

CHAPTER 13

Conclusions and Recommendations

This chapter examines the findings of the 2015 Threshold Evaluation and places the details in the broader context of the Lake Tahoe Region's suite of management objectives. It is an opportunity to look outside the resource silos that house individual standards and identify larger patterns, themes, and emerging issues that cut across individual disciplines. The recommendations included in this chapter have the benefit of being informed by the thoughtful comments of 15 independent scientific experts who peer reviewed draft versions of this report, the seven peer reviewers of the 2011 Threshold Evaluation Report, and the five threshold evaluation reports that preceded this report.

The results of the 2015 Threshold Evaluation Report suggest that the policies and on-the-ground restoration and redevelopment projects implemented by TRPA and partners under the Regional Plan continue to move the Region in the right direction. Of the 110 standards for which status determinations could be made in this evaluation, 77 (70 percent) were found to be "at or better than target" or "considerably better than target." That number is up from 58 (63 percent) in the 2011 evaluation. In addition, just two indicators were found to be declining relative to target in 2015, down from five indicators in 2011. These findings are broadly consistent with earlier evaluations, which have each shown that incremental, but measurable progress continues to be made.

It is important to place these findings in the broader context of the Region's long term goals for recovery from legacy impacts. Logging, grazing, and unregulated development shaped the landscape for 150 years. When the threshold standards were adopted, it was widely acknowledged that many represented goals of long duration for recovery and restoration of the Region that would not be attained quickly or even within a decade. Within water quality this is explicitly stated in the text of the standard, "*These numeric threshold standards for Pelagic Lake Tahoe are currently being exceeded and will likely continue to be exceeded until full implementation of the pollutant loading reductions prescribed by the Lake Tahoe Total Maximum Daily Load program are implemented by the State of California and Nevada.*" In fact, the implementation plan laid out in the Total Maximum Daily Load (TMDL) framework for restoring the historic clarity of the lake establishes pollutant load reduction over 65 years (Lahontan & NDEP 2010).

Threshold evaluation reports therefore serve as a check-in on the course to recovery. Incremental progress towards attainment has been reported in each of the five threshold evaluation reports, and this one is no different. Along with gains in important areas, the report also highlights areas of emerging concern that require additional attention. For example, the observed decline in deep

water plant communities and apparent declines in high elevation cushion plant communities are findings that may warrant research to understand the drivers or additional management consideration. The continued increase in pelagic primary productivity suggests the lake ecosystem continues to change, and additional research is needed to determine what the trend means for lake health and to understand its underlying drivers. Standards for which no status determination was possible continue to stymie the report. Status determinations were not possible for 38 percent (68 standards) of the 178 standards because of ambiguity in the standard, reference to an unknown historic baseline, or insufficient data. The proportion of standards for which status determinations could not be made, decreased from the 2011 evaluation which did not assign status to 39 percent of standards (59 standards). This is nonetheless an area where critical assessment in the threshold update initiative of those unmeasurable standards themselves and the value of the information they intend could ultimately improve the overall evaluation system.

Programmatic Recommendations

Following the 2011 Threshold Evaluation Report and the 2012 Regional Plan Update, the TRPA Governing Board identified priority areas where additional environmental gains could be achieved, gains that the 2015 report also flags for attention. In response to those emerging trends, the Board directed TRPA to work on seven strategic initiatives between 2015 and 2020; 1) Development Rights, 2) Shoreline, 3) Transportation, 4) Forest Ecosystem Health, 5) Aquatic Invasive Species Control, 6) Stormwater Operations and Maintenance Funding, and 7) Streamline and Update Monitoring and Thresholds. The findings of this report reinforce that those identified initiatives are focusing on the right areas and also flags some new linkages within the seven initiatives and their areas of concern.

As examples, the nearshore is impacted by the presence of aquatic invasive species and stormwater runoff. Development rights transfers and where development is located in the Region impacts sensitive land restoration and the transportation network required to move people around the region. The forest ecosystem health initiative is closely tied with the threshold monitoring and update initiative, because it highlights the disconnect between the metrics presented in the threshold evaluation report and the information forest managers most need to effectively manage the forests. The threshold update initiative is closely tied with all other initiatives and everything the agency does because it asks, “are we aimed at the right targets?” and “do we have the best information necessary to make good management decisions?”

The seven ongoing initiatives are comprehensive, touching virtually every part of the Region, from large landscape forest management in remote areas to development and transportation in urbanized environments and the ecosystem of the lake at the center of it all. In every corner of the Tahoe Basin, partnerships are asking the same question, “can we do better?” The findings of the report and recommendations of the peer reviewers suggest the question is properly framed and that we should continue to focus on this diverse set of resource areas.

In addition, the report suggests some new areas for adaptive management. A clear example of the interconnectedness of the system is the threat that increased on road parking near recreation sites poses to the trending improvements in the scenic thresholds. The problem reflects increasing numbers of visitors, which implicates the transportation system and recreation site management, which touches the recreation standards and metrics. Cross-cutting effects like this suggest that we should continue to ask about the ties that bind the initiatives and how the work of one initiative can deliver outcomes in another.

