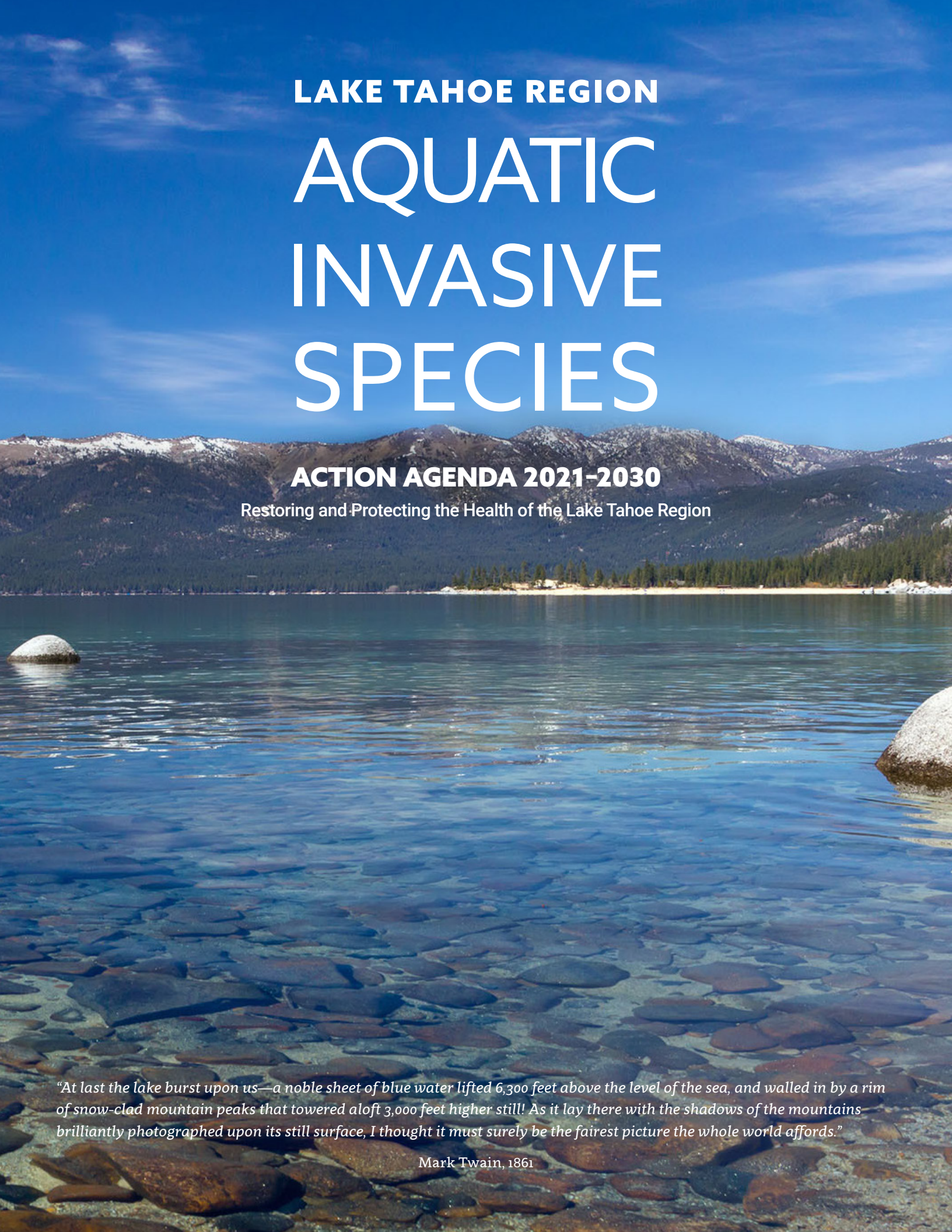


LAKE TAHOE REGION

AQUATIC INVASIVE SPECIES

ACTION AGENDA 2021–2030

Restoring and Protecting the Health of the Lake Tahoe Region

"At last the lake burst upon us—a noble sheet of blue water lifted 6,300 feet above the level of the sea, and walled in by a rim of snow-clad mountain peaks that towered aloft 3,000 feet higher still! As it lay there with the shadows of the mountains brilliantly photographed upon its still surface, I thought it must surely be the fairest picture the whole world affords."

