FYI INFORMATION

A Research Summary From the Washington Forest Protection Association

Study Suggests Amphibian Habitat in Some Headwater Streams More Dependent upon Geology and Gradient Than Age of Trees

Wildlife biologist Kevin Russell has done extensive research on torrent salamanders and other amphibians whose habitat is headwater streams in the Northwest like the one pictured above. These small streams, where rivers originate, represent vital habitat for the Columbia torrent salamander, and a deeper understanding of how forest management affects them is critical.

In the science of forest management—as it relates to water quality and fish and wildlife habitat—much focus has been brought to bear on streams and rivers, but small channels and rivulets called "headwater streams" actually account for 70-80 percent of the total watershed area in the Pacific Northwest. These smaller reaches, where rivers originate, are home to a variety of amphibian species.

Previous studies had seemed to indicate that habitat for three species in particular—the tailed frog, the Pacific giant salamander, and the torrent salamander—all relied on old growth forest to shade and cool these headwater streams, but some researchers are discovering that there may be other factors at work.

To better understand how timber harvest and buffer zones around these streams affected amphibian populations, Willamette Industries asked wildlife research biologist Kevin Russell to survey the Columbia torrent salamander across a random sampling of their forests. This particular species was perfect for the study because more than 95 percent of its territory is on private or state forestland within the Coast Range Mountains of southwestern Washington and northwestern Oregon, and most of it is commercially managed.

From 2000 to 2001, Russell and his research partners Todd Mabee and Michael Cole assessed hundreds of headwater streams throughout the range of these salamanders, and some interesting patterns were discovered, in addition to surprisingly large quantities of salamanders. "After studying the data we had collected, it appeared that there were more factors at work than just the age of the forests around the headwater streams," said Russell, who is now an assistant professor of wildlife ecology at the University of Wisconsin, Stevens Point. "The data pointed to the fact that although the riparian zone was a factor in the abundance of the species, it was overshadowed by the other factors within the stream itself—chiefly whether it was a steep or shallow gradient, and the type of geology underlying it."

While Columbia torrent salamanders were well-distributed throughout the landscape, they were particularly abun-

Photo by William Leonard

*Columbia torrent salamanders (*rhyacotriton kezeri*) are approximately 3–4 inches long from snout to tail. They tend to be brown or green on their back, with a yellowish underbelly. One of four torrent salamander species, they are found in the marine climate of the Coast Range in southwestern Washington and northwestern Oregon.*

dant in streams underlain by basalt with a fairly steep gradient. There are generally two types of geology in the Coast Range—basalt and marine sediment. It is these physical features, Russell concluded, rather than timber harvest, that overwhelmingly controlled the numbers of salamanders in the study. Russell feels there are three possible factors to explain these findings:

(1) Tree growth is very rapid in the Coast Range, so the loss of shade on the streams within the Columbia torrent salamander range might only affect them for a couple of years.
(2) The cooling effect of the area's marine climate could mitigate the need for shading to keep stream temperatures cooler.
(3) The Columbia torrent salamander might be more resistant to change than previously thought.

Management Implications

The Columbia torrent salamander is currently under consideration for listing under the Endangered Species Act in Washington, and the Forests and Fish Law is designed to protect 50 percent of perennial headwater streams. However, the placement of the protection right now, according to Russell, is somewhat random. He feels this data could be used to target where protection could be most beneficially used. "I'm certainly not saying that riparian protection for these headwater streams is unnecessary, but we may be able to use these findings to determine where exactly we should be targeting that protection. In situations when it isn't practical to have complete riparian protection on every stream, we could focus the protection on areas we have determined to already be favorable to torrent salamanders."

Kevin Russell

Conversely, he suggests that low-gradient, marine sediment streams may not be productive for torrent salamanders regardless of the amount of riparian protection provided, at least in the Coast Range. In a follow-up study, Russell surveyed an inland area that was home to the Cascade torrent salamander, using the same techniques and stratification of survey sites to evaluate how interior populations of torrent salamanders responded to gradient and geology. He again found these factors to be more influential on salamander population than previous studies had shown, although to a lesser degree due to the non-marine climate.

Bruce Bury, a zoologist with the U.S. Fish and Wildlife Service, believes that the location where timber harvest is occurring makes a huge difference. "Kevin Russell and others have shown that timber harvest in the cooler coastal locales in the Northwest and northern California has a minimal impact on the torrent salamander populations," he says. He is concerned, however, about how well the results translate to inland areas of the Northwest. Further, he and colleagues found that tailed frogs and torrent salamanders on the Olympic peninsula occur in areas with marine deposits when there is older forest present.

Cooperative Research and Adaptive Management

Prior to Kevin Russell's studies, most of the previous research into headwater amphibians had been focused on unmanaged and/or old growth forest areas. This made it difficult to ascertain the importance of the other factors at work when comparing streams that all have older vegetation around them, and Russell believes that their applicability to commercial, second-growth forest headwaters is limited. He believes that future research should be focused on further exploring the effects of commercial land use near headwater stream amphibians in various settings.

The foundation of the Forests and Fish Law is science and adaptive management. It provides for a Cooperative Monitoring Evaluation Research committee (CMER) that is charged with selecting studies to better understand the interactions of forest practices and fish and wildlife protection. Using adaptive management to monitor on-the-ground effects of forest practices and develop new ways of protecting natural resources, better protection for wildlife is created in the state based on the results of these studies.

Photo by William Flaxington

The Cascade torrent salamander, or rhyacotriton cascadae, *is another of the four species of torrents, and is found only in the Cascade Range in southwestern Washington and northwestern Oregon. Kevin Russell has also studied this species, and found similar—albeit lesser—effect on their populations in headwater streams. He theorizes that outside of the moderating influence of the marine climate, salamanders could be more susceptible to the effects of timber harvest.*

Marc Hayes of Washington's Fish and Wildlife department is an amphibian specialist for the committee. He says there is a study in the design phase right now that will look directly at how the geology underlying headwater streams affects the tailed frog, a species thought to have very similar habitat needs to torrent salamanders. "Kevin Russell's work has shown us a new direction to take with future study of these critical headwater streams," he says. "Adaptive management will be the key to ensuring that these increases in our knowledge will enable foresters planning timber harvest activities to employ headwater protection where it will be most effective."

For more information, Kevin Russell's complete study results are published in the *Journal of Wildlife Management, 68(2): 403-415*.

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