Environmental **M**anagement **I**nvolving **T**uolumne **E**valuation (EMITE)

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Mission Statement

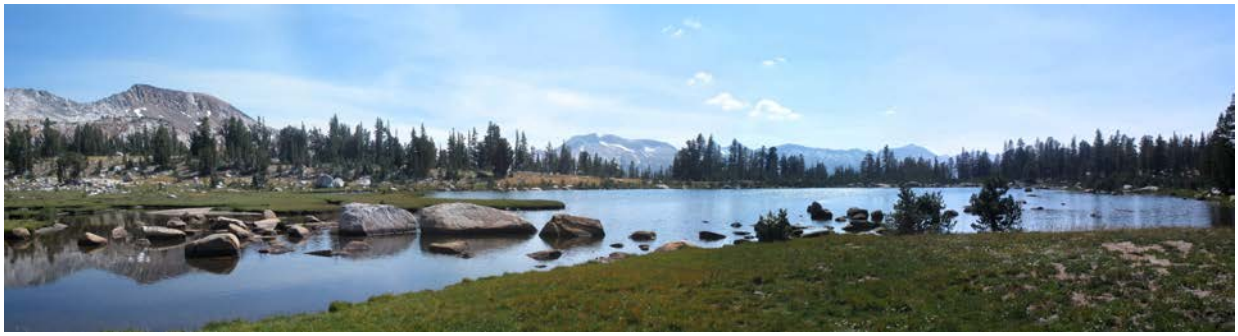
EMITE's mission is to maintain a water quality that is swimmable until 2030 in Yosemite National Park of Southern California. We also aim to prevent erosion and the growth of invasive species that could harm the watershed.

Background

Located in Southern California, east of San Francisco Yosemite National Park was once... The Merced river, which runs through the Yosemite Valley, carved the canyon walls upwards of 3,000 feet deep over 200,000 years ago. The valley used to be filled with glaciers. Up until 15,000 years ago the last glacier melted and created Lake Yosemite. Today the park is 750,000 acres and has 1,600 miles of streams. It habitats over 300 animals that rely on the unique ecosystem for water and their life cycle. Up until the early 1900s, the water in Yosemite was free of fish because of the waterfalls, glaciers, and upstreams system. In the early 1900s and until 1975, fish stocking or bringing non-native species to the streams. The fish caused more harm than good, with the native wildlife unable to defend against these new fish species. The Sierra Nevada yellow-legged frog is endangered with having less than 5% of the species still around. Fish stocking stopped in the 1970s but there are still many fish species still living in the Yosemite Valley.

History

The Valley was first habited by Native Americans until they were pushed out by the miners during the 1849 gold rush. This caused damage to the ecosystem; in 1864, Abraham Lincoln declared Yosemite Valley a public trust of California in hopes to prevent commercialization. This was the first time the United States government got involved in the protection of land. In 1889, an environmentalist named John Muir brought attention to the fact that the meadows surrounding the Yosemite Valley were being destroyed by sheep. He then petitioned for the land to be National Park Status in order to preserve the valley. In 1890, Yosemite National Park was created by Congress and was signed by President Benjamin Harrison. In 1903, Theodore Roosevelt asked John Muir to take him camping in the valley. As a favor, Muir then asked Roosevelt to expand the federally protected lands to include the Mariposa Groves. Today, the park will see nearly 5 million visitors annually.



Policies and Mandates

There are multiple policies that have been enacted over the past 100 years that limit degradation of the Tuolumne watershed. Some policies and mandates include wilderness permits, the Wild and Scenic River Act (WSRA), the National Historic Preservation Act (NHPA), and the National Environmental Policy Act (NEPA).

Wilderness Permits- A wilderness permit must be held for all leaders of groups staying overnight at Yosemite. This permit limits the number of people overnight in the park and the number of nights people can stay in the park. The permits come along with guidelines that express how to deal with waste, regulations to where and where you can camp, and how to not contaminate waterways. Campsites must be 100 feet from waterways, disposal of human waste, and limits the use of soap in waterways.

