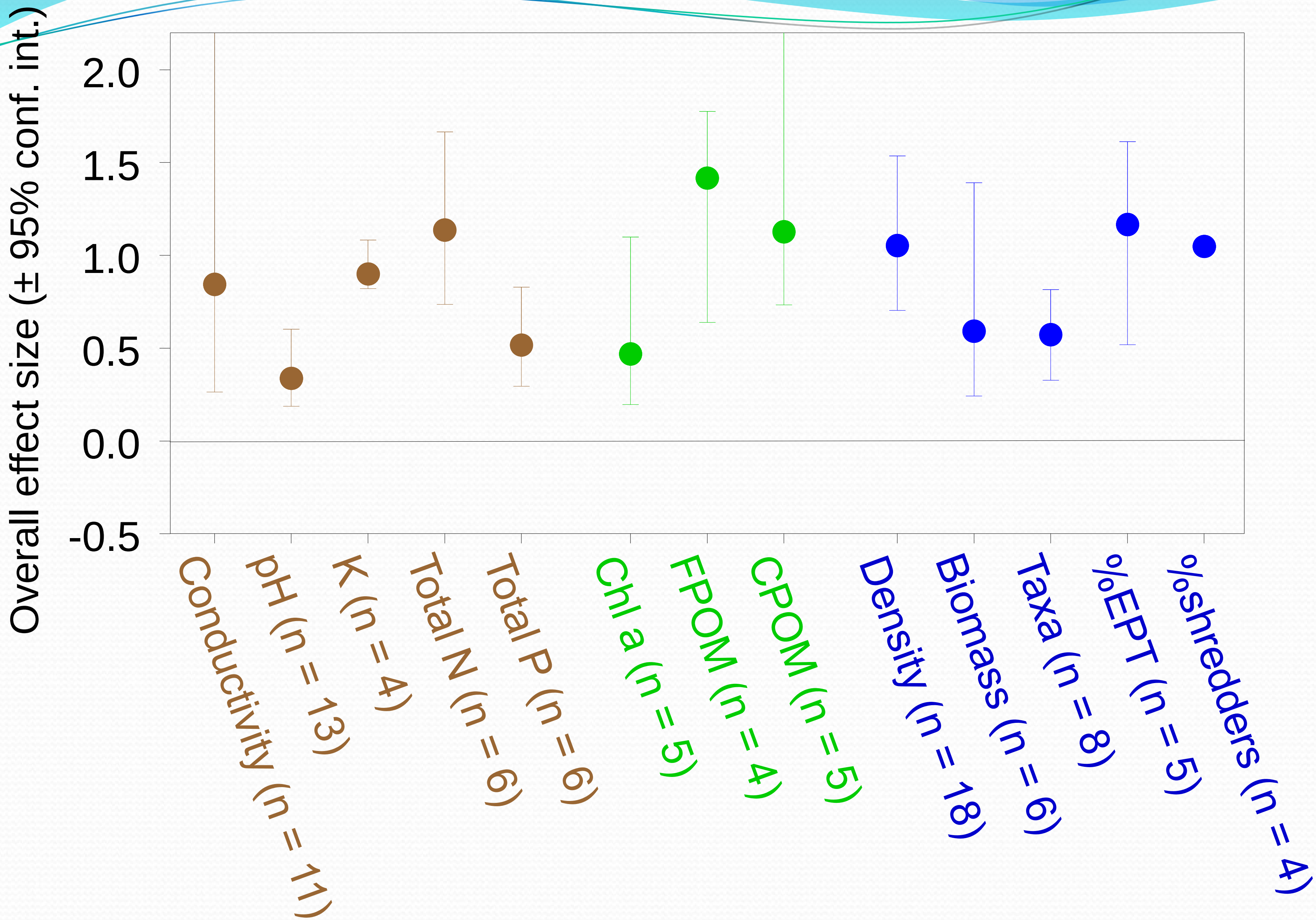
Different ways of protecting fishless source streams in Washington State, USA