Mark Twain, 1861

The Lake Tahoe Region Aquatic Invasive Species Action Agenda 2021–2030:

- Increases the pace and scale of AIS control
- Identifies priorities for AIS investments
- Maximizes return on investment
- Incorporates new performance metrics
- Supports adequate levels of monitoring
- Adds capacity to achieve goals
- Supports an all-taxa approach

The Action Agenda is a 10-year plan, structured in two five-year implementation phases:

Phase I (2021–2025) aggressively treats and controls AIS throughout the Region while conducting environmental review and a testing program for long-term AIS management within the Tahoe Keys. The Phase I goal is to reduce aquatic invasive plants to maintenance levels (or complete eradication) while actively exploring solutions to the largest infestation in the lake — the Tahoe Keys.

Phase II (2026-2030) focuses on reducing aquatic invasive plants and invasive fish in the Tahoe Keys while continuing to maintain, reduce, or when possible, eradicate AIS in other parts of the Lake Tahoe Region.

Regional AIS Goals:

- Prevent new introductions of AIS to the Region.
- Limit the spread of existing AIS populations in the Region by employing strategies that minimize threats to native species, and extirpate existing AIS populations when possible.
- Abate harmful ecological, economic, social, and public health impacts resulting from AIS.

The Lake Tahoe Environmental Improvement Program is a collaborative partnership working together to achieve the environmental goals of the region. The Aquatic Invasive Species Action Agenda implements the partnerships' action priority to control or eradicate aquatic invasive species to protect the biological diversity and scenic resources of the Lake Tahoe basin.

LAKE TAHOE ENVIRONMENTAL IMPROVEMENT PROGRAM

The Time to Increase Pace and Scale is Now

Lake Tahoe partners are currently treating between 5–15 acres of AIS annually. Failure to implement a comprehensive, simultaneous, and aggressive suite of control actions on all aquatic invasive taxa through 2030 will:

- Lessen chances of eradication and control of existing AIS populations;
- Detrimentally impact the ecological function of Lake Tahoe;
- Interject uncertainty into the Lake Tahoe Region economy;
- Make it more difficult to recover populations of the federally listed Lahontan Cutthroat Trout;
- Negatively affect the quality of experiences of residents and visitors; and
- Significantly increase long-term costs to address AIS in the Region.

The time is now to increase the pace and scale of AIS control to reduce the distribution and abundance of AIS in the Lake Tahoe Region. Enhancing the resilience of Lake Tahoe by addressing AIS threats will achieve the most strategic return on investment and ensure the Region continues to thrive.

Aquatic Invasive Species Performance Metrics

New performance metrics assess both level of effort and outcomes associated with AIS control in the Region. Adding these metrics to our evaluation process will help us understand the return on investment and progress made achieving regional AIS goals.

Programmatic Metrics Assess Effort

- Acres treated for invasive species
- Number of projects completed
- Biannual invasive species risk assessment completed
- Funds expended

Outcome-based Metrics Assess Achievements

PLANTS

- % increase or decrease in infested area (acres) per species
- # of AIS-infested acres
- # of newly established populations

INVASIVE FISH

- Reductions in biomass and size classes in designated areas of Lake Tahoe

AQUATIC INVASIVE INVERTEBRATES

- Reductions of signal crayfish and mysid shrimp in designated areas of Lake Tahoe

INVASIVE AMPHIBIANS

- Reductions of bullfrogs in designated areas of Lake Tahoe

Achieving an Optimal Return on Investment, 2021-2030

The Action Agenda is a three-fold increase in pace and scale relative to the current level of investment in AIS control underway in the Lake Tahoe Region. It is estimated to cost $74 million through 10 years, or $7.4 million annually, and will achieve the greatest return on investment, maximize benefits to ecosystem services, minimize risk, and reduce degradation to fish and wildlife habitats in the Region. Implementing this recommendation is expected to achieve:

