

Clean Water and Family Forest Management: Some Emerging Issues

By **PETER A. BISSON**

Over the last two decades most attention given to issues concerning water quality and forest management in the Pacific Northwest has focused on protecting habitat for salmon and trout. The attention has been catalyzed by multiple listings of fish populations under the Endangered Species Act and by adoption of watershed-based Habitat Conservation Plans (HCPs) and negotiated legal agreements for state and private lands. Additionally, efforts to recover salmon by protecting water quality and restoring stream and riparian habitat have included ambitious regional programs



such as the Puget Sound Partnership (www.psp.wa.gov/) and the Northwest Power and Conservation Council's Program for the Columbia River Basin (www.nwcouncil.org/fw/Default.asp). Most of these programs focus on federal and state lands, large industrial forests, and tribal lands, but small privately-owned forests play a key role in protecting water quality and conserving fish and wildlife.

Demand for clean water for a variety of uses will increase. Watersheds are where we live, grow crops and create various forms of industry. As the Pacific Northwest's human population expands, competition for water and the ecological goods and services that water provides will grow more intense. While protecting fish habitat will remain important, it will be only one of a suite of issues with which family forest managers charged with protecting water resources must remain engaged. In almost every case, they will be faced with balancing the ecosystem needs of fish with the need for drinking water, sanitation, energy, agriculture, commerce and recreation.

With this in mind it is helpful to review emerging issues that are of interest to small woodland owners: climate change, wildfires and invasive species. That climate is changing is beyond scientific dispute, even though the causes of change may

continue to be publicly debated. With climate change the frequency and severity of wildfires will also change, as will the patterns of invasion of new plants and animals into the Pacific Northwest and elsewhere. Each of these factors can cause significant changes in water quality and quantity, but their specific impacts in the context of forest management, and what can be done about them, are incompletely known. This article examines each issue from a scientific standpoint and considers how new findings can be incorporated into family forest management strategies.

Climate change

Potential effects of climate change on water quality in the Pacific Northwest include: (1) higher air temperatures resulting in increased precipitation falling as rain rather than snow; (2) diminishing winter snow pack and reduced flows during subsequent low flow periods; (3) possible increases in peak storm flows; and (4) rising water temperatures (see Figure 1).

Climate scenarios predict an increase in large floods, wildfires, and forest pathogen outbreaks, some of which have potential to actually *improve* habitat as a result of enhanced floodplain connections and trees entering streams. Many effects of climate warming, however, will

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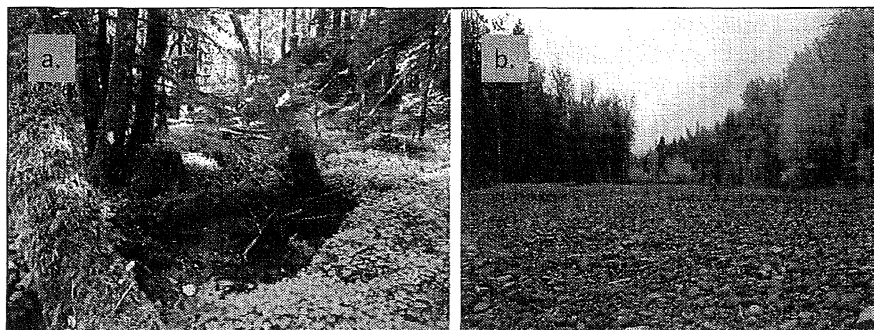
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have negative consequences for water supplies and aquatic organisms, at least in the short term. Summer water shortages are likely to be exacerbated by reduced snowmelt runoff—a problem affecting the water needs of both fish and humans. Severe wildfires and more frequent intense rainstorms can cause stream changes (heavy sedimentation, streambed scour and loss of riparian forests) that result in mortality and reduced productivity of aquatic organisms, as well as direct threats to water supplies and property. Over decades to centuries, wildfires and floods contribute to maintaining aquatic habitat, but the short-term consequences of these events are socially undesirable. Managers are therefore faced with the difficult task of formulating strategies that balance the long-term benefits and short-term risks of these rare events.

From a habitat standpoint, maintaining as much water as possible in

Figure 1.