Wild and Scenic River Act (WSRA)- The wild and scenic river act, passed in Congress in 1968, promotes preservation of particular rivers with "outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations" (American rivers). This legislation safeguards cleanwater, prevents human activity that harms water systems, and protects land around waterways.

National Historic Preservation Act (NHPA)- The National Historic Preservation Act was passed in Congress in 1965. This legislation protects historic sites in the United States. Though this act an Advisory Council on Historic Preservation was established.

National Environmental Policy Act (NEPA)- NEPA is used to give the public a voice in deciding the outcome of projects which may have effects on the environment. If a federal agency wants to create a dam or other invasive project, the agency will create an Environmental Assessment which summarizes harmful effects possible from the project.

Problems

Problem	Description	Causes
Problem 1: A warming climate	Yosemite relies on a snowline to provide a “spring pulse” or raise water levels when the temperature gets warmer. This increase in water levels spreads nutrients. Native animals rely on the spring pulse to carry out their life cycle. With a warming climate, the snow levels are lower. When these snow levels melt the spring pulse will decrease. Thus not bringing enough nutrients to the area.	California will likely increase about 5-11℉ in the next 80 years. This is due to the 40% increase in carbon dioxide and other greenhouse gases since the 1700s. This increase has caused a warming effect for Southern California.
Problem 2: Effects due to park visitors	Each year about 5 million people visit Yosemite, with about 75% visiting in the month of May - October. More recently, precautions have been put into place to limit and monitor effects on the environment related to visitors. However in the past regulations to campers were not as strict therefore erosion occurred to the watershed.	Specify a need for restoration on the Merced River which runs through the Yosemite Valley. One factor of the need for resteraction stemming from visitors trampling the riverbank.
Problem 3: Effects of invasive species	Several non-native and invasive plant and animal species threaten water quality and ecosystem health in Yosemite Valley. The New Zealand mud snail and Didymo are of particular concern. The former nonnative alters freshwater ecosystems as it has the capacity to "completely cover a river streambed." The latter is a freshwater algae that has the potential to form massive algal blooms.	Invasive and nonnative plants and animals can travel to new areas in a variety of ways, and is an especially common occurrence in our era of globalization. It is believed that Didymo came to California via fishing equipment and boats. It is also believed that the New Zealand mud snail was first brought to America with live sportfish shipments, but has spread from recreational activity.

Problem 1: A Warming Climate

Due to Southern California's Meditteranean climate, Yosemite tends to have very dry summers and wet winters. Yosemite's native plant and animal species rely heavily on the snow from winter melting throughout spring and early summer to provide the necessary nutrients for their life cycle. The snow can accumulate upwards of about 6,000 feet. When temperatures reach above freezing, the snow melts into the Yosemite Valley Watershed bringing nutrients and sediment downstream. However, recently temperatures in Southern California have increased alarmingly. This means less snowfall during the winters and droughts downstream during the summers. These drier summers can also lead to forest fires within Yosemite National Park.

In 2015, the Sierra Nevada region only accumulated 5% of their average annual snowfall. This led to a drought, and the native fish were almost depleted. With dry conditions, forest fires broke out leaving ash and wood debris to contaminate the water system.

Southern California's temperatures are expected to increase even more. By 2100, California will experience temperatures 5-11℉ above current levels. This is due to greenhouse gases, which have increased 40% since the 1700s with industrialism.

The Yosemite Waterfalls on the left during spring. After, the spring pulse has come through the waterfalls dry up in late summer as seen on the right.

Goal 1

Prevent droughts and forest fires in Yosemite. The real goal would be to prevent a decrease in winter snowfall but climate change and rising temperatures is a global phenomenon that reaches beyond the scope of the Yosemite Valley. Thus, the focus should be to limit the severity of the effects caused by climate change. Digging more reservoirs will keep a steady water supply during the late summer months. Also, creating a slope towards the streams to make sure that the snowfall melts into the water. This will help create a larger spring pulse. Planting fire resistant shrubs as a barrier in areas where forest fires are of the highest concern. This would help prevent ash from polluting the streams. California Buckwheat would be a good shrub to plant as they are easily grown in Southern California's climate.

