Recovery Potential Metrics
Summary Form

Indicator Name: CORRIDOR ROAD CROSSINGS

Type: Stressor Exposure

Rationale/Relevance to Recovery Potential: Road crossings are linked with degraded condition for several reasons, but because most crossings are likely permanent, their relevance to recovery potential is also linked to whether the degraded conditions can be managed or mitigated for. Road crossings are linked with channel destabilization, tree collapse, hanging tributary junctions as a result of variable incision rates, and erosion around artificial structures including bridges. Local scouring alters sedimentation and deposition processes, and more sediment and chemicals enter streams where a road crosses. Wetland road crossings often block drainage passages and groundwater flows, effectively raising the upslope water table and killing vegetation by root inundation, while lowering the downslope water table. Small road crossings for which the culverts do not allow upstream fish passage and constrict the available useful habitat for salmonids already vulnerable to other impacts.

How Measured: Mean number of crossings per mile, or number of crossings per area of the corridor.

Data Source: Land cover or transportation GIS data are widely available. National road and stream data is obtainable through the National Atlas (See: http://nationalatlas.gov/). Landsat data is also often used for road and stream data and can be accessed through the USGS Earth Explorer (See: http://edcsns17.cr.usgs.gov/EarthExplorer/). ESRI offers a free roads dataset that can be opened in ArcMap (http://www.arcgis.com/home/item.html?id=3b93337983e9436f8db950e38a8629af). Data on unimproved road crossings in remote parts of federal lands may need to be obtained through the land management agency.

Status/Comments: Operational, widely applicable to small to medium-size rivers, streams, and wetlands.

Examples from Supporting Literature (abbrev. citations and points made):

- (ourso and frenzel 2002) As contributing factors to a subbasin's impervious area, storm drains and roads appeared to be important elements influencing the degradation of water quality with respect to the biota.
- (Paul and Meyer 2001) Other geomorphic changes of note in urban channels include erosion around bridges, which are generally more abundant as a result of increased road densities in urban channels (Douglas 1974). Bridges have both upstream and downstream effects, including plunge pools created below bridge culverts that may serve as barriers to fish movement. Knickpoints are another common feature of urban channels. These readily erodeable points of sudden change in depth are created by channel erosion, dredging, or bridge construction and are transmitted throughout the catchment, causing channel destabilization (Neller 1988). Other features include increased tree collapse, hanging tributary junctions as a result of variable incision rates, and erosion around artificial structures (e.g., utility support pilings) (Roberts 1989) (340-341). Changes in the hydrology and geomorphology of streams likely affect the hydraulic environment of streams, altering, among other things, the velocity profiles and hyporheic/parafluvial dynamics of channels. Such changes would affect many ecological processes, from filter-feeding organisms (Hart&Finelli 1999) to carbon processing and nutrient cycling (Jones & Mulholland 2000) (340-341).

- (Forman and Alexander 1998) Wetland road crossings often block drainage passages and groundwater flows, effectively raising the upslope water table and killing vegetation by root inundation, while lowering the downslope water table with accompanying damage to vegetation (116, 118) (218).
- (Forman and Alexander 1998) Streams may be altered for considerable distances both upstream and downstream of bridges. Upstream, levees or channelization tend to result in reduced flooding of the riparian zone, grade degradation, hydraulic structural problems, and more channelization (17). Downstream, the grade change at a bridge results in local scouring that alters sedimentation and deposition processes (17, 49). Sediment and chemicals enter streams where a road crosses, and mathematical models predict sediment loading in and out of reaches affected by stream crossings (5). The fixed stream (or river) location at a bridge or culvert reduces both the amount and variability of stream migration across a floodplain. Therefore, stream ecosystems have altered flow rates, pool-riffle sequences, and scour, which typically reduce habitat-forming debris and aquatic organisms (218).
- (Freeman et al., 2007) One of the many factors limiting coho and steelhead productivity are small road crossings for which the culverts do not allow upstream fish passage and thus constrict the available useful habitat. Northcote and Hinch (2004) found that stream crossings were ‘‘perhaps the greatest environmental impact of forestry on fish migration.’’ In British Columbia alone, there are 225,000 stream crossings with approximately 10,000 new crossings added each year (Harper and Quigley, 2000). By restricting access to headwater streams, fish passage barriers at road crossings force spawning females to select less optimal spawning sites and crowd fry and juveniles into downstream habitats where they are more susceptible to predation (11).