

REPORT

C.A.S.T.

Colorado River Basin: Action for Streams & Tributaries

Group 12

UAPP411/611: Regional Watershed Management

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Mission Statement

C.A.S.T. is committed to restoring, protecting, and sustaining the water resources of the Colorado River Basin. The region is currently facing a series of environmental challenges, including water scarcity, habitat degradation, and the impacts of climate change. These factors have put tremendous strain on the river's capacity to meet the needs of agriculture, urban populations, wildlife, and recreational users.

Our mission is to develop and implement a comprehensive set of strategies that address these issues while getting a collaboration between key stakeholders, such as federal and state agencies, water users, environmental groups, and local communities. Through these efforts, we aim to ensure that the Colorado River Basin remains a pivotal resource for all people now and in the future.

Our goal is to complete the restoration and sustainability efforts by 2040. This includes increasing water storage, restoring critical habitats, promoting water conservation, and limiting the negative impacts of invasive species and climate change.

Background

Geographical Context

The Colorado River Basin covers a vast area of approximately 246,000 square miles, stretching across seven U.S. states: Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. The river's path runs from the Rocky Mountains of Colorado down to Mexico, providing critical water to more than 40 million people, including cities like Phoenix, Las Vegas, and Los Angeles.

Map:



The river also plays a crucial role in agriculture, supplying water to nearly 5 million acres of farmland. Additionally, it supports a wide range of ecosystems, including wetlands, riparian zones, and desert habitats, making it one of the most ecologically important rivers in North America. This is why this issue was so important to our group.

Physical Characteristics of the Region

The Colorado River originates in the Rocky Mountains of Colorado, flowing through the arid regions of the southwestern United States before reaching the Gulf of California. The river's flow is heavily influenced by snowmelt from the mountains, with peak flow occurring in the spring as snow accumulations melt. However, flow rates have been declining over the past several decades due to rising temperatures, reduced snowpack, and increased evaporation.

- **Key Tributaries:** Green River, Gunnison River, San Juan River, and others feed into the Colorado River, contributing to the overall flow.
 - **Water Flow:** The river's flow has decreased significantly from an average of 15,000 cubic feet per second in the 20th century to around 12,000 cubic feet per second in recent years.
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Water Quality and Composition

The quality of water in the Colorado River has declined in recent decades due to various pollutants, including agricultural runoff, wastewater discharges, and industrial pollutants. High levels of nitrogen and phosphorus from fertilizers and manure runoff contribute to algal blooms and reduced oxygen levels in the water.

- **Salinity:** Salinity has increased, making water unsuitable for agriculture and drinking. This is due to the over-extraction of water, combined with the evaporation of water that leaves behind salts.
 - **Pollution Sources:** Urban and industrial runoff, along with wastewater discharges, have contributed to a rise in heavy metals and other contaminants in the water. The effects of these pollutants are widespread, affecting not only water quality which is bad for us, but also sea life.
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Biological Diversity

Ecosystem and Species Diversity

The Colorado River Basin supports a wide variety of species, many of which are constantly in the region. Native species like the Colorado pikeminnow, razorback sucker, and southwestern willow flycatcher are critically endangered due to habitat loss, water diversion, and pollution.

- **Native Species:** These species rely on the river's health for survival, but their numbers have lowered as a result of degraded habitats and disrupted water flows.
- **Invasive Species:** Non-native species, such as the tamarisk tree and zebra mussel, have further stressed the river's ecosystem. Tamarisk, for example, consumes large amounts of water which is not good.

Challenges to Biodiversity

- **Habitat Degradation:** Dams, water diversion, and pollution have severely altered the river's natural habitat, resulting in the loss of wetlands, riparian zones, and critical fish habitats.
- **Endangered Species:** Species like the Colorado pikeminnow are at risk of extinction due to habitat fragmentation and water flow alterations.



Picture of a Colorado Pikeminnow

Ecological Health and Restoration

Efforts to restore habitats, such as wetland restoration projects and the removal of invasive species, are critical to improving the river's ecological health. For example, the Colorado River Delta Restoration Project has focused on restoring the river's delta in Mexico to improve habitat for native species.