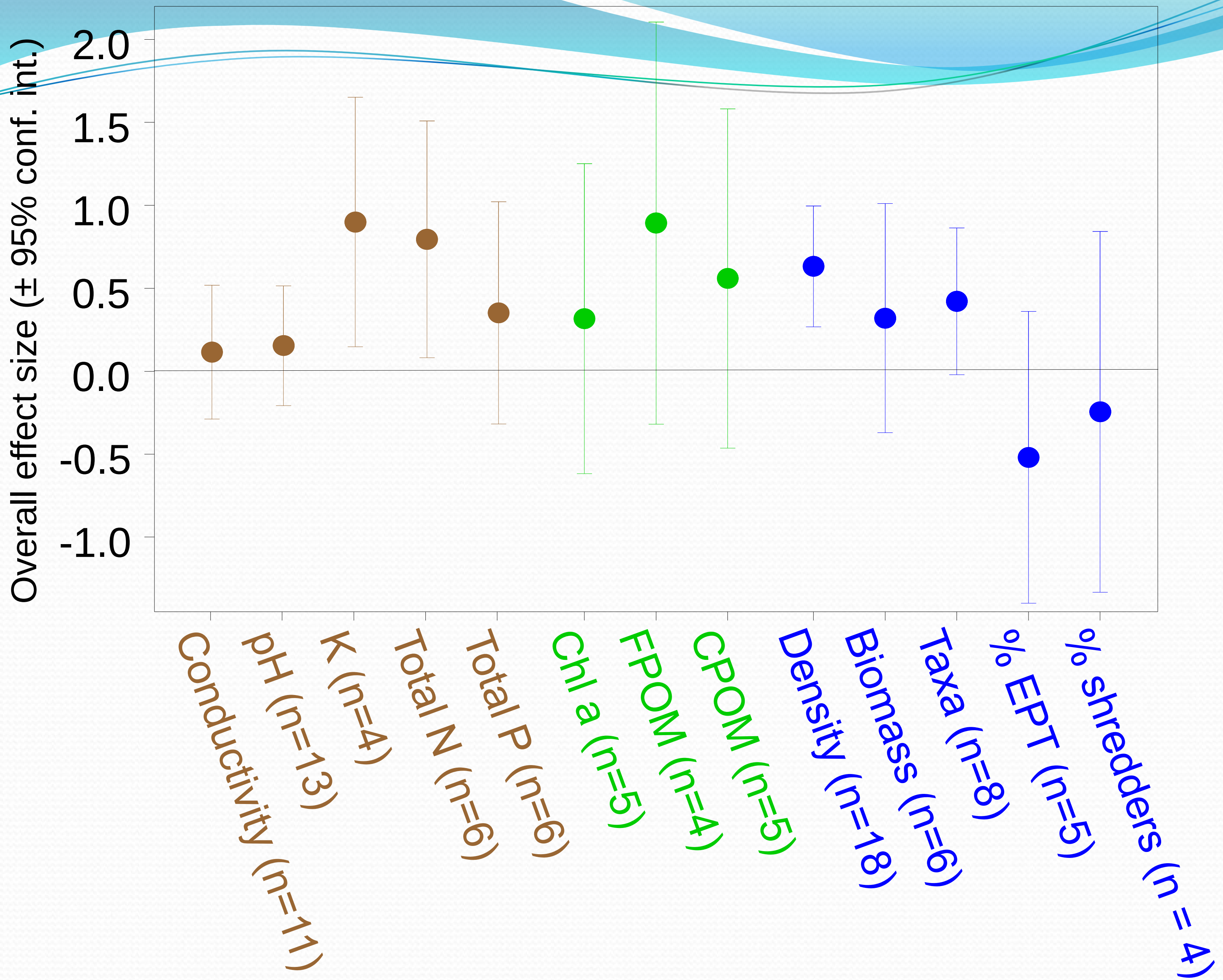
Current Forest Practices Rules

Absolute values of effect sizes

Note: bootstrapped 95% C.I.



Richardson JS & Béraud S. 2014. Effects of riparian forest harvest on streams: a meta-analysis. *Journal of Applied Ecology* 51:1712-1721.



