

The Shifting Habitat Mosaic

What is the shifting habitat mosaic?

River corridors alternate between constrained canyon reaches and unconstrained floodplain reaches. As rivers enter the unconstrained reach from a canyon section, the waters slow as they spread across the floodplain surface, depositing sediment and allowing riparian plants to establish and grow. It is the ecological processes in unconstrained flood plain reaches which are responsible for most of the diversity and productivity of river systems.

River flows change through time as rain events or the melting of winter snowpack causes flooding. Flood events reshape the floodplain surface, causing the river to cut new channels as it abandons old routes.

Figure 1. The shifting habitat mosaic of a river in Russia. Photo by S. Chilcote

Through time, growing riparian vegetation reinforces islands and bars while dead vegetation inputs large amounts of wood into the river, further redirecting the river's course.

As surface waters of the river change channels, shallow groundwater continues to flow through the large cobbles that used to be the river bottom. This groundwater is isolated from changes in air temperature. Also, nutrients accumulate in the water because the absence of light restricts uptake by plants. This shallow groundwater resurfaces at various points down stream in the floodplain, creating areas of the river that are consistent in temperature and rich in nutrients. These areas become hotspots of biodiversity and productivity in the flood plain.

Changes in main channel, groundwater springs, and ponds on the floodplain surface create a patchwork of different environmental conditions that is commonly referred to as a *habitat mosaic*. The exact structure of this mosaic changes through time (both within and between years) with changes in flow and vegetation patterns, creating a shifting habitat mosaic. Organisms have evolved under these shifting habitat conditions which, although they change where they are, generally are available in similar forms and amounts. In fact, organisms have come to rely on the shifting habitat mosaic.

Why is the shifting habitat mosaic important?

As a result of the shifting habitat mosaic, floodplains are hotspots of productivity. Algae blooms in the nutrient rich water when it resurfaces after flowing underground. Bugs fall off of trees feeding the fish. Wood and leaves enter the river from the riparian vegetation, feeding the bacteria and bugs, and providing places for organisms to hide.

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The shifting habitat mosaic provides these abundant energy resources as well as a range of habitat types and conditions in close proximity to each other. This means that there are suitable conditions for any life stage of an individual organism, whether it is an egg, juvenile, or adult of an insect, amphibian or fish. It also means that a greater variety of a particular type of organism can live in a smaller area because there are likely to find preferable conditions. A variety of habitats increased species biodiversity as well as supports the successful reproduction of individual species.

Flood plains are vital to all kinds of organisms: aquatic, terrestrial, and avian. For example, in the US Pacific Northwest, 29% of wildlife species are riparian obligates. In northern Colorado, 82% of all birds breed in riparian vegetation. In Switzerland, 80% of all fauna occur in flood plains (Tockner and Stanford, 2002). The shifting habitat mosaic of rivers is the basis for the healthy ecological function, productivity, and biodiversity of riverine systems.

Humans in the riverscape

It is estimated that the services provided to humans by a hectare of floodplain area, such as disturbance regulation, water supply, and water treatment, is worth an average of $19,580 per year. In comparison, forests are only valued at $969 per hectare per year and croplands are even lower at $92 per hectare per year (Tockner and Stanford, 2002). Yet, flood plains only cover 1.4% of the land surface. (Tockner and Stanford, 2002).

Despite their innate value, floodplains are among the most impacted landscapes on earth. Humans plant their crops on the valley floors because of the fertile soils and flat terrain. Human build their houses and cities in valley bottoms because of the suitable terrain and easy access to transportation corridors.

Figure 2. Example of floodplain alteration in Portland, Oregon and Vancouver, Washington. Image courtesy of Google Earth.

In Europe and Asia, 60-90% of the entire floodplain corridor has been transformed to cropland or urbanized (Tockner et al, 2008). It is the ecological processes in unconstrained floodplain reaches that are responsible for most of the diversity and productivity of river systems. Human activities that alter the flow of water and the freedom of a river to move across the cross the floodplain surface undermine the ecological foundation and integrity of rivers. In doing so, we lose the shifting habitat mosaic of flood plains, the very thing that gives rivers their ecological and human value.

References

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Tockner, Klement, Stuart E. Binn, Christopher Gordon, Robert J. Naiman, and Jack A. Stanford. 2008. Flood plains: critically threatened ecosystems. Aquatic Ecosystems Trends and Global Prospects. N.V.C. Polunin. Cambridge University Press: 45-61, Chapter 4.

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