Problem 2: High volume of visitors per year

Yoesemite is a well-known national park; it experiences high traffic throughout the year, however visitation is heavily concentrated in the spring and summer months. Each year about 5 million people visit Yosemite, with about 75% visiting in the month of May - October. The park already has systems in place to monitor effects of visitors through the Visitor Use and Impact Monitoring Program (VUIMP). The program monitors rivers by their free-flowing condition, water quality, and outstandingly remarkable values (ORVs). ORVs are defined by areas of scenic vista to subalpine meadows. Many factors are monitored however resources such as geological features are not monitored.

Furthermore a major issue in relation to visitors is that many of these programs and protections to the area have been put into place in the past 50 years, before that regulations were not as strict. For decades visitors caused erosion in water banks, specifically in the Merced River where trees were cleared in excess, campers trampled riverbanks, and downcutting caused further erosion. Although more precautions are in place now, effects from erosion are still felt in the area.

Goal 2

Expand monitoring of visitor impacts on the watershed and land surrounding waterways. Implementation of education to help prevent visitors from creating further erosion. Work to strengthen laws related to preservation.

Problem 3

Invasive and nonnative species are a worldwide problem, affecting ecosystem health and viability on a massive scale. The situation is no different in the Yosemite Valley watershed. Invasive and nonnative species, most notably the New Zealand mud snail and a freshwater algae called Didymo, have major impacts on stream health in the watershed, affecting both aquatic ecosystems and water quality. Yosemite National Park currently oversees an invasive plant management program that involves "prevention, inventory/early detection, prioritization, treatment, monitoring, and education and outreach" with an Integrated Pest Management system. While this system is invaluable to the park, the problem is ongoing, therefore to bolster the program and treatment sub-program could be very beneficial to the Yosemite Valley watershed.

Goal 3

Prevent further spreading of invasive species through the park via careful monitoring of those species already introduced, as well as future potential invasive species; strengthen the current invasive management program and further emphasize invasive removal on park grounds.

(Left) A photo showing the size and physical appearance of the New Zealand mud snail, an invasive pest to the Yosemite watershed.
(Right) A photo of the Yellow Star-Thistle, another invasive species that threatens the watershed as well as much of California.

Summary of Goals

In order to maintain a swimmable water quality within the Yosemite watershed, we aim to prevent droughts and forest fires; expand monitoring of visitor impacts to Yosemite National Park, and regulate accordingly; and prevent further spread of invasive species in the park.

Conclusion

The Yosemite watershed holds immense cultural, historic, scenic, natural, and economic value to the state of California, and to America at large. It is imperative that we work to upkeep the watershed and retain its water quality for generations to come. By analyzing the state of the watershed and determining feasible, effective solutions for which to combat any problems, we will have the best chance of achieving our goal to maintain a swimmable water quality in the watershed.

Recommendations

To combat issues presented by a warming climate, we recommend that:

- Construct reservoirs to accumulate snowfall runoff
- Create a slope so that snowfall is headed into the stream
- Plant fire resistant shrubs to mitigate damage from forest fires

To combat issues presented by the effects of park visitors, we recommend that:

- Monitor systems already in effect in the watershed will be expanded to cover more areas in the watershed. These monitoring systems should also include erosion to geological systems.
- Federal laws protecting environmental lands need to be strengthened. Specifically (NEPA), the National Environmental Policy Act, has been weakened over the past decade.
- Creation of an initiative that increases education to the general public/visitors to promote good environmental practices involving waterways and general erosion in the park.

To combat issues presented by the effects of invasive species, we recommend that:

- Park funds be allocated to invasive species monitoring in and around the watershed
- An advisory panel be created to review the effectiveness of the current invasive species management program and subsequently report on their findings. If the board has further suggestions for improvements to the program, we highly recommend that those be considered by the park.
- Local naturalists be awarded grant funding to organize volunteer invasive species removal efforts, targeting those species already found in the park.

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