Stream Crossings and Climate Change: Part 1

Bulletin Synopsis *August 2014*

The design and construction of forest road stream crossings should consider (1) how to build resilient structures in anticipation of changing precipitation patterns and (2) how to minimize fragmentation of streams for aquatic species that may need to seek new cold water refuges. Emerging approaches link infrastructure and ecological resiliency by designing structures that account for stream function and form.

Changing Precipitation Patterns

The warming of the atmosphere and the oceans have combined impacts that are causing long term changes in global precipitation intensity and regional precipitation totals:

- A warmer atmosphere can hold more water vapor, which has led to an increase in the percentage of precipitation falling in heavy precipitation events – this trend is projected to continue.
- A warmer atmosphere and increasing sea surface temperatures are increasing evaporation rates. Over land, especially in drier regions, this can exacerbate drought.
- As sea surface temperatures increase, there is more energy to fuel stronger tropical storms, hurricanes, and extra-tropical coastal storms.
- The amount of total annual precipitation is changing, with regions such as the northeastern U.S. and Canada receiving more and regions like the southwestern U.S. receiving less.

As climate continues to warm, it is likely that historic precipitation rates and frequencies will become a less reliable predictor of future precipitation patterns. To provide insight on changes in extreme precipitation, the Northeast Regional Climate Center created a web-based tool – the data indicate that what was considered a 100-year storm event in the northeast in 1950 is now likely to occur twice as often.

The Role of Watershed Characteristics and Conditions

Changing precipitation patterns are affecting regional flood trends – generally decreasing in the Southwest and increasing in the Northeast and Midwest U.S. There is also variation within regions, based on differing watershed characteristics (soil moisture, topography, ground cover) and local precipitation. Watersheds with steep slopes and stream channels that rapidly concentrate flow are conducive to flash flood events – these are exhibiting increases in flooding as heavy downpours become more prevalent.

Linking Infrastructure and Ecosystem Resiliency

A properly designed crossing (1) maintains connectivity for upstream and downstream movement of fish and other aquatic organisms, (2) maintains natural flow regimes, and (3) supports the transport of organic and inorganic materials. Crossings that match the slope of the stream, span the full width of the stream, and have natural stream bed materials through the structure are likely to address these concerns.

Inclusion of these design elements will often lead to selection of open-bottom structures, such as pipe arches or bridges (as opposed to culverts), and result in a wider opening than would be selected based purely on hydrologic concerns – this has the added benefit of accommodating larger flow events.

Managing Risk

In this changing environment, minimizing risk and costs associated with stream crossings should include:

- **Using temporary structures** where feasible, to reduce flooding exposure and eliminate long-term maintenance and stream impacts.
- Designing new (or upgrading old) structures to **address changing precipitation patterns and ecosystem function** – minimize structure failure and the need to rebuild prematurely.

A synopsis of a recent Manomet evaluation of the costs and benefits of stream crossing best management practices is available here (pg. 44, Table 5).

Click on the sub-headings above to go directly to the corresponding section of the full bulletin, or read the full bulletin online:
http://climatesmartnetwork.org/2014/08/stream-crossings-and-climate-change-part-1/