Richardson JS & Béraud S. 2014. Effects of riparian forest harvest on streams: a meta-analysis. *Journal of Applied Ecology* 51:1712-1721.

OBJECTIVES (WPs)

1. Develop process-based models to compare outcomes (local and catchment scale) of different scenarios for streamside protection. This will be integrated with an economic analysis of costs of the different scenarios.

2. Augment data available for models by a sampling program carefully structured to expand the range of ecosystem variants sampled and to account for underlying environmental gradients, which can modify specific responses to forestry.

3. Develop a white paper for the options for riparian management around small streams.

CONSORTIUM DESCRIPTION

University of British Columbia, CANADA

RICHARDSON

University of Oulu, FINLAND

MUOTKA

Swedish Agricultural University, SWEDEN

KUGLEROVÁ

PARTNERS

- Swedish Forest Agency
- British Columbia Ministry of Forests, Lands and Natural Resource Operations
- Metsahallitus Parks and Wildlife Finland
- The Swedish Agency for Marine and Water Management
- SCA Skog AB (Sweden)
- Ontario Ministry of Natural Resources and Forestry
- Svesaskog (Sweden)
- Forest Practices Board, British Columbia
- Bothnian Sea Water District Authority
- Metsäkeskus, Finnish Forest Centre

1. Develop process-based models to compare outcomes (local and catchment scale) of different scenarios for streamside protection.

Different buffer widths on source streams

Different arrangements – specific reaches

Variable widths

Different environmental background (e.g. latitude, stream slope, etc.)

Kreutzweiser, D.P., P.K. Sibley, J.S. Richardson & A.M. Gordon. 2012. Introduction and a theoretical basis for using disturbance by forest management activities to sustain aquatic ecosystems. *Freshwater Science* 31:224-231.

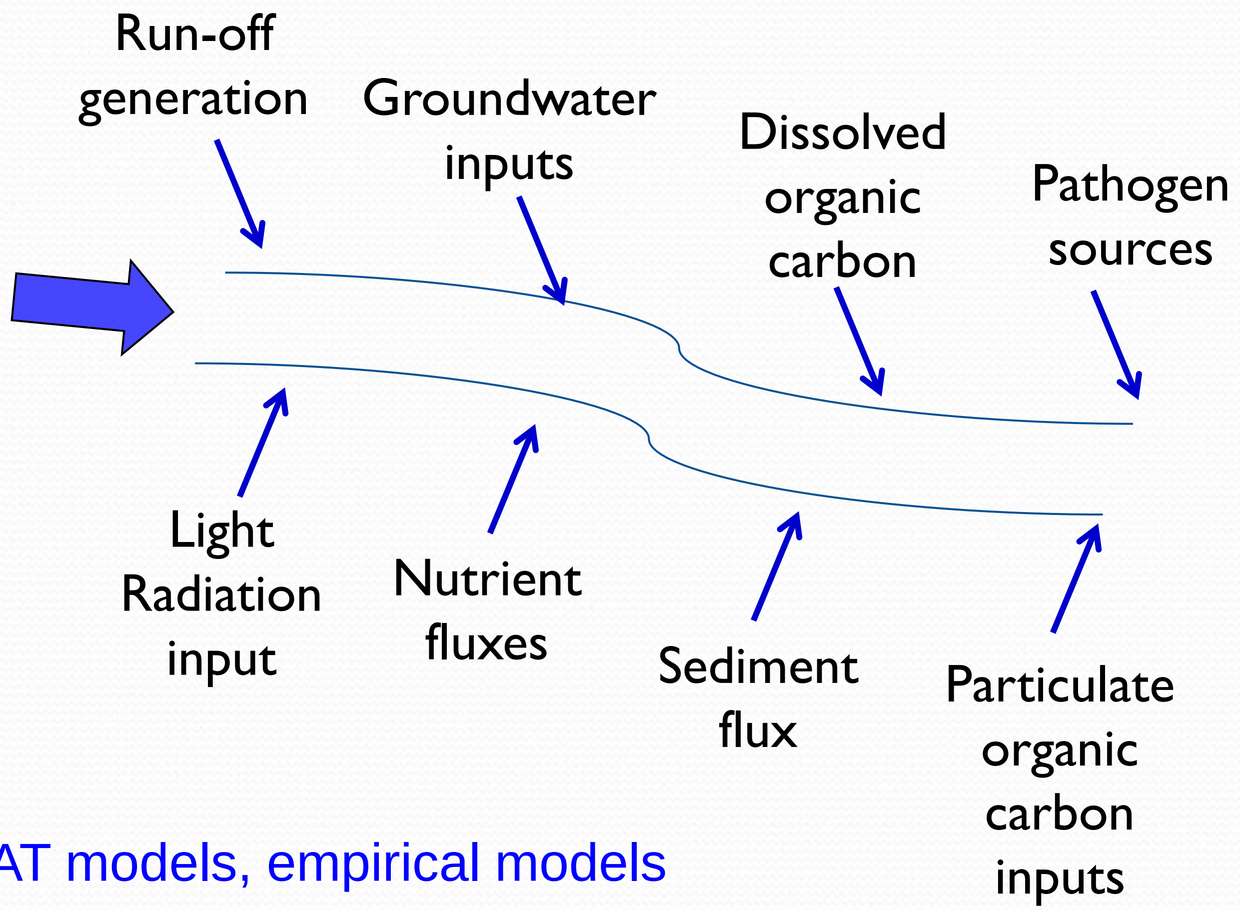
These model outcomes will be integrated with an economic analysis of costs of the different scenarios.