Examples of the effects of climate change on water quality: (a) shrinking perennial drainage network of headwater streams; and (b) extreme low flows during the dry season.

streams and lakes during dry periods is an effective way of combating the harmful effects of climate change, and there will be obvious benefits to downstream water users of keeping flows as high as possible. Connecting rivers to their floodplains by allowing them to meander and maintain surface connections to floodplain ponds provides a safety valve that helps reduce the scouring effect of high

flows on spawning locations, provides refuges for aquatic organisms, and improves water quality. Some of the ways small woodland owners can help buffer the adverse effects of climate change include:

- Minimize increases in water temperature by maintaining well-shaded riparian areas.
- Maintain a forest stand structure

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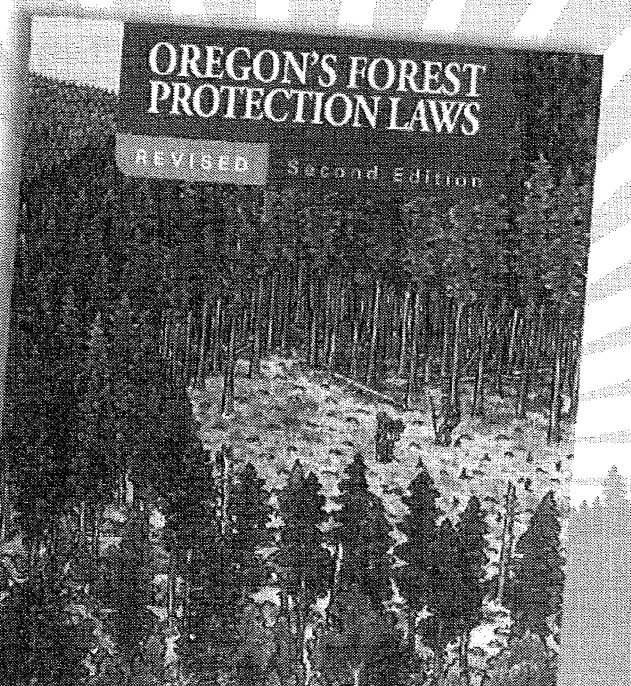
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that retains snow water and promotes fog drip, and reduces the "rain on snow" effect associated with forest openings in the transient snow zone.

- Disconnect road drainage from the stream network by diverting runoff away from active channels to soften discharge peaks during intense storms.

- Ensure that fish have access to seasonal habitats, e.g., floodplain ponds in winter or cool water areas in summer.

- Protect springs and seeps from water appropriations that would lessen habitat quality and downstream water availability.

Wildfires

Wildfires cause immediate increases in water temperature, although direct heating is brief. Some fire retardants used to control wildfire contain chemicals that can harm aquatic life if present in sufficient concentrations. More significantly, however, sediment

concentrations usually rise in the post-fire environment, watersheds become more prone to landslides, peak flows often increase during storms, stream food webs are altered, and loss of riparian vegetation leads to higher prolonged stream temperatures. All of these changes can be harmful to fish and they typically cause problems for downstream water users. Nevertheless, the role of wildfire in maintaining long-term habitat complexity has been shown in several recent studies. Wildfires have been found to be a catalyst for delivering trees and boulders

Figure 2.



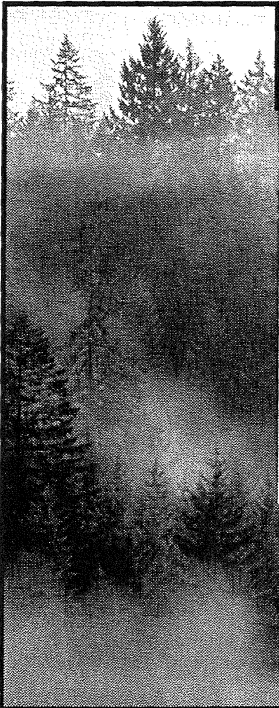
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Invasive riparian plants such as Japanese knotweed can spread asexually through rhizome fragmentation, spawning isolated plants (a) that coalesce to form dense thickets. Water quality impacts of these invaders are poorly understood.

to streams. These fire-derived materials can function as aquatic habitat for more than a century and help maintain the productivity of salmon and trout.

The debate within the natural resource community over what are appropriate pre- and post-fire forest treatments goes far beyond maintaining clean water, and therefore it is useful to consider the issue of stream protection in a much larger context. Because climate change will lead to more and hotter wildfires for a variety of reasons, the question arises: "What can be done to reduce short-term damage to aquatic and riparian conditions while conserving the long-term habitat benefits of fire?" At present, there are no simple answers to this question. Fuels reduction treatments may be worthwhile in riparian areas where the risk of intense fire is very high, but some riparian zones are not likely to burn severely and fuels treatments may compromise aquatic habitat development and harm water quality if they reduce wood recruitment, alter floodplains, and damage stream banks. Likewise, post-fire treatments such as salvage logging and erosion control using hay bales may be appropriate in some locations, but inappropriate in others.

Family forest managers are encour-





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