- 90% reduction to eradication of aquatic invasive plants in nearshore and upstream areas and the Tahoe Keys;
- 90% reduction in invasive fish biomass in priority areas;
- Reductions of aquatic invasive invertebrates and amphibians in designated areas;
- Creation of an emergency invasive species fund;
- Newly developed detection and monitoring tools;
- Comprehensive lake-wide monitoring;
- Investment in new AIS control technologies and methodologies;
- A bi-annual high-risk invasive species assessment;
- Investment in a marina engagement strategy; and
- Expanded administrative staff capacity to implement increased pace and scale.

The plan outlines four funding levels to achieve Basin AIS goals:

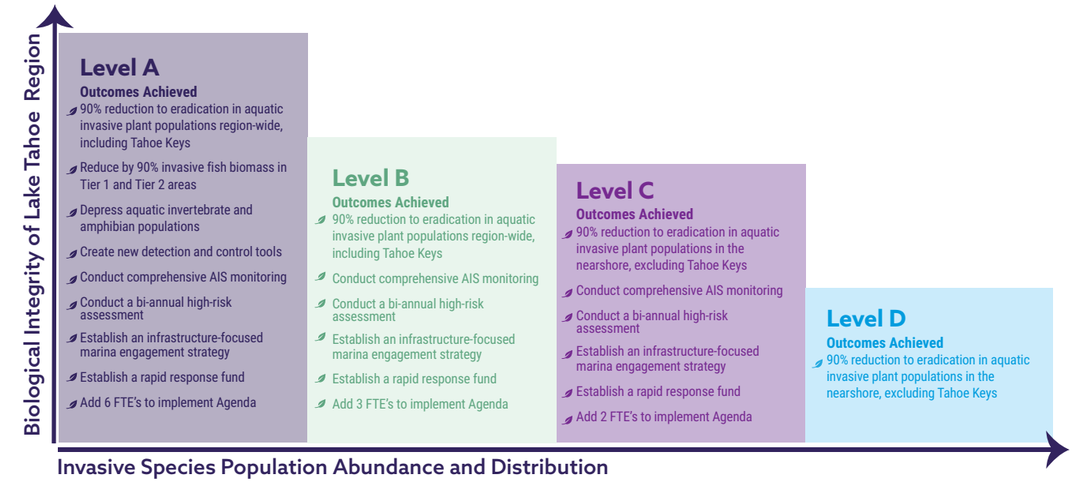
Level A: All-taxa AIS control throughout the region, including Tahoe Keys

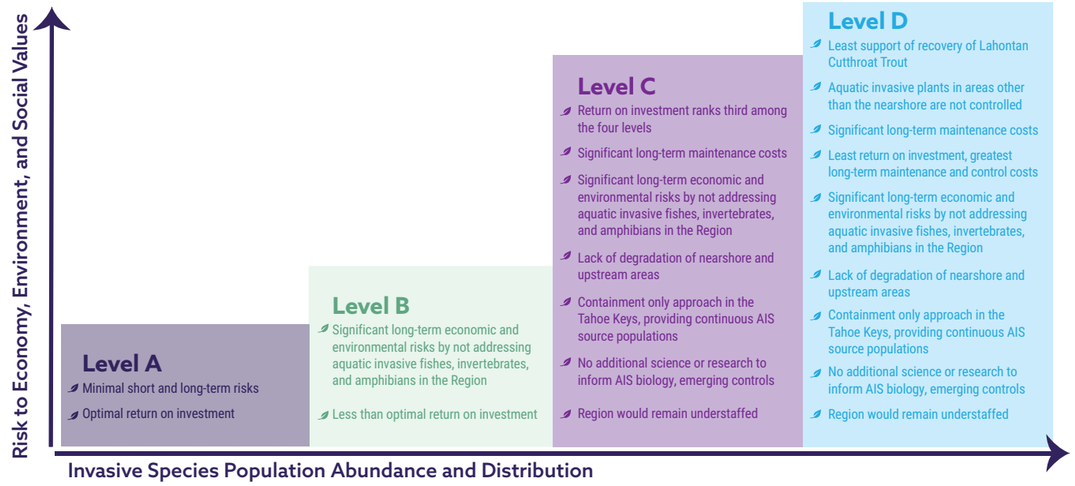
Level B: AIS Plant-only control throughout Region, including Tahoe Keys

