Floodplains and Channel Migration Zones

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Channel Migration Zones

The channel migration zone (CMZ) is the area where the active channel of a stream is prone to movement over time. Channel migration is usually found along a small percentage of the entire stream network length; however, effective management of ecological functions in CMZs is critical to reduce flood hazards, erosion and habitat loss, and to avoid the need for future shoreline stabilization.

CMZs are also known as "flood hazard" or "floodway fringe" areas, and are generally considered to be spatially equivalent to the 100-year flood plain, i.e. the floodplain area subject to a one percent or greater chance of flooding in any given year. The ordinary high water mark (OHWM) is not a reasonably comparable standard, as it does not encompass a sufficient area to maintain sustainable ecological functions or reduce flood hazards.

While CMZs hazardous areas for development, fish and wildlife also depend on the habitat created when a river is allowed to migrate. Protection for channel migration zones goes beyond protecting existing habitats to focus on the processes that create and maintain that habitat.

Ecological Function of Channel Migration Zones

Riparian zones and floodplains are critical landscape components, linking aquatic and terrestrial systems; they regulate aquatic habitat formation, as well as the entry of water, nutrients, and organic material into aquatic habitats.

Salmon use floodplain channels for spawning and for over wintering, feeding and refuge. Salmon and other aquatic life take advantage of side channels that provide a rich food supply and stable hydrologic conditions. Juvenile salmon typically feed in the shallows and seek cover from predators in deeper water or in woody debris complexes and emergent vegetation. The growth that the juvenile salmon are able to acquire in these habitats improves their overall size and survival rates. The hyporheic zone, the shallow unconfined aquifer under the flood plain that is in hydraulic continuity with the river, extends for considerable distance (even miles) across the width of the flood plain and many yards beneath the surface and provides extensive intergraval habitat for aquatic invertebrates during droughts and high-flow events, and is capable of re-supplying the population of an area at and immediate below the stream bed once conditions in the stream improve.

The riparian area is the zone where aquatic and terrestrial ecosystems interact and is essential to both fish and wildlife. Vegetation along riverbanks provides habitat for most wildlife and is extremely important for most species of Pacific Salmon. Streamside plants shade the water, help moderate water temperature, promote stream-bank stability, and providing organic nutrients to the aquatic ecosystem.

Riparian trees are the source of large in-stream woody debris that is a primary factor influencing channel form, creating the pools, riffles and side channels that are essential habitat for many fish and other aquatic species. Erosion is buffered by tree roots and large organic debris introduced into channels through erosion and windfall. Large woody debris forms stable associations when trapped within side channels, and functions to minimize bank erosion, dissipate channel energy, meter flow down the side channels, create localized rearing and flood refuge areas, and contribute to the stabilization of the main river channel. Side channels provide important rearing, spawning and migration areas for chinook, coho and steelhead salmon.

The quantity of woody debris in stream channels has decreased over time as a result of various land use practices, including clearing of riparian trees. Continued local recruitment of key member logs to the river is needed in order to create and maintain productive aquatic habitat.

Management Principles

In unconfined stream reaches, movement of the active channel across the floodplain through time may eradicate riparian buffer strips. The object of having a riparian buffer start at the outer edge of the stream channel migration zone, instead of at the edge of the current channel, is to ensure that riparian functions will be maintained even if the stream were to move away from its present position.

Operationally, the CMZ should be equivalent to the area that a stream is expected to occupy in the time period it takes to grow a tree of sufficient size to provide geomorphic/ecological functions in the channel. On smaller streams, it may be appropriate to be concerned where the stream could move within 100 years or less. However, larger wood is needed to function in larger, high-energy channels. To be functional, recruitment trees must be very large, with root wads attached. As a consequence, on a larger stream, it may be necessary to include areas in the CMZ that the stream could occupy in the next 200 years or more.

For example, Type 1 streams include shorelines of statewide significance, which are river segments where the mean annual flow is measured at one thousand cubic feet per second or more. These are high-energy environments where the largest trees are needed to form key structural pieces that will form log jams and complex pool habitats needed to create and maintain productive floodplain fish habitat. It will take much longer to grow appropriately sized trees in riparian forest adjacent to these systems. To be functional, recruitment trees must be very large, with root wads attached. Research conducted in the Queets River corridor demonstrates how large trees play a crucial role in floodplain and terrace formation (Abbe,1996). Both field observations and historical evidence show that log jams can form stable structures that control local channel hydraulics and provide refugia for riparian forest development over decades, and possibly centuries. “Key member” logs greater than 1000 years old were discovered buried within flood plain islands and terraces. In addition to forming islands, terrace and channels, large wood debris is associated with eighty percent of floodplain pools.

Best Available Science

Three sources of best available science indicate that standard habitat buffers should be measured from the outer edge of the channel meander zone when such a zone is present:

1) The Washington Department of Fish and Wildlife, in it's Management Recommendations for Washington's Priority Habitats: Riparian, states (page 86):

"The channels of some streams, particularly larger streams and rivers in broad, alluvial valleys, may migrate across the valley as a result of natural erosional and depositional processes; the area over which the channel is expected to migrate is called the channel migration zone. For these streams and rivers, RHA measurement should begin at the edge
of the channel migration zone."

