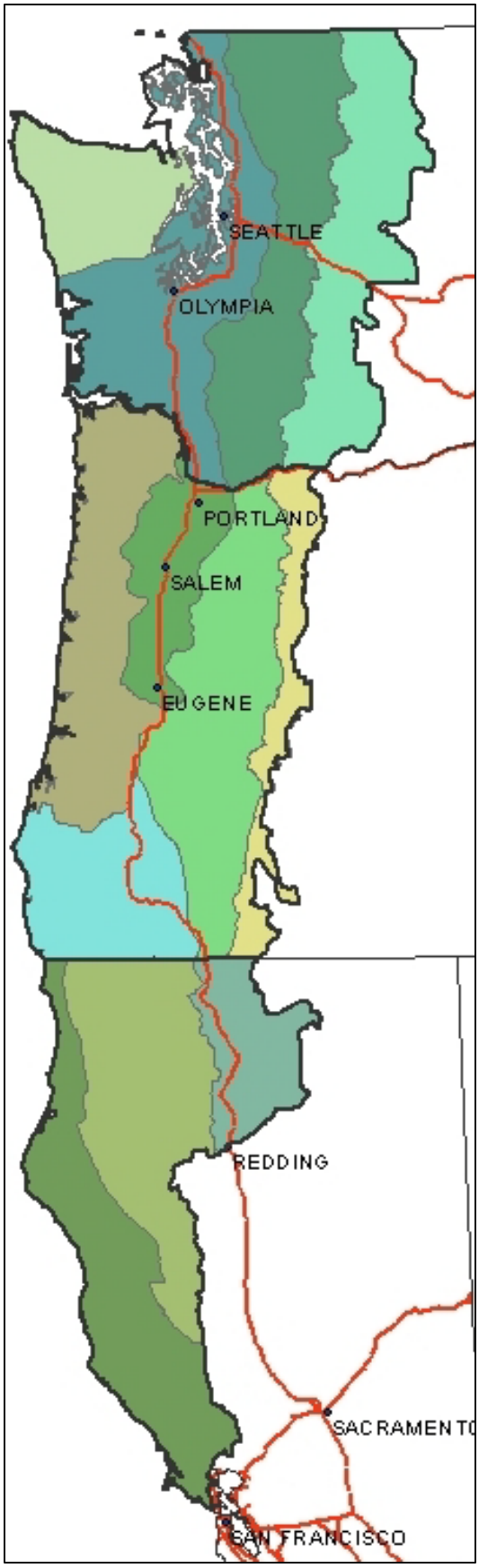
Aquatic Bibliography &
Science Questions
for the USDA
Forest Service

Science Synthesis

pursuant to forest planning
in the area of the

Northwest Forest Plan



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What is the Forest Service Science Synthesis

The Science Synthesis is a review of the current science literature addressing a broad scope of issues and questions pursuant to formal planning in the area of the Northwest Forest Plan. In fact, all national forests under the jurisdiction of the Forest Service are receiving new forest plans.

The planning process unfolds under the 2012 Planning Rule. The 2012 Planning Rule states in section **§ 219.3 Role of science in planning:**

"The responsible official shall use the best available scientific information to inform the planning process required by this subpart. In doing so, the responsible official shall determine what information is the most accurate, reliable, and relevant to the issues being considered. The responsible official shall document how the best available scientific information was used to inform the assessment, the plan decision, and the monitoring program as required in §§ 219.6(a)(3) and 219.14(a)(4). Such documentation must: Identify what information was determined to be the best available scientific information, explain the basis for that determination, and explain how the information was applied to the issues considered."

The first formal stage in planning involves conducting assessments of landscape at what is termed the 'unit scale' which means a national forest area. The Planning Rule states: "Assessments rapidly evaluate existing information about relevant ecological, economic, and social conditions, trends, and sustainability and their relationship to the land management plan within the context of the broader landscape. The responsible official shall consider and evaluate existing and possible future conditions and trends of the plan area, and assess the sustainability of social, economic, and ecological systems within the plan area, in the context of the broader landscape (§ 219.6)."

