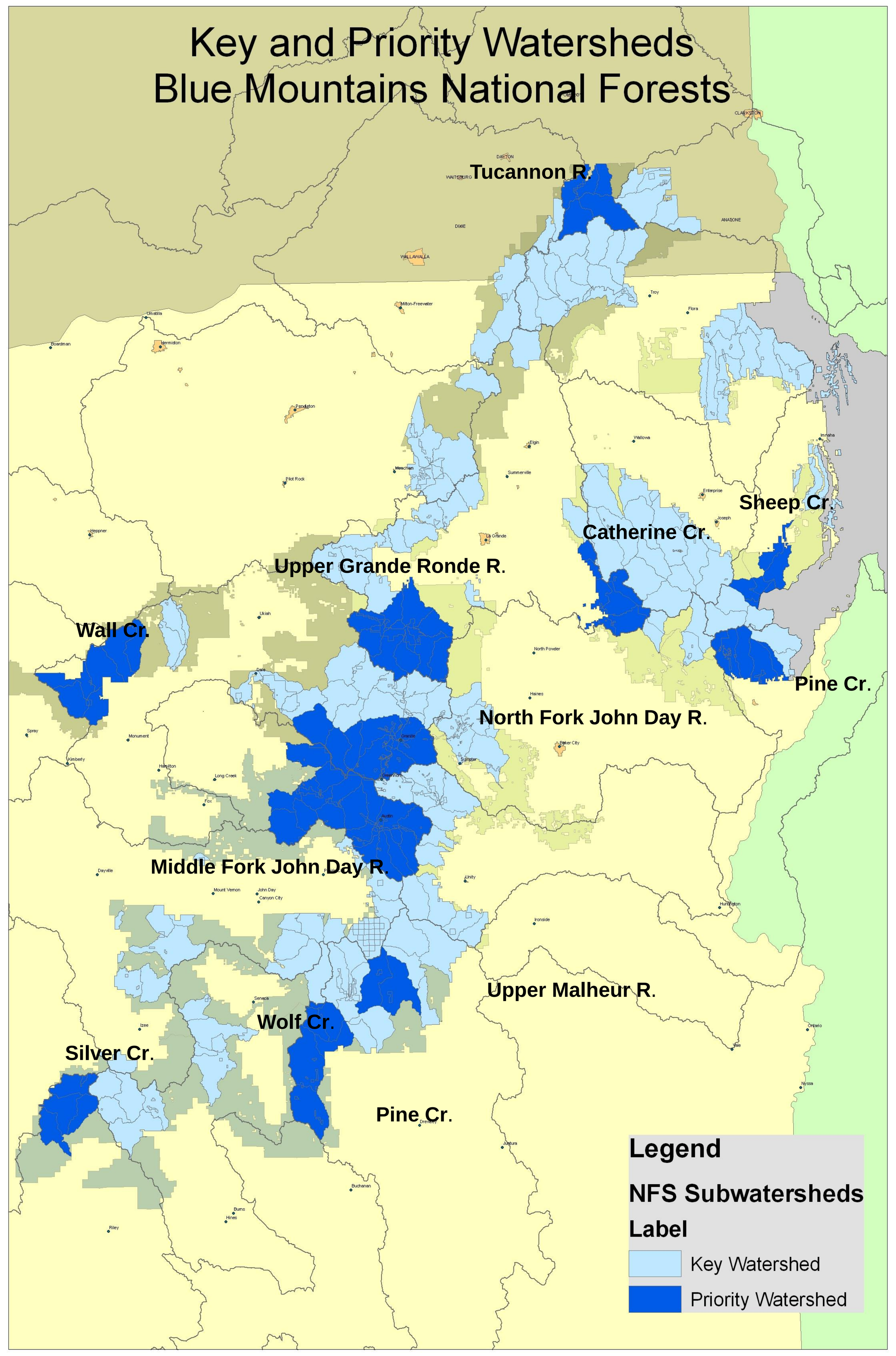
Watershed Restoration



- *Key watersheds* have a combination of good watershed conditions and strong focal species population strength, and/or have high potential for restoration
    - Watershed condition factors: upland forest conditions, forest road extent and locations, riparian and aquatic habitat conditions

Table 1. Key watersheds identified by National Forest

National Forest	Acres	land base (%)
Malheur	937,000	54
Umatilla	810,000	58
Wallowa-Whitman	1,481,000	62

- *Priority watersheds* are key watersheds that the forest have selected as priorities for focused watershed, riparian and aquatic habitat restoration
    - Forests may change priority watersheds at any time
    - New priority watersheds will be selected as restoration is completed in priority watersheds
- Restoration needs for specific watersheds are determined through watershed analysis, watershed restoration action plans, water quality restoration plans, and recovery plans for ESA-listed aquatic species
- *All projects will tier to applicable Forest Plan desired conditions.*
- Monitoring tracks progress towards desired conditions

Watershed Conditions, Water Quality and Water Uses

Blue Mountains National Forests Plan Revision

Watershed conditions are a function of the condition and properties of vegetation, soils, riparian habitats, stream channels, aquatic habitats, and characteristic of the disturbance regime.

