



Climate Impact, Vulnerability and Adaptation

Overview

Broad scale changes in climate already impact local conditions across the West and are likely to continue and accelerate in the coming decades.

Communities need to plan for such changes in order to continue to provide vital services to local residents and to support the economy. Integrating climate change science into water management planning is one step towards preparing people for climate change.

Changes include:

- 1) the timing and availability of water
- 2) changes in tree and wildlife species
- 3) changes in wildfire frequency and intensity

Overall, managers in the Southern Sierra can expect:

- **warmer** temperatures
- **declining** snowpack
- a dramatic **shift** in timing for runoff
- **shifts** in major types of vegetation
- With less certainty, **changes in precipitation** and **wildfire patterns** are also likely

Temperature – Average annual temperature in the Southern Sierra is expected to rise about 2° C (4° F) by mid-century and 3-4° C (5-7° F) by late century. Summer temperatures are expected to rise slightly more (4-6° C; 7-13° F) than winter temperatures (3-4° C; 5-7° F) by the end of the century.

Precipitation – Precipitation projections were more variable than temperature projections. Drier conditions are expected owing to greater evaporation and evapotranspiration.

Runoff – precipitation increasingly falls as rain instead of snow

- greater runoff Jan-April, and lower runoff May-September
- annual average precipitation that may increase, decrease, or remain similar to historic levels.

Snowpack – 75% decline in snowpack by mid-century and 85% by late century.

Climate water deficit – water deficit is expected to increase by about 20% by mid-century and 40-50% by late century owing to increased temperatures and higher evaporation.

Vegetation – High elevation alpine zones will become vegetated with subalpine trees. Mixed conifer forest is expected to increase in area. Grasslands and woodlands at lower elevations would become drier and many species would become extinct or migrate.

Wildfire – When compared to the historic period (1961-1990), biomass consumed by wildfire is expected to **double** or **triple** by mid-century and triple or quadruple by late century. The area burned, however, is only expected to **increase 20-65%** by late century.

VULNERABILITIES

- Seasonal changes in runoff and the timing of water availability for storage and human consumption leave human communities vulnerable to water shortages and cost increases.
- Reduced water availability may leave recreation-based industries vulnerable to economic hardship or collapse.
- Reduced water availability may leave plant communities vulnerable to type conversion or extinction.
- Increased warming may leave animal species vulnerable to extinction.
- Drought, severe storms, wildfire, and lower summer flows leave water quality vulnerable to degradation.

ADAPTATION STRATEGIES

Strategies that reduce the impacts of climate change by addressing specific goals and vulnerabilities will allow continued functioning of natural systems while also providing water resources for human populations.

Climate change will likely exacerbate existing stressors on human and natural communities. Natural disasters such as

fires and floods may be exacerbated by land management practices. “No regrets” strategies may include reducing existing stressors to services functioning watersheds provide.

Some common water resources and watershed function adaptation strategies include:

- Residential and agricultural conservation measures to reduce water demand.
- Reduce water demand by changing the types of crops grown in the region
- Increase late summer flow through wetland and meadow restoration
- Restore watersheds and wetlands to increase water storage and flood abatement potential and reconnect floodplains with watercourses.
- Maintain water quality by reducing activities that lead to soils compaction and erosion, such as overgrazing, timber harvest, and roads.
- Diversify local economy to become more resilient in the face of drought and water insecurity.

Common Themes

- 1) Climate change vulnerability will likely occur on a scale at least as large as watersheds
 - a. Adaptation and mitigation strategies may need to be planned and implemented at large scales
 - i. Whole watershed collaboration approach on planning, understanding management/climate impacts and project implementation
 - b. Many moving parts – natural resources – everything connected
 - i. Requires integration
- 2) Challenges in the southern Sierra include capacity, infrastructure and population
 - a. Need for watershed plans and collaborative project implementation
- 3) No regrets strategies, Co-benefits, conjunctive uses
- 4) Resiliency

5) Climate change will impact other regions/stakeholders, etc