American Society of Adaptation Professionals

Institute for Sustainable Communities

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Prize for Progress
2017

SNAPSHOT

Preparing for Extreme Rainfall on the Chequamegon-Nicolet National Forest

LEAD ORGANIZATION
U.S. Forest Service

STATE
Wisconsin

TYPE OF ADAPTATION
Watershed

Challenges

Due to climate change, mega-storms have occurred with increasing frequency across the Midwest over the past 60 years, and this pattern is expected to continue. In recognition of these more severe storms and the negative impact they have on waterways, roads, and natural habitats throughout Wisconsin, the U.S. Forest Service selected the Chequamegon-Nicolet National Forest as a pilot site to demonstrate the value of vulnerability assessments and strategically prioritize climate adaptation action. The project focused on two key watersheds, Marengo River and Twentymile Creek, for major infrastructure upgrades, including stream crossing upgrades, culvert replacement, streambank stabilization, and tree planting.

IMPACT AREAS

Flooding, Forest, Natural Systems, Extreme Precipitation, Storm Damage

CHALLENGES

Mega-storms have been occurring with increasing frequency in the Midwest

SOLUTIONS

Culverts with a longer lifespan, better debris passage, less failure, and less maintenance

Solutions

In the spring of 2016, the project team upgraded natural and built infrastructure, including 20 culverts, throughout the pilot area using stream simulation design—a method of infrastructure improvement that reflects a stream's natural conditions and processes. This approach provides continuity at stream crossings, allowing aquatic organisms to pass up and downstream uninhibited while water, wood, and sediment pass downstream at their natural rate.

Results

Following the upgrades, a mega-storm in July 2016 led eight counties to declare a state of emergency and resulted in an estimated $30 million in damages. In Chequamegon-Nicolet National Forest, the storm caused considerable damage, washing out a dozen road-stream crossings, damaging three bridges, and severely damaging streams, rivers, and wetlands in the area. However, of the 20 culverts upgraded through the pilot study, 17 withstood the storm, marking a demonstrable success for the upgraded infrastructure and storm impact modeling.

Cost Savings

While advanced stream simulation culverts cost more than traditional culverts initially, these costs are often mitigated by a longer lifespan, better passage of ice and debris, less frequent failure, and reduced maintenance costs.[1]

Protecting Ecosystems and Infrastructure

In addition to cost savings, stream crossings that withstood the July 2016 flood were critical points of access for emergency responders and evacuation. Once the storm abated, they allowed access to the rest of the road system for rapid emergency repairs.

Lighter Touch on the Land

Stream simulation culverts avoid much of the environmental damage caused by narrow or undersized culverts, which build up a high head at moderate flood flows, creating large scour pools downstream and greater pressure and turbulence on the structure. When these culverts fail, they send tremendous amounts of water, sand, and gravel downstream, causing substantial erosion and sedimentation. When they are set too high, they restrict the movement of aquatic organisms.

Upcoming Projects

Though the new culvert system mitigates some risk of erosion and sedimentation, the U.S. Forest Service is considering future projects to stabilize eroding riverbanks and shade streams by planting pine seedlings. This helps address continued concerns about soil and mineral removal and deposits, as well as the subsequent changes in water quality.

1 *O'Shaughnessy, Eric, Matthew Landi, Stephanie R. Januchowski-Hartley & Matthew Diebel, 2016. Conservation Leverage: Ecological Design Culverts also Return Fiscal Benefits, Fisheries, 41:12, 750-757.*

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