Watershed conditions are addressed in the DEIS using estimates of the change in vegetative conditions, grazing, roads, and the restoration of riparian and aquatic habitats.

Watershed conditions are expected to improve under all alternatives, and is displayed in the DEIS by the number of watersheds in improved condition.

Improved watershed and riparian habitat conditions will directly or indirectly contribute to improved water quality on the national forests.

All alternatives will:

- Promote the recovery or improvement of:
    - Riparian and aquatic composition, structure and ecosystem function
    - Watershed function
    - Physical, biological and chemical processes
    - Water quality
- Contribute to the maintenance and recovery of species diversity by restoring:
    - Upland vegetation and soils,
    - Riparian and aquatic habitats, and
    - Roads impacting the stream network.

Past research (Lee et al. 1997) demonstrated that high road density was directly correlated to degraded watershed and aquatic habitat conditions, as well as reduced population strength of resident fish species across the Columbia River basin.

More recently, methods have been developed that indicate a small percentage of forests roads is responsible for a high percentage of road-related increases in sediment delivery to streams (Black et al. 2010). Application of this method on one watershed on the Umatilla national forests showed that as little as 10 percent of the forest road network is responsible for as much as 90 percent of road-related sediment delivery to streams. These roads are called *hydrologically connected* roads.

Under all alternatives, the forest would seek to reduce road-related impacts to watersheds, aquatic habitats, and aquatic species by focusing on the roads with the highest impact to these resources.

Water Quality

- Water quality on NFS lands is generally good
- Stream temperatures are the primary water quality concern on NFS lands
- Within Blue Mountains subbasins, there are 4,148 miles of water quality limited (303d) streams
    - 1,237 miles are on NFS lands
    - 2,911 miles are downstream of national forest boundaries or on private lands within national forest boundaries.
    - 81 percent of stream miles are listed for stream temperature
    - 3 percent of streams are listed for high suspended sediment loads or turbidity

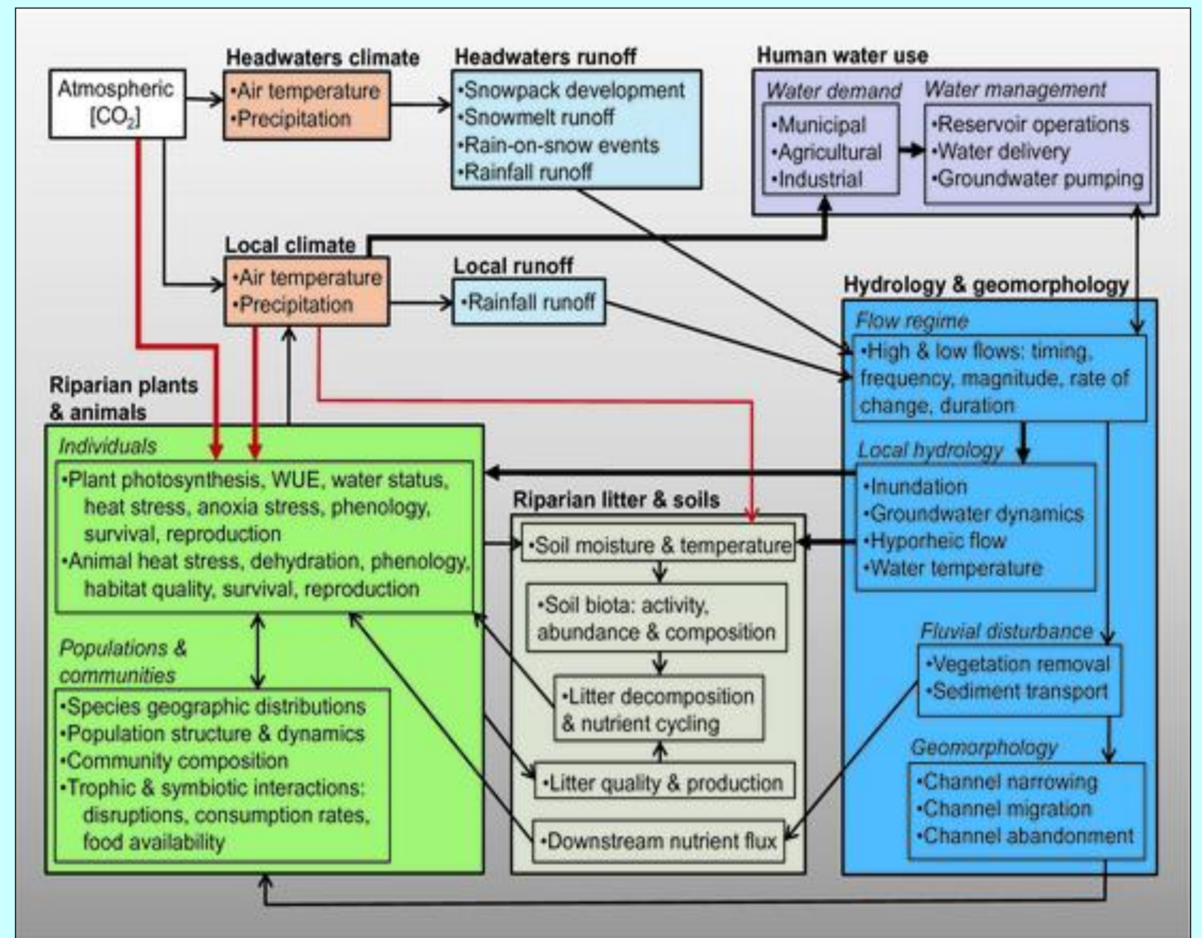
Roads affect the hydrology of forest watersheds and are recognized as a leading source of sediment to forest streams, resulting in reduced water quality, and degraded aquatic habitat conditions.