Level C: AIS Plant-only control throughout the Region, excluding Tahoe Keys

Level D: AIS Plant-only control in nearshore, excluding Tahoe Keys

Implementing Action Agenda Level A achieves the greatest biological integrity in the Lake Tahoe Region while minimizing risk to the economic, environment, and societal values. Implementing Level D funding achieves the least biological integrity and involves the greatest risk.

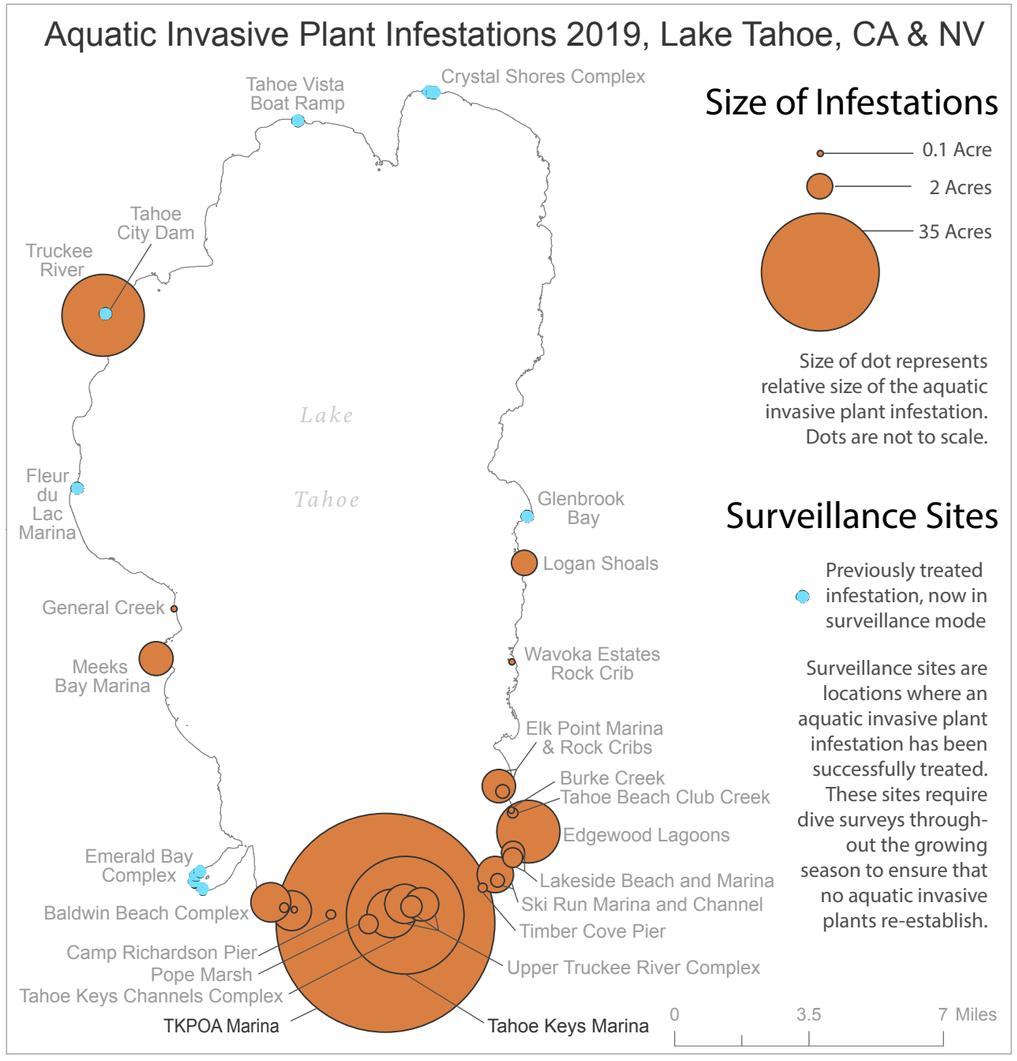




Strategic Investments Needed to Implement the Action Agenda, 2021–2030

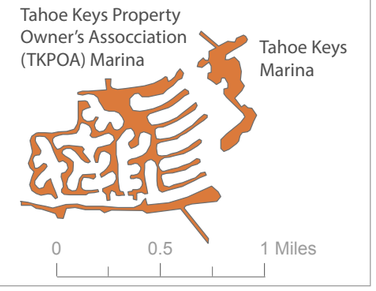
Outcomes		Phase I (2021–2025)	Phase II (2026–2030)
Aquatic Invasive Plant Control Outside Tahoe Keys	Reduce by 90% the acreage of aquatic invasive plant populations	$12.5 M	$6.25 M
	Early Detection Rapid Response - no new aquatic invasive plant populations become established	$1.25 M	$1.25 M
Aquatic Invasive Plant Control in Tahoe Keys	Reduce by 90%, or eradicate, aquatic invasive plant populations	$7 M	$17.2 M
	Environmental review that informs management decisions	$1.5 M	$0
Aquatic Invasive Plant Control Totals		**$22.25 M**	**$24.7 M**
Aquatic Invasive Fish, Invertebrate, and Amphibian Control	Reduce by 90% invasive fish biomass, and invasive aquatic invertebrates and American bullfrogs in designated areas of Lake Tahoe	$2.625 M	$1.845 M
Aquatic Invasive Fish, Invertebrate and Amphibian Control Totals		**$2.625 M**	**$1.845 M**
Research and Monitoring	Enhance detection of aquatic invasive species, conduct surveys (nearshore, in-situ diver, drone), assess population abundance and distribution of AIS, invest in new technologies	$4.29 M	$5.235 M