Both the observed successes and causes for concern documented in this report informed the development of two types of recommendations included in this chapter. The first are programmatic recommendations to promote standard attainment. The second focus on the threshold update initiative and taking a comprehensive look at the threshold standard system to ensure that it continues to reflect the most important values of the Region, is based on the latest science, and provides managers with the information they need to effectively manage this natural treasure.

The next sections identify themes for action by TRPA or within the larger basin partnership to advance further threshold gains needed in response to the report's findings.

Partnerships and Progress

TRPA is charged with coordinating the many partners in the Region to achieve shared goals that cut across jurisdictions, organizations, and governments. None of the agency's daily work or the seven strategic initiatives can be accomplished in isolation by TRPA alone. Recognizing the complex landscape in which threshold progress and restoration occur is essential to the basin's collective impact. And in the Region, partnerships are how we develop and implement the plans that transform our aspirational goals into reality.

The report highlighted two facts about the Region: 1) partnerships drive progress in the Region, and 2) as emerging issues have been flagged (in threshold evaluation reports and elsewhere) new partnerships have emerged to respond and established partnerships have evolved to meet the challenges. The number of partnerships successfully promoting attainment of our shared objectives are too numerous to count. Below are some notable successes and these and others like them are the means to respond to threshold report findings:

Aquatic Invasive Species - When the threat of quagga mussel invasion at Lake Tahoe became apparent 10 years ago, TRPA and partners convened to set the direction and guide AIS management for the Region. The Aquatic Invasive Species Coordinating Committee (AISCC) is comprised of representatives from 14 agencies – federal, regional, state – and is further supported by local governments and private NGOs. The AIS program now also reaches outside the region to a larger western states and national coalition to leverage legislative influence, funding, and best practices. Building and maintaining an environment where these types of far-reaching and robust partnerships are possible and successful is the first step toward the actions needed in response to evaluation reports like this one. The AISCC is a recent example of how continually growing partnerships leads to successful responses to emerging issues.

Lake Tahoe TMDL – In response to the observed decline of a third of the lake's clarity over several decades, local, state and national agencies joined together to develop the Lake Tahoe Total Maximum Daily Load (TMDL), which charts a course of action to restore the historic clarity of the lake. The TMDL, signed in 2011, is a science based framework for reducing pollutant loads in the lake. Coupled with TRPA's work, the TMDL partnerships provide unprecedented collaboration, science, and added muscle to the regional efforts to restore clarity. Because the research that went into the TMDL revealed the specific pollutants and their sources that are most adversely affecting the lake, TRPA and its' partners can now zero in on programs that have the biggest positive impact on clarity.

Tahoe Yellow Cress – The Tahoe Yellow Cress Adaptive Management Working Group began 15 years ago to prevent the disappearance of this unique and rare Lake Tahoe wildflower. The group guided the study of the plant's ecology and developed the first comprehensive

conservation strategy in 2002, and has been actively implementing it ever since. In October 2015, the U.S. Fish and Wildlife Service announced its decision not to list Tahoe Yellow Cress as a federally endangered or threatened species after an extensive review found previously identified habitat threats no longer pose significant risk to the health and well-being of the species. That decision was a direct result of the collaborative partnership in the Region working to ensure the species survives.

New and similar partnerships are now being built and nurtured in response to emerging ecosystem conditions of concern. Far-reaching coalitions are being built to address interregional transportation, large forest and vegetation landscapes, recreation and visitor engagement management, and nearshore water quality conditions. We do not have to wait for a report every four years to act, and as soon as the need for building new partnership initiatives becomes apparent, we start organizing around actions that are already underway. It is these new associations of partners collaborating on solutions to emergent issues that will account for continued progress toward our regional shared goals.

As part of the commitment to adaptive management, TRPA is continually asking itself how it can be a better partner. As part of the threshold review process, opportunities emerged for TRPA to foster new partnerships and better support existing partnerships in the Region to promote threshold attainment.

1. Continue to Invest in Retooling Communication

The foundation of successful partnership is communication. Nearly six years ago the agency set new strategic goals for improved information access and transparency. The goal was to shorten the adaptive management lifecycle and promote engagement with stakeholders. The peer reviewers of 2015 Threshold Evaluation Report encouraged the agency to continue to rethink how it presents and shares information.

A range of suggestions were offered by the 2015 peer review panel. Some suggested structural modifications such as combining the presentation of individual standards to reduce redundancy and enhance the readability of the report. Others suggested that reorganizing the report's presentation would better illuminate the interdependencies and linkages between thresholds standards. Another reviewer suggested a greater focus on data accessibility and making the raw information presented in the report available to researchers and the general public.