"In the assessment for plan development or revision, the responsible official shall identify and evaluate existing information relevant to the plan area for the following:

(1) Terrestrial ecosystems, aquatic ecosystems, and watersheds;
(2) Air, soil, and water resources and quality;
(3) System drivers, including dominant ecological processes, disturbance regimes, and stressors, such as natural succession, wildland fire, invasive

species, and climate change; and the ability of terrestrial and aquatic ecosystems on the plan area to adapt to change;
(4) Baseline assessment of carbon stocks;
(5) Threatened, endangered, proposed and candidate species, and potential species of conservation concern present in the plan area;
(6) Social, cultural, and economic conditions;
(7) Benefits people obtain from the NFS planning area (ecosystem services);
(8) Multiple uses and their contributions to local, regional, and national economies;
(9) Recreation settings, opportunities and access, and scenic character;
(10) Renewable and nonrenewable energy and mineral resources;
(11) Infrastructure, such as recreational facilities and transportation and utility corridors;
(12) Areas of tribal importance;
(13) Cultural and historic resources and uses;
(14) Land status and ownership, use, and access patterns; and
(15) Existing designated areas located in the plan area including wilderness and wild and scenic rivers and potential need and opportunity for additional designated areas.

The combination of section 219.3 - the use of best available scientific information (BASI) - and the broad scope of topics addressed in an Assessment requires the agency to document “what information was determined to be the best available scientific information, explain the basis for that determination, and explain how the information was applied to the issues considered.” Thus, prior to the formal Assessment process the Forest Service is conducting a science review and synthesis to inform future planning.

As part of the Science Synthesis the Forest Service invited the public to submit scientific literature or citations believed important to a science review. Pacific Rivers and the Coast Range Association in turn sought input from leading aquatic scientists to develop a bibliography of citations and a list of relevant science question related to the Northwest Forest Plan Aquatic Conservation Strategy (ACS).

What follows are the submitted bibliography and the list of question for the portion of the Science Synthesis addressing aquatic ecosystems.

This document is available at www.coastrange.org

AQUATIC CONSERVATION BIBLIOGRAPHY:
A submission to the USDA Forest Service Science Synthesis.

Developed by Pacific Rivers and the Coast Range Association.

Contents:

Note: references/citations in red text indicate non-peer-reviewed but significant material.

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2. RIPARIAN RESERVES/WIDTHS AND IMPORTANCE OF HEADWATER STREAMS

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4. FISH, AMPHIBIANS AND CLIMATE CHANGE:

[includes Fish (e.g. coho salmo,n chinook salmon, steelhead, pacific lamprey) and Climate Change Impacts related to fish and fisheries]

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Key aquatic science questions for the Forest Service Science Synthesis

STREAM TEMPERATURE:

What factors determine the temperature of forest streams?

What is the biological importance of conserving or restoring natural temperature regimes in streams and rivers?

What are the likely effects of climate change on future stream temperatures?

How does the width and downstream continuity of riparian forest buffer zones affect the temperature of surface waters?

How does thinning or other logging within Riparian Reserves and riparian areas affect the temperature of surface waters?

How does thinning interact with natural disturbance processes to affect stream temperature?

What riparian management practices are needed to minimize the adverse impacts of forestry on stream temperature?

EROSION, SEDIMENT DELIVERY, AND SUSPENDED SEDIMENT IN SURFACE WATERS

How does increased erosion caused by logging harm streams and other waters?

What is the role of Riparian Reserves in minimizing erosion from logging roads?

What is the role of Riparian Reserves in minimizing erosion from landslides?

What is the role of Riparian Reserves in minimizing ground disturbance from logging?

What is the role of Riparian Reserves in minimizing gullying and channel expansion as a result of logging?

What are the consequences for erosion and sediment delivery of Riparian Reserve widths on headwater streams?

What are the consequences for erosion and sediment delivery of thinning or other logging within Riparian Reserves?

NUTRIENT DELIVERY AND EUTROPHICATION

Where do nutrients originate on managed forest landscapes?

What is the consequence of increased nutrient delivery to streams, wetlands, rivers and lakes from forestry operations?

Didn't salmon runs in the past contribute large amounts of nutrients to streams and what are the implications for today's streams?

How do riparian forests mediate nutrient delivery to surface waters?

How do the width and downstream continuity of riparian forest buffer zones affect nutrient delivery to surface waters?

How does forest harvesting within riparian areas affect nutrient delivery to surface waters?

What configuration of riparian area management is needed to minimize delivery of nutrients from forest disturbances?

What other management practices can help reduce or minimize nutrient delivery associated with forest management?

STREAM HABITAT & LARGE WOODY DEBRIS

How is woody debris important to stream and other freshwater ecosystems?

What is the role of riparian forests in determining the availability of wood to freshwater ecosystems?

What are the effects of narrowing Riparian Reserves from ACS Standards on

woody debris supply for streams?