Costs of operations differ by protection measures and landscapes

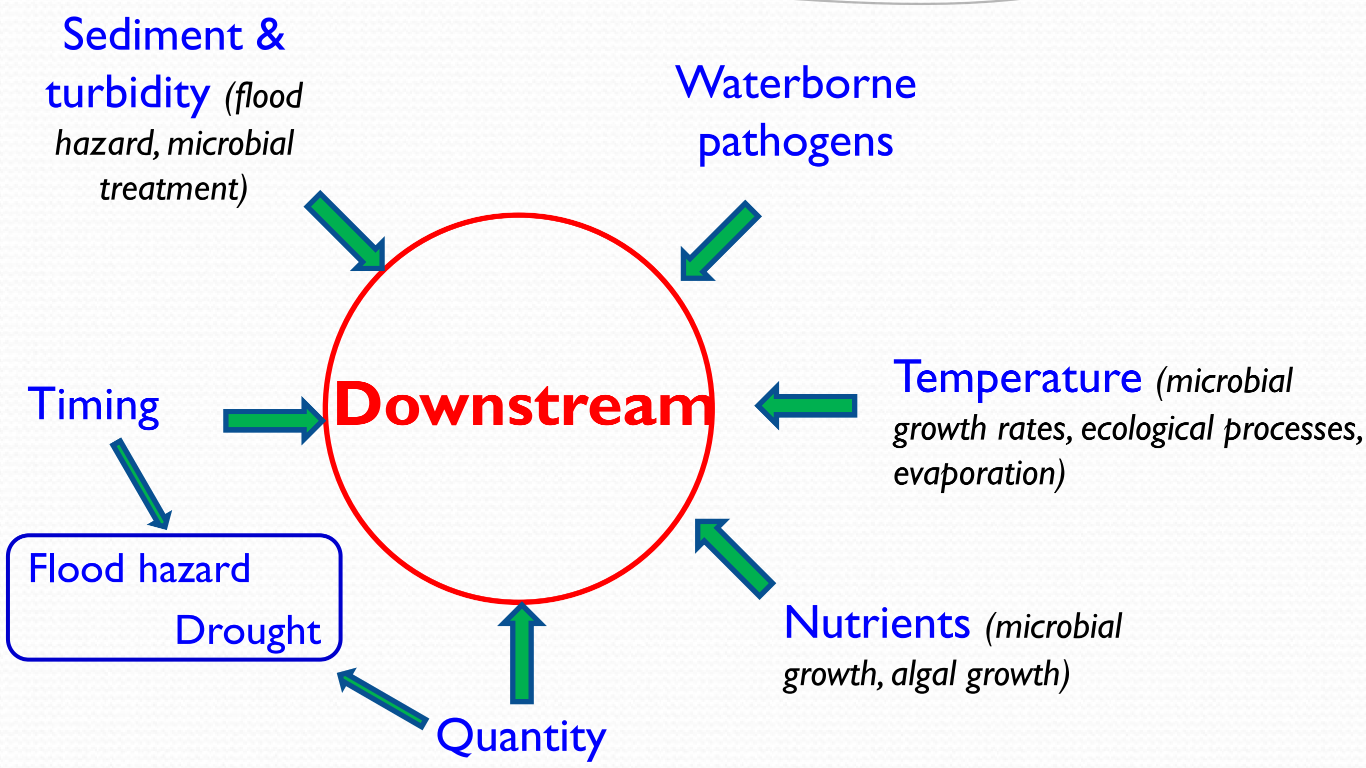
Kuglerová L, Ågren A, Jansson, R., Laudon, H. 2014. Toward optimizing riparian buffer zones: Ecological and biogeochemical implications for forest management. *Forest Ecology and Management* 334:74-84.