TRPA and partners continue to explore how to more effectively turn the vast amounts of information collected into knowledge and to share that knowledge in ways that inform adaptive management in the Region. The Lake Tahoe Info web platform (<https://laketahoeinfo.org>) is emerging as a central repository for all Lake Tahoe based information. The platform was born out of collaboration between TRPA, the U.S. Environmental Protection Agency, the U.S. Forest Service, and the California Strategic Growth Council. The platform was initially intended to house only sustainability and Environmental Improvement Program (EIP) information. However, the early success of the website has led to its intentionally incremental expansion focused on filling specific voids and targeted needs identified and accepted by the partnership.

In late 2016, TRPA will launch a beta-version of the thresholds reporting platform on the Lake Tahoe Info website (Figure 13-1). The agency plans to experiment with the organization and presentation of the website to provide those interested with better

access to the information about the lake and its ecosystem. The goal is for future threshold evaluations to be reported continuously in real time through this information and reporting platform as new best data and information becomes available rather than waiting for periodic comprehensive compilations on a 4-year cycle.

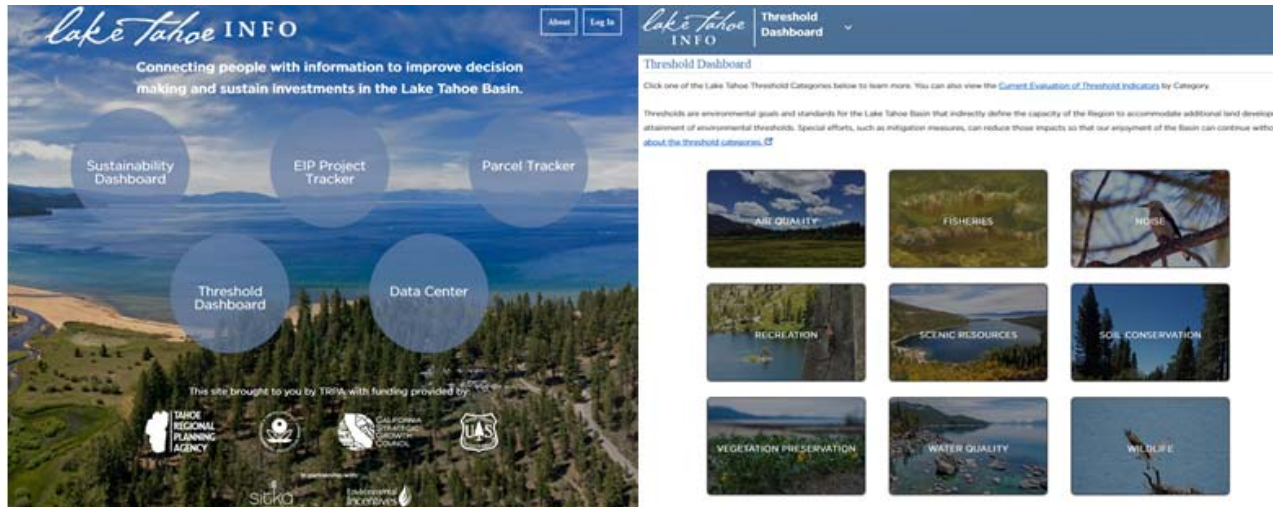


Figure 13-1: Screen shots from the LInfo.org website and mock-up of the threshold dashboard reporting platform.

2. **Target Attainment Dates** - The TRPA Code of Ordinances requires an interim target to be identified for each standard that is identified as out of attainment. Each threshold evaluation report has diligently listed interim targets for standards, even when no specific commitments or secured funding source was in place to achieve them. To establish interim targets, authors generally looked at past program implementation or historic rates of change and assumed a similar trajectory going forward. The limitations of establishing interim targets based on this methodology have been noted in past threshold evaluations and was again questioned by the peer reviewers of this evaluation.

Unlike the detailed studies and modelling of pollutant load reductions of the TMDL, the interim targets listed in threshold evaluation reports have rarely been founded on scientifically modelled projections or firm commitments tied to specific funding. A peer reviewer of the 2015 report expanded the critique more broadly and suggested the practice of setting interim targets should be abandoned in the absence of a specific plan to achieve the target, saying, *“I doubt that the “estimated attainment date” will have much meaning for most indicators. Unless they’re tied to a concrete, funded plan or program, it’s almost silly to use what I assume would be a linear extrapolation of prior trends to “calculate” a date. Absent firm legally and/or financially obligated commitments, just don’t do it.”* The sentiments were echoed by other peer reviewers and struck a chord within TRPA.