Research and Monitoring Totals		**$4.29 M**	**$5.235 M**
Assessment, Emergency Fund, Infrastructure Enhancements to Prevent Spread of AIS, and Added Staff Capacity	Bi-annual high-risk assessment of AIS, established partnership program to advance infrastructure advancements at marinas and other lake locations to prevent the spread of AIS, an EDRR emergency fund, and sufficient staffing to implement the Agenda.	$7.2 M	$6.28 M
Administrative Totals		**$7.2 M**	**$6.28 M**
TOTALS		**$36.385 M**	**$38.06 M**
GRAND TOTAL			**$74.445 M**

AIS Budget, 2021-2030



Challenging Geography of Tahoe Keys

Based on acreage, the two Tahoe Keys marinas comprise 70 percent of all aquatic plant infestations in Lake Tahoe. The size of these infestations and the complexity associated with the geography of the Tahoe Keys make identifying and implementing control treatments a challenge. Although most marinas contain one or two embayments, the Tahoe Keys complex contains a myriad of connected waterways.



Map produced by S.Matthews, Tahoe RCD 2019.

THE MOST

UNWANTED

LAKE TAHOE AQUATIC INVASIVE SPECIES

Aquatic invasive plants, fish, invertebrates, and amphibians are impacting the Lake Tahoe Region aquatic food webs and altering the productivity of regional ecosystems:

Plants

Eurasian watermilfoil and curlyleaf pondweed

- Reduce native species
- Cause unwanted effects on water quality and recreation
  - » Contribute to excessive phosphorus releases into water during annual die-offs
  - » Impair recreational boating navigation
- Is an aesthetic nuisance to local homeowners
- Impede water flow

Eurasian watermilfoil
Credit: M. Rydel Marine Taxonomic Services, Ltd.