Human Activities and Ecological Factors

Water Use and Demand

The Colorado River is heavily relied upon for irrigation, urban water supply, and industrial uses. Approximately 70% of the river's water is allocated for agricultural use, with crops like alfalfa, cotton, and corn requiring significant irrigation. Urban areas like Las Vegas and Phoenix also rely on the river for drinking water, placing further strain on the system.

Infographic:

- **Water Usage Breakdown:** Agriculture (70%), Urban (20%), Industrial (10%).

Agricultural Impact

The agricultural sector is both a significant user of water and a contributor to pollution in the river. Practices such as over-irrigation and the use of chemical fertilizers have led to water quality issues and reduced water availability.

- **Water-Efficient Practices:** The promotion of drip irrigation and sustainable farming practices can help lessen these issues.

Urban Growth and Water Demand

Urban growth in cities like Phoenix and Las Vegas is making the strain on water resources worse. As populations increase, so does water demand for household use, recreation, and industry. The overreliance on the river for drinking water, coupled with inefficient water distribution systems, has led to reduced water availability for both ecological and human needs.

Problems

P1: Declining Water Availability

Causes:

- Climate change has caused a decrease in snowpack and earlier snowmelt.
- Rising temperatures have increased evaporation rates, reducing water levels in the river.
- Increased water usage by agriculture, cities, and industries has reduced the available flow.

Goals:

- Increase Water Efficiency
- Expand Water Reuse and Supply
- Improve Water management and cooperation between States

Solutions:

- Switch irrigation system to drip irrigation
 - The majority of irrigation systems use flood irrigation which is uncontrolled, intensive water placement
 - Switching to drip irrigation precisely puts water into the roots of the plant and conserves water drastically
 - Treating Recycling
 - Treat wastewater and use it for irrigation and industrial use
 - Update the Colorado River Compact
 - Updating the Colorado River Compact could reassign water usage based on population and need
 - Protect Natural Systems
 - Restore wetlands and forests to improve water retention
 - Try to manage wildfires that affect watershed quality
 - Plan for less snowpack
 - This prepares the states that depend on the watershed so that way they can plan and preserve water accordingly
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P2: Habitat Loss and Ecosystem Degradation

Causes:

- Water diversion, dams, and irrigation systems have altered the river's natural flow.
- Urbanization and agriculture have encroached on critical habitats.
- Invasive species like tamarisk and Russian olive are disrupting ecosystems.

Goals:

1. **Restore Ecosystem Health:** Improve habitats for wildlife and plants, especially in wetlands and rivers.
2. **Maintain Ecological Services:** Ensure natural services like water filtration and flood control are preserved.
3. **Prevent Further Degradation:** Reduce the impact of human activities like irrigation, urban development, and invasive species.

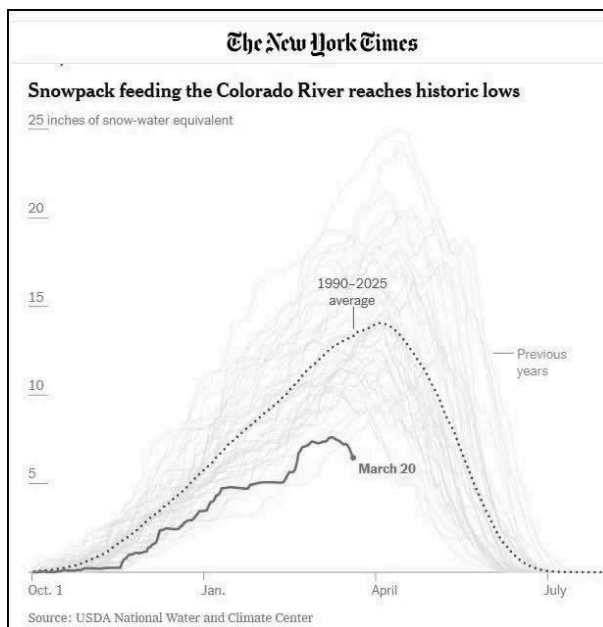
Solutions:

1. **Restoring Natural Water Flow:** Remove or fix dams to allow water to flow more naturally and reconnect ecosystems.
2. **Efficient Water Management:** Implement better irrigation techniques and water conservation methods to reduce strain on river resources.
3. **Invasive Species Control:** Use targeted programs to control invasive species and promote the planting of native vegetation.
4. **Urban Development Regulations:** Enforce stricter development controls near critical habitats to protect wetlands and floodplains.
5. **Collaborative Conservation Efforts:** Work with federal, state, and local governments, as well as communities, to promote sustainable practices and restore ecosystems.