Establishing goals for each threshold standard in isolation is an outdated approach that fails to consider the interconnectedness of resources or the network of partners that collectively manage those resources and make restoration projects happen. Over the last 20 years, the 100-plus partners of the EIP have implemented nearly 500 projects in the Region that have protected environmentally sensitive lands, improved water quality, and enhanced recreational opportunities. These programs and projects are the building

blocks for bringing about threshold gains. The establishment of realistic interim targets requires extensive engagement and coordination with the many agencies that implement projects and regulate in the Region. Each agency has its own mission and priorities and the process of aligning those missions and priorities and reaching consensus on scope, scale, timing, funding, and feasibility of next actions requires significant investment of time and resources. The Tahoe Interagency Executive Steering Committee (TIE-SC) oversees implementation of the EIP and is leading the discussion on priorities. The TIE-SC has been actively engaged in facilitating the discussion on EIP goals and action plans for the next five years of EIP programs and projects.

3. **Closer link between monitoring data and decision making** - While it is often repeated that additional information leads to better decisions, not all information is equally useful. Within the field of decision theory, value of information (VOI) refers to the fact that different pieces of information have different value and different levels of influence on a decision (Sato 2011; Trainor-Guitton 2014). The notion that the highest value monitoring or research efforts are those that help distinguish between management alternatives resonated with TRPA, its partners, and the peer reviewers of this report.

Recent work has suggested that like other types of investments, there are diminishing returns from investing in the collection of additional monitoring data after a certain point (Grantham et al. 2008). Here diminishing returns result not from the information collection itself, but because the additional information is less likely to significantly influence a necessary decision. Understanding the value of individual pieces of information for management decisions is critically important to allocating scarce resources and helps avoid unnecessary expenditures.

Regional partners are already rethinking how we invest in monitoring. For several years, the Nearshore Agency Working Group (Lahontan Regional Water Quality Control Board, Nevada Division of Environmental Protection, U.S. Environmental Protection Agency, and TRPA) has been developing a coherent framework for guiding investments in nearshore science and monitoring efforts. Through the Nearshore Resource Allocation Plan (NRAP), the group is taking a fresh look at how Tahoe's agencies invest in nearshore monitoring and nearshore science and is seeking to improve coordination and return on investments in the allocation of scarce monitoring dollars. The goal of the process is to think through how information collected through monitoring feeds into the management decisions in the Region and ensure that the information collected is actively informing management.

By beginning with how information will be used to inform decisions, we can identify and prioritize gathering information that is most likely to inform decision making and promote threshold attainment. A draft of the NRAP is expected to be released for discussion and review in late 2016.

Better information for decision-making could also be generated with increased focus on project and policy effectiveness and understanding system drivers and their influence on threshold status and trend. The decisions made daily by the partners in the Region are based on their knowledge of the effectiveness of their actions. There are over 200 compliance measures currently used by TRPA and its partners to attain or maintain threshold standards (see Appendix I). Efficient management requires making tough choices about the relative merits or contributions of each compliance measure to those

goals, and understanding the marginal cost and benefit of investing more or less in any one of the measures. This allocation is complicated by the diversity of goals for the region and the number of compliance measures that contribute to attaining or maintaining multiple threshold standards.

A greater focus on impact evaluation and causation research would likely be both more challenging and more expensive than simply reporting on status and trends, but it could also be more useful. Understanding which policies or projects are the most cost-effective mechanisms to promote threshold attainment is ultimately what enables better decision making. Building this knowledge base is also an essential component for the effective implementation of TRPA's adaptive management system (plan–do–check–adjust). Adaptive management requires the generation of knowledge that enables decision-makers to better understand project and program effectiveness and more efficiently allocate resources to achieve desired outcomes. Understanding the success of existing investments and the incremental benefit of investing more in a program or project is a key to more efficiently allocating resources.

4. **Better Coordination of Monitoring and Reporting** – In some instances, status determination was not possible because data analysis was still in process and not available for inclusion in the report. The threshold evaluation report, like most work in the Region, is only possible because of the contributions of numerous partners. The report continues to rely on those contributions. Better aligning the scheduling of reporting, monitoring and attendant analysis could lead to more complete information in future reports. Even more effective would be the successful implementation of continuous real time reporting through LT Info outlined above.

Manage Systems Not Symptoms

The partnership's effectiveness depends on shifting our emphasis from silos to systems. As with the 2011 report, the siloed evaluation approach of the current threshold system was again questioned by the 2015 scientific experts in the peer review. They suggested greater emphasis be placed on the inter-relatedness of the individual elements of the threshold system and on understanding the drivers of change in the context of the broader ecosystem (TRPA 2012).

The guidance is consistent with the direction that other large restoration efforts in the country have taken. For example, the South Florida Ecosystem Restoration Task Force that oversees the multi-billion dollar restoration of the Everglades recently developed and implemented 11 system wide ecological measures of restoration efficacy (Doren et al. 2009). And, the Expert Scientific Panel assembled by the United States Government Accountability Office to review indicators of program success for restoration of the Chesapeake Bay offered similar guidance (GAO 2005). The GAO stressed the need to be able to integrate information from individual indicators in order to say something about the state of the system as whole.