Tiwari T, Lundström J, Kuglerová L, Laudon H, Ohman K, Ågren AM. 2016. Cost of riparian buffer zones: A comparison of hydrologically adapted site-specific riparian buffers with traditional fixed widths. *Water Resources Research* 52: doi:10.1002/2015WR018014

Spatially explicit catchment processes



EcoPath, SWAT models, empirical models



Account for landscape features, e.g. latitude, elevation, slopes, potential evapotranspiration, etc.

Wipfli MS, Richardson JS, Naiman RJ. 2007. Ecological linkages between headwaters and downstream ecosystems: transport of organic matter, invertebrates, and wood down headwater channels. *Journal of the American Water Resources Association* 43:72-85.

WP2.

Augment data available for models by a sampling program

Structured to expand the range of ecosystem traits sampled

Environmental gradients, such as

- Latitude
- Altitude
- Stream size
- Slopes (stream slope, hill slope)
- Potential evapotranspiration

others?

WP3.

3. Develop a white paper for the options for riparian management around small streams

Riparian management guidelines have often been adopted from other jurisdictions …

Not accounting for underlying environmental differences

Not tested in new places

Need to account for different ecosystem values

Richardson JS, Naiman RJ & Bisson PA. 2012. How did fixed-width buffers become standard practice for protecting freshwaters and their riparian areas from forest harvest practices? *Freshwater Science* 31:232-238.

WP3.

3. Develop a white paper for the options for riparian management around small streams

Provide guidance for riparian management

Outline designs for how one might test effectiveness and efficiency of management around source stream protection

Expected Impact of the Project

Better understanding of how different practices might lead to outcomes to protect downstream values

Guidance for how to tailor management guidelines to recognise landscape differences

Explicit evaluation of the trade-offs between resource values – considering industry values and social values

Tiwari T, Lundström J, Kuglerová L, Laudon H, Ohman K, Ågren AM. 2016. Cost of riparian buffer zones: A comparison of hydrologically adapted site-specific riparian buffers with traditional fixed widths. *Water Resources Research* 52: doi:10.1002/2015WR018014

Meeting the aims of the call

Project includes biology, hydrology, biogeochemistry and geomorphology

Project includes economic analysis

We will be working directly with government agencies and forest industry partners, and aim to develop lasting, productive relationships

Post-graduate students, post-doctoral fellows will spend time in the different countries participating

Meetings with partners annually moving between the 3 primary countries

Water JPI

UBC

University of British Columbia, CANADA

University of Oulu, FINLAND

SLU

Swedish Agricultural University, SWEDEN

formas

The Swedish Research Council FORMAS

ACADEMY OF FINLAND

NSERC CRSNG

Natural Sciences and Engineering Research Council, CANADA

Water JPI

JOINT CALL 2016

European Commission