2) The State Wild Salmonid Policy also states in its performance measures for riparian areas and wetland that buffers for Types 1-3 are to be placed "on each side of the stream's full channel migration or disturbance zone."

3) An Ecosystem Approach to Salmonid Conservation (i.e. the ManTech Report) states:

We define buffer zones as areas adjacent to the stream channel or floodplain in which land-use activities are prohibited or substantially restricted. . . In unconstrained reaches with braided or shifting channels and broad floodplains . . . . it is more appropriate to define the riparian zone based on the extent of the floodplain, rather than the active channel, because movement of the active channel across the floodplain through time may render buffer strips ineffective.

Policy Implications

The policy goals of biological conservation and restoration should focus on protecting ecological integrity, a term that refers to a system's overall health and wholeness, including the presence of all appropriate elements (physical and biological) and the occurrence of all processes (e.g. erosion and deposition) at appropriate rates. Integrity is the primary directive for water policy in the United States (Clean Water Act).

The only way to sustain healthy populations of fish and wildlife is to adequately protect habitat and the physical processes that create and maintain that habitat. Processes are an essential component of integrity.

Because suitable conditions for all species and life history stages will be supplied by providing them the conditions under which they naturally evolved, evolutionary history provides the basis for assessing biological integrity.

Restoration of natural floodplain functions will have multiple benefits: reduction of flood damage to life and property and improvement to water quality and fish and wildlife habitat.

Regulatory Precedents

The importance of protecting channel migration zones (CMZs) along rivers and streams is now well established in regulations. The State's new forest practices rules and Shoreline Management Act guidelines include explicit recognition and protection of CMZs.

Forest Practices Rule (Chapter 222-16-010 WAC) defines the CMZ as the "the area where the active channel of a stream is prone to move and this results in a potential near-term loss of riparian habitat adjacent to the stream". The Board Manual, which is appended to WAC 222 as a guidance document, further defines this zone as equivalent to the 100-year floodplain. The 100-year time span was chosen because it represents the time it takes to grow mature trees that can provide function large woody debris to most streams. The Manual also acknowledges that, in large, meandering rivers, a more detailed analysis is needed to determine an appropriate time frame needed to grow functional wood (and consequently, delimit an appropriate width for defining the CMZ).

Shoreline Master Program Guidelines (Chapter 173-26 WAC) require local governments to map the general location of CMZs as part of their inventory and analysis, and provides the following definition for the CMZ:

"Channel migration zone (CMZ)" means the lateral extent of likely movement along a stream reach with evidence of active stream channel movement over the past one hundred years. Evidence of active movement can be provided from aerial photos or specific channel and valley bottom characteristics. A time frame of one hundred years was chosen because aerial photos and field evidence can be used to evaluate movement in this time frame. Also, this time span typically represents the time it takes to grow mature trees that can provide functional large woody debris to most streams. In large meandering rivers a more detailed analysis can be conducted to relate bank erosion processes and the time required to grow trees that function as stable large woody debris. With the exception of shorelands in or meeting the criteria for the "natural" and "rural conservancy" environments, areas separated from the active channel by legally existing artificial channel constraints that limit bank erosion and channel avulsion without hydraulic connections shall not be considered within the CMZ. All areas, including areas within the "natural" and "rural conservancy" environments, separated from the natural channel by legally existing structures designed to withstand the 100-year flood shall not be considered within the CMZ. A tributary stream or other hydraulic connection allowing T&E species fish passage draining through a dike or other constricting structure shall be considered part of the CMZ. (Note: The intent of the last sentence is to deal with the connection, not the entire tributary. Ecology will clarify this in technical assistance materials concerning CMZ delineation).

At the heart of the new Shoreline regulations is a requirement that local officials identify the ecological functions performed by shorelines and protects them based on what the local environment needs.

FEMA Flood Hazard Maps

The 100-year flood is a relatively rare event (1-percent chance in any given year), but structures located in the floodplain have a significant chance (26%) of suffering flood damage during the term of a 30-year mortgage. For these reasons, flood insurance is required as a condition of receiving Federal or federally backed financial assistance.

The FEMA Flood Hazard Mapping Technical Services Division maintains and updates the National Flood Insurance Program maps. Because of the infrequent occurrence of flood events, mapped Flood Hazard Areas are not based only on the past flooding occurrences. The fact that a flood hasn't occurred within memory doesn't mean one won't happen soon. Instead, flood maps are intended to predict flood risks based on local hydrology, topology, precipitation, flood protection measures such as levees, and other scientific data. The flood hazard maps are based on the best information available at the time the maps were prepared, and are used in 279 communities in Washington to provide information on flooding risks. However, the maps are based on hydraulic models, using limited data, and are considered inaccurate. For example, up to 30 percent of flood losses in recent years were outside the designated flood zone (DOE, 2001).

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