This threshold evaluation report highlights the need for the agency and partners to continue to look outside the individual threshold categories and indicator silos and think about broader drivers. A clear and pressing example is the nexus among threshold standards for scenic, recreation, and air quality. Visitation to the Region may be growing and visitation patterns changing. This evaluation found that increasing visitation also poses a challenge for the recreation experience and scenic quality. As visitors frequent Lake Tahoe, the roadsides are increasingly cluttered with parked cars. Roadside parking is an emerging stressor on scenic resources. And use of the individual auto affects other threshold standards as well. TRPA recently

commissioned the development of a recreation travel study to better understand how visitors are getting to and moving around the Region. Understanding visitor systems dynamics is increasingly important to adaptively managing transportation, recreation access, quality of recreation experience, and air and water quality. The Regional Transportation Plan Update recognizes these linkages and will propose solutions to better link these areas. Development of new partnerships and metrics around recreation management and visitor engagement may also be needed to fully manage the systemic effects of growing visitation expected from population increases outside the region and greater demand for the Tahoe experience.

In an environment where resource managers are increasingly being asked to administer programs and projects that deliver multiple benefits across a range of objectives, it is of growing importance that we actively consider and address the linkages within the interconnected systems we manage. Ecosystem-based management is an approach that promises to deliver those multiple benefits through a more holistic management approach. Ecosystem-based management is the term used to describe management actions that focus on systems and processes, in contrast to historic approaches that focused on managing individual species or specific parts of an ecosystem (Ruckelshaus et al. 2008). Numerous challenges have been identified in implementing systems based approaches, including the cost, lag between implementation and response timeframes, transaction costs of coordinating across disciplines, difficulty in communicating ecosystem objectives to stakeholders, and evolving understanding of drivers and linkages at the ecosystem scale (Wasson et al. 2015).

Nonetheless, the basin partnerships are already engaging the ecosystem management approach more fully. The newly formed Lake Tahoe West Restoration Partnership is a local example of a partnership that is designed to take a more holistic approach to forest management for multiple goals. The partnership aims to restore the resiliency of the West Shore's forests, watersheds, recreational opportunities, and communities by accelerating the pace of project implementation and expanding the scale of ecosystem management particularly in light of the dynamics of changing climate conditions. The core partnership, which includes the National Forest Foundation, California Tahoe Conservancy, U.S. Forest Service Lake Tahoe Basin Management Unit and Pacific Southwest Research Station, California State Parks, and TRPA, aims to address forest and watershed health issues over 70,000 acres of federal, state, local, and private lands, from Emerald Bay to Squaw Valley.

Acknowledge Uncertainty and Incorporate It: Climate Change

Both the 2015 report and peer review comments point to a growing body of knowledge we have been urged to bring into our standards and evaluations. Globally, 2015 was the warmest year on modern record. Temperatures in 2015 were over 1.5 °F (0.8 °C) warmer than the average temperatures of the 20th century, breaking the record set just a year earlier (NOAA & NASA 2016). The fingerprints of climate change are already visible in the Region. Average minimum air temperature has increased by 4.3 °F (2.4 °C) over the last hundred years. With rising temperatures there has been a correspondent decrease in the number of days with below freezing temperatures, which have declined by almost 30 days in the last 100 years (UC Davis - TERC 2016).

These changes are also evident in the Region's waters. Lake Tahoe has steadily warmed since regular measurements began in 1970, and the volume averaged temperature of the lake is now nearly a 0.8 °F (0.24 °C) higher (UC Davis - TERC 2016). The rate at which the lake is warming has increased in recent years (UC Davis - TERC 2016). A warmer lake is likely to alter species

composition, potentially altering the food web of the lake (Winder et al. 2009) and make it more hospitable to invasive species (TRPA 2014a).

The fraction of the Region's precipitation that fell as snow in 2015 (6.5 percent) was the lowest ever recorded (UC Davis - TERC 2016) and the studies suggest a future with significantly less snow in the Region. Tributary inflow from snowmelt is cooler than rain driven streamflow and the cooler waters generally sink to the bottom of the lake as they flow in. Higher temperatures of the inflowing waters in 2015 is one plausible explanation for the decline in clarity between 2014 and 2015 despite the relatively dry year (UC Davis - TERC 2016).

On land, rising temperatures and more frequent and intense drought events will increasingly pose a challenge for forest management (Thompson et al. 2009). While evidence from the historic record suggests that extended droughts are relatively common in the Region, climate change will likely increase the frequency and intensity of future droughts and require us to revisit forest management practices and other ecosystem dynamics in a warmer world.