Curlyleaf pondweed

Invasive Fish

Goldfish, warm water fish

- Alter food web function
- Decrease the biodiversity of native fish
- Predation and competition with native fish
- The behavior of invasive fish can increase suitable habitat for invasive plant growth
- Fish waste can increase nutrient loads

Goldfish
Credit: B. O'Rourke, CDFW

Aquatic Invertebrates

Asian clams

- Where present, they outcompete native species and dominate the ecosystem
- Contribute to algal blooms
- Shell deposits affect the aesthetics of the nearshore

Asian clams

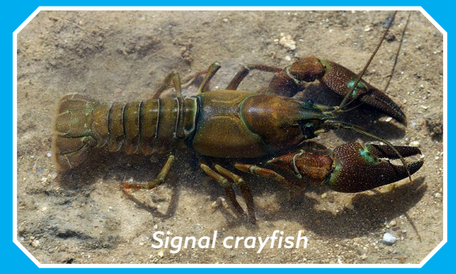
Mysid shrimp

- Reduce water clarity
- Reduce, or eliminate, native phytoplankton
- Alter food web dynamics
- Potential to hamper Lahontan Cutthroat Trout recovery efforts

Mysid shrimp

Signal crayfish

- Where present, they outcompete native species and dominate the ecosystem
- Reduce food for native benthic macroinvertebrates
- Contribute nitrogen, affecting water quality
- Reduce native aquatic invertebrates, such as the Tahoe stonefly
- Graze on native algal communities



Signal crayfish

Invasive Amphibians

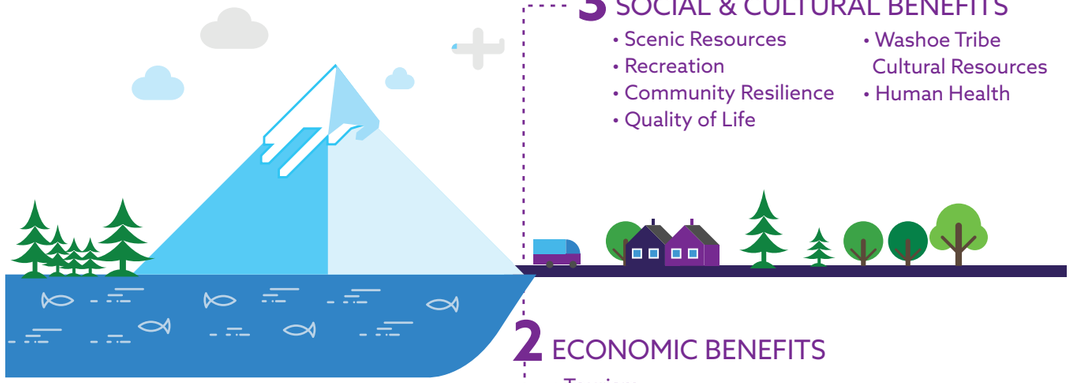
American bullfrogs

- Damage sensitive wetland areas
- Transmit chytrid fungus to other amphibians
- Outcompete native species because of size and role as a voracious predator

American bullfrogs

The Regional Economy Depends on a Healthy Lake Tahoe

Lake Tahoe is one of the largest subalpine lakes in the world and is recognized nationally and globally as a natural resource of special significance. Lake Tahoe is also an Outstanding National Resource Water known for its extraordinary clarity and blue color. Maintaining and sustaining a healthy Lake Tahoe protects valuable economic, environmental, and social/cultural resources in the Region, such as:



3 SOCIAL & CULTURAL BENEFITS

- Scenic Resources
- Recreation
- Community Resilience
- Quality of Life
- Washoe Tribe Cultural Resources
- Human Health

2 ECONOMIC BENEFITS

- Tourism
- Jobs
- Personal Income
- Property Values
- Boating Industry
- Recreation

1 ENVIRONMENTAL BENEFITS

- Water Quality
- Air Quality
- Biologically Diverse Plant Communities
- Healthy Wildlife Populations
- Lahontan Cutthroat Trout Recovery

Visitor services, Environmental, Health, and Other clusters drive 95 percent of the regional economy (Applied Development Economics 2015). Recreation is the second most important component of the Visitor Services cluster. The top three clusters depend on the continued outstanding quality of the natural environment.