Water Availability and Water Uses

- Total streamflow from the Blue Mountains averages 7.4 million acre-feet per year
    - About 70 percent of annual streamflow (5.2 million acre-feet) originates within national forest system lands
- By volume, the largest water rights within national forest system lands are for instream flow
- Most water rights within national forest system lands are for livestock watering and use less than 1/10th of 1 percent of total streamflow
- Water is used for domestic livestock, irrigated agriculture and human use in areas downstream of national forest system lands.
    - 97 percent of downstream use is for irrigated agriculture
    - Withdrawals for irrigation total 2.6 million acre-feet, or about 32 percent of average streamflow
    - About 1 percent of total water withdrawals are for domestic and public water supplies
- Most water use for irrigation occurs between April 1st and October 15th
    - Irrigation water withdrawals from Blue Mountain streams are about 30 percent of total streamflow during the irrigation season (April 1 to October 15), but exceed 50% in 7 subbasins (Burnt, Powder, Walla Walla, Umatilla, Willow, Silvies, Silver)
- Irrigation water use is greatest between July and September and withdraws about 57% percent of total seasonal streamflow from Blue Mountains streams
    - Irrigation water use between July and September exceeds 75 percent of seasonal streamflow in 9 basins (Burnt, Powder, Upper Grande Ronde, Walla Walla, Umatilla, Willow, Upper John Day, Silvies, and Silver Creek

Climate Change

- Average annual temperatures in the Blue Mountains have risen about 1.8°F since 1900 and 1.0°F since 1970
- Temperatures are expected to increase from 3.6 to 7.2°F by 2100,
- Precipitation is expected to increase slightly, but more will come as rain rather than snow
    - This change alone is likely to result in lower late-summer water availability and stream flow
- Winter precipitation is expected to increase, summer precipitation is expected to decrease
- Mountain snowpack is currently responsible for 70 percent of annual streamflow in the Blue Mountains
    - Mountain snowpack is expected to decline by as much as 65 percent by 2080
- Higher winter and spring temperatures are expected to result in earlier runoff and lower late-season stream flow
    - The effect of this change will be greatest in the river basins with the highest current water use



Changes in temperature and precipitation driven by increases in atmospheric CO_2 will directly or indirectly affect local climate and watershed functions (from Perry et al. 2012)

- Observed changes in the Blue Mountains include:
- Average April-1 snow water content is 25% lower over the period 1970 to 2010. No increases have been recorded at any of the 26 long-term SNOTEL sites over the same period.
- At the 16 stream gages with the longest records, March stream flow is higher at all 16 sites, and June stream flow is lower at 15 of 16 sites.
    - This change is generally consistent with increased winter and spring temperatures across the Blue Mountains and is similar to observed changes in spring runoff throughout the western U.S.
- Since 1950, 83 percent of fall and winter peak flows at 30 sites in northeast Oregon and 23 percent of spring peak flows have resulted from rain events.
- This change is generally consistent with increased winter and spring temperatures across the Blue Mountains and is similar to observed changes in spring runoff throughout the western U.S.
- The frequency and magnitude of winter peaks is expected to increase and the volume of snowmelt is likely to decrease over this century