These are only some of the system effects expected to flow from changing climatic conditions. While the full impact of these changes is not known, partners are already working to understand and plan for the likely shifts. For example, global climate change likely poses a threat to the integrity of the Region's vegetation communities and plant species and threatens to exacerbate existing stressors. Forecasts suggest high elevation areas such as the Lake Tahoe Region may experience range shifts, re-sorting of species associations, extirpations, and extinctions (e.g. Seastedt et al. 2004, Loarie et al. 2008, Tomback and Achuff 2010). The current prolonged drought, likely exacerbated by climate change (Diffenbaugh et al. 2015), has contributed to the bark beetle epidemic that the southern Sierra is experiencing. The outbreak has left tens of millions of dead trees on the landscape. The Tahoe Region is also experiencing increased beetle activity, but it is unknown yet whether we will experience infestations on the scale observed to the south. Drought and overcrowding reduce trees' ability to fend off beetle attacks and increases the risk of large scale infestations and tree die-offs.

While there is still much uncertainty and areas where management adaptations have yet to be defined, regional partners have already begun important planning and management adaptations. Partners have worked for over a decade on fuels reduction and forest health projects in the wildland urban interface (WUI) with the primary goals of protecting communities from wildfire and improving forest health. Regional partners are now actively exploring forest health treatments beyond the WUI to increase the resilience of Tahoe's forests. The forest health strategic initiative will take the last decade of adaptive management actions even further. It seeks to support the U.S. Forest Service and other land management partners as they work to address growing system stressors and consider multi-benefit restoration and management through a collaborative, multi-agency process. The group recognizes the potential impact of warmer temperatures and more frequent drought and is asking difficult questions about how best to manage the forest in the face of multiple threats. The science of forest management has begun to focus on landscape level forest resilience or "the capacity of the system to resist damage and recover quickly when challenged by environmental pressures" (Fuller and Quine 2016).

The strategic initiative to address shoreline development policy in the Region and the recreational experience along Lake Tahoe's shore is also actively incorporating uncertainty and the potential impacts of changing climate into planning and recommendations for new codes and ordinances. The natural rim of lake Tahoe sits at 6,223 feet (1,897m), and the dam at Tahoe City enables 6.1 feet (1.9 meters) of water storage, bringing the maximum elevation of the lake to 6229.1 feet (1,899m).

Since the dam in Tahoe City was installed, the lake’s elevation has averaged about 6225 feet (1,897.4 meters). Climate forecasts for the Region suggest that warmer temperatures and more variable rainfall are likely to lead to more frequent and dramatic fluctuations in lake level (U. S. Bureau of Reclamation 2015) and observations from the last 15 years suggest that this is already the case (UC Davis - TERC 2016).

While the shoreline and forest health initiatives are at the forefront of climate policy in the Region, they are not the only ones addressing these challenges. The lessons learned through these initiatives will provide an invaluable platform that supports future efforts.

Adaptive Management and the Threshold & Monitoring Update Initiative

Because change is happening all around us and the need to iterate more regularly to adapt to changing needs and conditions is essential, we have made the goal of continual adaptive management intentional. And the additional uncertainty associated with drivers largely beyond local control (eg. climatic change, population growth) makes management systems that can incorporate uncertainty even more valuable. Nearly 10 years ago, TRPA embraced more fully the “plan-do-check-adjust” adaptive management approach. We made it the foundation not only of the Regional Plan but also TRPA’s Strategic Plan Objectives, Strategic Initiatives, internal initiatives, ongoing annual activities, and even reorganized to build it into TRPA’s organizational division structure and reinforce it in our operating model (Figure 13-1). The model shifts the emphasis from creating the perfect plan and actions for all time towards creating good plans that can be more regularly and continually adapted and improved using new best information as it becomes available to deliver on objectives.



Figure 13-2 The “Plan-do-check-adjust” approach utilized by TRPA and the basin partnership for adaptive management and continuous improvement.

While both TRPA and the basin partnership are getting better at mobilizing to make adaptive improvements to programs in response to evaluative information, such as this threshold report, the area where we have not adapted as well is in keeping our evaluation standards and measures of effectiveness up to date. The peer reviewers’ recommendation in this respect is to create an adaptive management cycle for goals (threshold standards) to ensure that the plans and projects are continually aimed at the right target. The 2015 Threshold Evaluation Report peer reviewers acknowledged this and challenged the agency and its partners to ask: Is the information we collect and analyze generating knowledge that leads to better decision making? In the executive summary of the 2015 peer review, Conservation Science Partners, the lead of the peer review, writes, “Improvements to the Monitoring Program section will be easier to implement once the recommendations on improving the threshold standards themselves have been carried out.”

The TRPA Governing Board’s strategic initiative, endorsed in 2015, to review and update the threshold standards is charged with the task of taking a comprehensive look at the standards to ensure that they continue to reflect the most relevant values of the Region and are supported by the latest science. The next section of this chapter outlines a recommended first step in that process.

Recommendations for the Review and Modification of Threshold Standards: Phase I - Assessment of Threshold Standards

The programmatic recommendations focus on how the things that are already in motion can be made more effective. In short, how can we do what we do better? But in the comments of the peer reviewers of the 2011 and 2015 threshold evaluations, a much larger question loomed. Are we focused on the right things? Are the programs and policies that are continuously being adjusted and refined still focused on the right goals? And, is the information that guides those adjustments the best that can be offered? The latter questions are the focus of the threshold update initiative, and the comments of the peer reviews have further reinforced its central importance to the success of the other initiatives and the restoration of the Region.