P3: Climate Change Impacts

- **Reduced Snowpack:** Warmer temperatures lead to less snow accumulation, reducing spring runoff into the river.
- **Increased Evaporation:** Higher temperatures cause more water to evaporate from the river and reservoirs, depleting water levels.
- **Prolonged Droughts:** Climate change intensifies droughts, reducing water availability during dry periods.
- **Unpredictable Precipitation:** Changing rainfall patterns make water flow less predictable and harder to manage.
- **Ecosystem Disruption:** Altered water temperatures and flow affect habitats for fish and wildlife, threatening biodiversity.



Goals

1. **Increase Water Availability:** Ensure a reliable and sustainable water supply for all uses in the basin.
2. **Protect Ecosystems:** Maintain healthy aquatic and riparian habitats despite changing conditions.
3. **Adapt Water Management:** Adjust to unpredictable water flow and ensure efficient use during droughts.

Solutions

1. **Enhance Water Storage:** Invest in infrastructure improvements like additional reservoirs

- and water-saving technologies to store more water during wetter years.
2. **Water Conservation:** Promote water conservation efforts in agriculture, industry, and residential areas to reduce demand.
 3. **Climate-Resilient Water Management:** Develop adaptive water management strategies that account for shifting climate patterns and prioritize the most critical needs.
 4. **Restore Ecosystems:** Implement projects that restore habitats, such as wetland and riparian zone restoration, to help ecosystems cope with changes in water availability.
 5. **Research and Monitoring:** Increase research on climate change impacts and implement better monitoring systems to track changes in precipitation, temperature, and river flow for more accurate predictions.
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Goals

Increase Water Storage by 15% by 2040

To address water scarcity, we aim to increase water storage in the Colorado River Basin by 15% by 2040. This will be achieved through the restoration of wetlands, the creation of small reservoirs, and the implementation of rainwater harvesting systems. Restoring wetlands, which can naturally store water, will be a primary method for achieving this goal.

Restore 200 km² of Riparian Habitat by 2035

We aim to restore 200 km² of riparian habitat by 2035 through efforts to remove invasive species, plant native species, and prevent erosion. These efforts will help improve biodiversity and create a better ecosystem along the river.

Enhance Forest Health and Wildfire Resilience by 2035

To battle the increasing threat of wildfires, we plan to work with forestry groups to thin overcrowded forests and promote fire-resistant plants. This will reduce the risk of catastrophic fires that damage ecosystems and degrade water quality.

Reduce Non-Native Species by 50% by 2030

We aim to reduce the presence of non-native species like tamarisk and Russian olive by 50% by 2030. This will be achieved through targeted removal efforts, reforestation with native plants, and better land management practices.

Promote Water Conservation by 2030

To address increasing water demand, we will launch public education campaigns promoting water conservation in urban areas, agriculture, and recreation. This will include incentives for using water efficient technologies and changing consumption habits.

Recommendations

Water Conservation Practices

We recommend implementing drip irrigation, rainwater harvesting, and public education campaigns to promote water-saving practices in urban areas and agriculture. Additionally, water rationing and conservation efforts will need to be prioritized during periods of drought.

Habitat Restoration

Large-scale habitat restoration efforts will be necessary to address habitat loss and ecosystem degradation. This includes the restoration of riparian zones, wetlands, and native plant regrowth, with a focus on removing invasive species and improving water quality.

Climate Change Mitigation

We recommend investing in climate-resilient water management strategies, including reducing greenhouse gas emissions and preparing for future shifts in hydrology. Additionally, improving water storage and infrastructure will help communities adapt to climate change.

Conclusion

The Colorado River Basin faces significant challenges due to water scarcity, habitat loss, and the impacts of climate change. Immediate and long-term action is needed to help make sure the water is a good resource. By implementing the recommendations outlined in this report, we can work towards restoring the river's health and ensuring its availability for future generations.

Sources

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