Total Tahoe Economy = $5.1 billion

Our Goals

Full Action Agenda Implementation will restore and enhance the biological integrity of Lake Tahoe by:

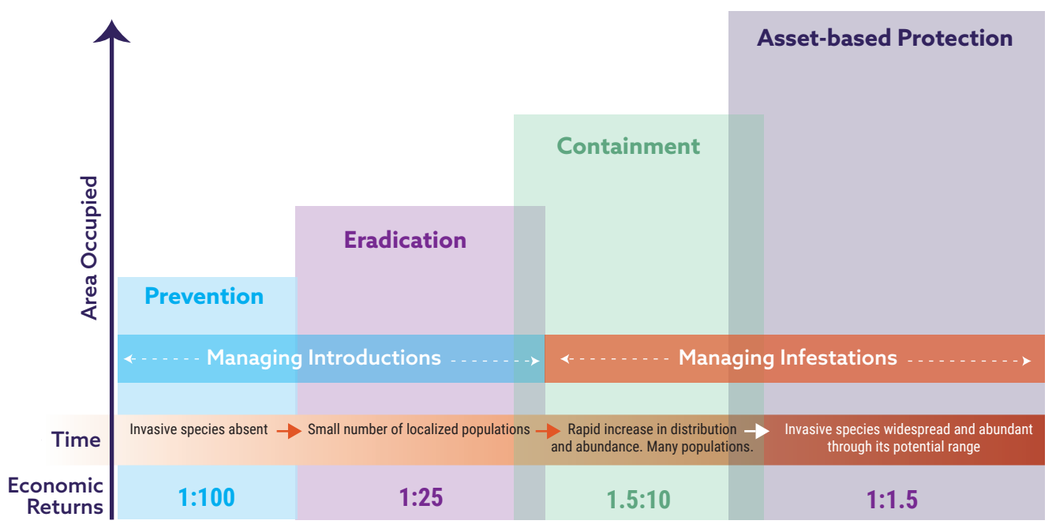
- Preventing the introduction of new AIS into the Region's waters;
- Reducing the abundance and distribution of established AIS populations; and
- Abating harmful ecological, economic, and social impacts resulting from AIS.

Achieving these goals will protect the Region from further degradation caused by aquatic invasive species.

The most cost-effective approach to managing invasive species is to prevent their introduction, or eradicate them when their populations are small and localized. As populations become established, containment and management of populations result in the greatest long-term economic, environmental, and social damages.

Current efforts to shield the Tahoe basin from an invasive mussel infestation focus on the *Clean, Drain, Dry* strategy. This includes watercraft inspection and decontamination stations, and outreach efforts. These strategic investments have prevented the introduction of quagga or zebra mussels to the Region, at a fraction of the cost of containment and eradication. An infestation of these invasive mussels would cost the Region millions of dollars annually and in perpetuity.

Eurasian watermilfoil (EWM) is an aquatic invasive plant found both inside the Tahoe Keys and along Lake Tahoe's shoreline. Managers eradicate newly detected populations of EWM along the shoreline while populations are small. The Tahoe Keys, which are infested with aquatic invasive plants and invasive fish, serve as invasive species source populations for the Region. Managers work to contain AIS in the Tahoe Keys while pilot projects are completed to test the efficacy of eradication methods. Containment is costlier than eradication, or prevention. When invasive species cannot be prevented, eradicated, or contained, efforts to protect assets have the greatest cost and fewest returns on investment.



Creative
Resource
Strategies