The majority of the threshold standards were adopted in 1982 and are now nearly 35 years old. The scientific basis for many of the threshold standards dates back to the 1970s. Recognizing a widely acknowledged consensus, the TRPA Governing Board identified the review and update of the threshold standard system as a strategic initiative for the agency to engage in over the next five years. The threshold standard system includes both the threshold standards themselves and the monitoring, evaluation, and reporting structure that supports the system.

The initiative to review the threshold standard system enjoys robust support in the two states. In 2014, California and Nevada signed a memorandum of understanding to establish the Tahoe Science Advisory Council (TSAC), a 14-member panel of scientific experts from the leading institutions in the two states, to provide scientific guidance and inform management decisions in the Region. In establishing the TSAC, the states identified providing science-based recommendations on threshold standards as among the first tasks of the council. The TSAC role in the review process was reaffirmed at the first meeting its executive committee in July 2015 and at the first meeting of the TSAC in May 2016, and also supported by the Tahoe Interagency Executive Steering Committee at its meeting in April 2016. This chapter outlines the first phase in a process designed to capitalize on this broad support base to review and strengthen the threshold standards system.

The establishment of standards that can be objectively evaluated is the most frequent recommendation for modification included in the individual indicator sheets in the 2015 threshold evaluation. Moving from narrative standards towards specific numeric standards is a challenge that is not unique to the agency or the Tahoe Region. Over the last 20 years the U.S. Environmental Protection Agency has consistently encouraged states to transition from narrative to numeric criteria, which it describes as “ultimately necessary for effective state programs” (EPA 2011). This is clearly an important priority, but in reflecting on the recommendations in this and previous threshold evaluations it was clear that simply substituting numeric criteria for the existing standards might not be sufficient to address the issues identified. The peer reviewers of the 2011 Threshold Evaluation Report suggested a need to move away from a system that silos environmental values towards a more holistic landscape perspective. A more comprehensive approach is required to address concerns of that nature.

Reviewing and updating the standards that establish the goals for the restoration of the Tahoe Region will require a phased approach over multiple years. The proposed first phase is an assessment of the existing threshold standards against national and international best practices. The assessment (outlined in greater detail below) is designed to take a comprehensive look at the existing standards and establish the knowledge base necessary for informed review and possible

revision of the threshold standard system. To provide context for the proposed assessment, a brief background of the existing threshold standards is included below.

Origin of TRPA Environmental Threshold Carrying Capacities

Congress amended the Bi-State Compact (Compact) in 1980 (PL 96-551; December 19, 1980) with a directive and a Compact definition (Article II (i)) to adopt standards it termed “environmental threshold carrying capacities.” The Compact defined the standards as:

“... an environmental standard necessary to maintain a significant scenic, recreational, educational, scientific or natural value of the region or to maintain public health and safety within the region. Such standards shall include but not be limited to standards for air quality, water quality, soil conservation, vegetation preservation and noise”.

The definition included in the Compact bears little resemblance to the notion of “carrying capacity” as it is generally understood. The disconnect between and potential for confusion has been repeatedly identified and was again called out by the peer reviewers of the 2015 threshold evaluation report. One suggested changing the name entirely:

“..simply refer to “Threshold Standard” instead. The term “carrying capacity” has very specific meanings depending on context, and could lead to unintended interpretation.”

To avoid this confusion TRPA and partners routinely refer to “threshold standards” in keeping with the Compact definition.

The Compact directed TRPA and partners to identify appropriate environmental standards within 18 months of signing (PL 96-551, Article V(b)), and to develop and implement a Regional Plan to assure attainment or maintenance of those standards (PL 96-551, Article V(b)). TRPA initiated a 10 step process that included public comment and an environmental impact statement with an objective of developing recommendations for adopting the required standards (Box 1, TRPA 1982a).

In October 1982, TRPA released a report based on the best available science at the time detailing suggested environmental threshold standards (TRPA 1982b). The report, completed within the timeframe mandated in the 1980 Compact, provided a rationale for each proposed threshold standard, summarized relevant scientific information related to the proposed standard, and provided guidance on how attainment would be achieved (TRPA 1982). The TRPA

Steps used to identify and establish TRPA Environmental Threshold Carrying Capacities.

1. Select environmental components
2. Develop value or goals statements
3. Identify environmental variations
4. Model relationships of variables to the environment
5. Select Alternative Threshold Sets
6. Determine implication of alternative thresholds
7. Prepare and circulate EIS
8. Prepare draft study report
9. Conduct public hearings
10. Governing Board certify EIS and adopt thresholds

Figure 13-3: Steps used to identify and establish TRPA Environmental Threshold Carrying Capacities (TRPA 1982a)

Governing Board unanimously adopted the proposed standards via Resolution 82-11 in December

1982. The resolution established nine threshold categories that have been retained to this day and adopted multiple standards in each: air quality, fisheries, noise, recreation, scenic resources, soil conservation, vegetation preservation, water quality, and wildlife.

Historical Context

The conceptual basis for the threshold standards traces its origin to the agencies involved in the 1970s, and federal and state environmental quality legislation of the time, such as the Porter-Cologne Act in California (1969), Clean Air Act (1970), Clean Water Act (1972), Noise Control Act (1972), Endangered Species Act (1973), and Safe Drinking Water Act (1974). These national regulations along with the 1969 TRPA Compact agreement between Nevada and California (PL 91-147; December 16, 1969) likely framed the approach for standard development in Tahoe. In 1974, the EPA published a report entitled "*The Lake Tahoe Study*" which introduced the "environmental threshold" concept as a means to protect environmental quality in the Tahoe Region. According to that report, environmental thresholds would be represented by a set of parameters that specify the numerical value beyond which undesirable ecological damage occurs. In 1978, the Western Federal Regional Council (WFRC), a coalition of 11 federal agencies, signed a consensus federal policy statement for the Tahoe Region. The statement encouraged federal agencies to promote the establishment of "environmental threshold controls" to guide decision making in the Region. The federal agencies committed to policies to enhance coordination of National Forest land use planning to emphasize outdoor recreation and protection of water quality, threatened and endangered species, cultural resources, scenery, air quality, and the health of natural communities.

In 1979, the WFRC published the "*Lake Tahoe Environmental Assessment*" summarizing existing environmental and socioeconomic conditions at Lake Tahoe and exploring the feasibility of applying the environmental thresholds concept to the Tahoe Region. Chapter 7 of that assessment presented a framework for integrating environmental thresholds ("socially desirable levels of environmental quality") with the carrying capacity concept. The WFRC report proposed application of the carrying capacity concept to human populations and suggested that carrying capacities could be defined based on the environmental impacts of human activities (WFRC 1979a). The WFRC suggested integrating the carrying capacity and environmental thresholds concepts by starting with the desired environmental conditions in the Region (environmental thresholds) and then to achieve those conditions by defining levels of development and human activity (carrying capacities) to ensure the desired environmental conditions are maintained (WFRC 1979a).

The inclusion of the term "carrying capacity" in the Bi-State Compact, likely originated out of the work of the WFRC. However, the WFRC treated "Environmental Thresholds" and "Carrying Capacities" as distinct, but related, ideas and never merged the terms together in the way they appear in the Bi-State Compact.

The WFRC report suggested definitions for both "environmental thresholds" and for "carrying capacity." Environmental thresholds were defined as "end-states" for a resource (e.g., air quality, wildlife), or socially desirable levels of environmental quality. The concept of a carrying capacity emerged from the field of ecology, where it is used to describe limits on a species' population size imposed by the environment. Carrying capacities for the Tahoe region, the report suggested, should be defined as, "the maximum population and associated urban activity that a region can accommodate without exceeding environmental thresholds and without exceeding the infrastructure and mitigation cost limitations."

The WFRC suggested the "carrying capacity" and "environmental thresholds" concepts could be integrated to manage the Region by defining both the desired environmental conditions

("environmental thresholds") and levels of development and human activity ("carrying capacities") to ensure the desired environmental conditions are maintained (WFRC 1979). Thus then was the approach ultimately made explicit in the Compact, to adopt environmental standards (Compact Article II(I)) and an implementing Regional Plan with levels of development defined as growth caps and management actions designed to achieve the adopted standards (Compact Article V(c)). The Regional Plan regulates human activities and provides a vision for desired changes in those activities (e.g., a different regional development pattern, non-auto mobility, scenic improvements, etc.), while prescribing standards that must be met to ensure that the desired environmental conditions (e.g., water quality, air quality, etc.) are attained and maintained

Using the example of carbon monoxide, the WFRC report suggests that the desired end-state for carbon monoxide concentration could be achieved by a suite of management and mitigating actions; a) reducing the number of vehicle trips, b) increasing road capacity, c) cleaner burning automobiles, or some combination of all three (WFRC 1979b). Within this framework, the determination of carrying capacities for impacts from human activities in the Region is a function of action to manage and mitigate the environmental impacts of those activities versus an absolute numerical limit on a given human activity. "Carrying capacity" in this context refers to the policies and programs that govern development and human activities to ensure the desired conditions are achieved.

The peer reviewers of the draft 2015 Threshold Evaluation pointed out that since its introduction, when it focused primarily on the number of people, the application of the carrying capacity concept for management of people in ecological systems has evolved substantially. A broad body of scientific study has now developed over the last four decades, generally in the field of recreation management, giving the concept robust and more nuanced meaning. Years of management experience that found that total capacity limits were "seldom the most effective way to deal with most management problems (Cole & Carlson 2010)." