Effects of Forest Roads on Mature and Old-Growth Forests

Temporary Road, Four Forest Restoration Initiative, Coconino National Forest. Photo Credit: WildEarth Guardians

Roads are necessary for the administration of national forests, but not for the protection of mature and old-growth forests and trees. Roads indisputably also harm the aquatic and terrestrial environments they cut through at multiple scales. The construction, maintenance, expansion, and decommissioning of roads can in many ways reduce the ecological integrity of the sites being protected or managed. This aspect of forest management and the ecological consequences of forest roads are well documented and include a range of harmful aquatic and terrestrial effects along with an increased risk of floods and wildfires.

Roads contribute more sediment to streams than any other land management activity on Forest Service lands and have dramatic and lasting impacts on fish and aquatic habitat. The construction and presence of forest roads can dramatically change the hydrology and geomorphology of a forest area leading to reductions in the quantity and quality of aquatic habitat. Compacted roadbeds reduce rainfall infiltration, intercepting and concentrating water runoff, and providing a ready source of sediment for transport to waterways. Sedimentation in stream beds has been linked to decreased juvenile fish densities, loss of winter carrying capacity, increased predation of fish, and reductions in macro-invertebrate populations that are a food source to many fish species. The presence of roads close to streams inherently means the absence or reduction of the number of trees in riparian zones needed for large wood recruitment, bank stabilization, and stream-side shade—negatively affecting fish habitat.

Roads and motorized trails impact wildlife through a number of mechanisms including: direct mortality (poaching, hunting/trapping), changes in movement and habitat-use patterns (disturbance/avoidance), as well as indirect impacts including altering adjacent habitat and interference with predator/prey relationships. Numerous studies show that roads reduce the abundance, diversity, and distribution of several forest species. It is well documented that beyond specific road density thresholds certain species will be negatively affected, and some risk being extirpated.

Climate change is further compounding the negative impacts of forest roads as more extreme weather events are leading to increased flood severity, more frequent landslides, changing hydrographs, and changes in erosion and sedimentation. Roads and other infrastructure that are near or beyond their design life are at considerable risk of damage from flooding and geomorphic disturbance (e.g., debris slides). If road damage increases as expected, it will have a profound impact on access to Federal lands and on repair costs. Forests fragmented by roads will likely demonstrate less resistance and resilience to stressors, like those associated with climate change. One of the most well documented impacts of climate change on wildlife is a shift in the ranges of species. As animals migrate, landscape connectivity will be increasingly important, and reducing road densities in key wildlife corridors will increase wildlife resiliency.

In addition to climate change, the intersection between forest access and human wildfire ignitions is rightfully gaining more attention. The Congressional Research Service found that 89% of wildfires from 2018-2022 were human-caused. Another study found that humans ignited four times as many fires as lightning. This represented 92% of the fires in the eastern United States and 65% of the fire ignitions in the western U.S. Forest roads can increase the occurrence of human-caused fires, whether by accident or arson, and road access has been correlated with the number of fire ignitions. Forest roads create linear gaps with reduced canopy cover, and increased solar radiation, temperature, and wind speed that influence ignition risk and burn severity. Invasive weeds and grasses common along roadsides also create fine fuels that can be combustible. These edge effects can change microclimates far into the forest. After a forest fire, roads that were previously well vegetated often burn or have been bladed for fire suppression access or firebreaks leaving them highly susceptible to erosion and weed invasion. Roads are a source of chronic erosion following a fire, and pulses of hillslope sediment and large woody debris can result in culvert failures.

The ecological benefits, especially increased watershed resilience, from reducing the forest road system and performing critical maintenance are widely accepted. Reconnecting fragmented forests has been shown to benefit native species. Decommissioning roads in riparian areas may provide further benefits to salmon and other aquatic organisms by permitting reestablishment of streamside vegetation, which provides shade and maintains a cooler, more moderated microclimate over the stream. Road decommissioning restores wildlife habitat by providing security and food such as grasses, forbs, and fruiting shrubs. Upon road decompaction, vegetation and soils can develop more rapidly and sequester large amounts of carbon. Research on the Clearwater National Forest in Idaho estimated total soil carbon storage increased six-fold on decompacted roads compared to untreated abandoned roads. Further analysis found that recontouring roads had higher soil organic carbon than decompacting the roads. Undoubtedly, there are numerous

benefits from reducing the forest road system and controlling motorized access. The path to this reduction should favor road decommissioning over storage or closure.

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