How does tree tipping thinning affect the supply of woody debris in riparian areas and streams?

What riparian management practices are needed to minimize the adverse impacts of forestry on woody debris?

STREAM FLOWS AND STREAM FLOW TIMING

How do timber harvest and roads affect the amount, timing and spatial distribution of stream flows?

How do timber harvest and forest roads affect wetlands, surface water, shallow sub-surface water and groundwater?

How do timber harvest and forest roads affect stream hydrologic conditions that in turn may affect stream physical habitats, for example floodplain extent, dynamics, and connectivity; channel dynamics, conditions and complexity; and streambank stability and integrity?

How does climate change interact with timber harvest and roads to affect or influence a) late winter/early spring peak flows? b) base flows or late summer flows (particularly over time, i.e., after timber harvest entry and road construction or re-construction)?

ROAD IMPACTS

How do roads, culverts and stream crossings affect fish movements and migratory pathways, particularly over time and given limited budgets for road maintenance or repairs?

How do roads affect fishing pressure for rare and threatened/endangered fish species?

How do roads affect the spread of invasive species (both terrestrial and aquatic)?

What are appropriate minimum standards for roads to protect aquatic and riparian ecosystems and watersheds and to conserve listed fish and other aquatic species (especially given reasonably foreseeable climate impacts – see

climate Qs below)?

What are some of the other secondary or indirect ways that roads and road crossings can affect streams and fish habitats (e.g., sediment impacts, stream thermal impacts, nutrient flow impacts, etc...?).

IMPORTANCE OF SMALLER STREAMS

What is the importance of smaller non-fish bearing, fishbearing and intermittent headwater streams protection, particularly in light of watershed cumulative (hydrologic) effects (CWEs) and climate change?

Can smaller streams, particularly those associated with springs, seeps, wetlands and extensive surface-to-groundwater connections in headwater areas be managed as refugia from timber harvest and road related impacts and thus provide future survival opportunities for climate sensitive species, particularly bull trout and amphibians?

Can impacts to smaller streams caused by current plan and project level protections, or planned reductions in minimum riparian reserve widths adversely affect amphibians, bull trout and other resident and anadromous salmonids, particularly in light of climate change?

Note: see scientific papers regarding cumulative watershed effects (CWEs) and current and projected climate impacts

CLIMATE CHANGE AND CLIMATE IMPACTS

What are some of the current trends in regional air and associated stream temperatures in the Pacific Northwest and Northern California?

What do peer reviewed climate science journals and down-scaled climate models predict to occur in the next 50-100 years to regional stream thermal conditions?

How will forest ecosystems and stream ecosystems generally respond if these climate predictions are reasonably accurate? For example:

a) How will stream hydrographs respond in currently snow dominated, rain-on-snow transitional, and rain dominated watersheds?

b) What will occur to peak flows and late winter/early spring channel scour

events, particularly in warm/wet years? What impacts are likely to threatened and endangered species such as bull trout?
c) What will occur to late season (summer flows), particularly in warm/dry i.e., drought years? What impacts are likely to listed fish and listed/at risk amphibian species?

What species of fish and amphibians are likely to be adversely affected or need additional aquatic and riparian protections, given the above changes and trends? How will these species be protected?

CUMULATIVE IMPACTS

What analytical or management criteria/measures does the scientific literature suggest for land management agencies to determine allowable level(s) of cumulative impacts to *watersheds, streams, fish, amphibians, riparian reserves, stream temperatures, stream flows, pattern of flows and flow timing, water quality, nutrient flows, large woody debris, floodplain complexity and connectivity, stream channel conditions, riparian and instream physical habitats, endangered/threatened or sensitive (at risk) fish, amphibian and invertebrate species, and other critical aquatic ecosystem functions or components?*

What explicit standards or analytical or management criteria/measures does the scientific literature suggest for timely adaptive management responses at appropriate unit level (i.e. National Forest or watershed scale) to avoid cumulative impacts to the above aquatic ecosystem components and conditions?

What does the scientific literature suggest for monitoring frequency/timing of analytical or management criteria/measures for a timely response to changing conditions?

At what point in a program of monitoring will information and analysis be less than adequate to assess cumulative impacts? In other words, at what thresholds will failure by likely given various assumptions of environmental stress.
In practice how should the U.S.D.A. Forest Service monitor and qualitatively respond to ensure ecosystem integrity and sustainability using the above (highlighted in italics) components and conditions?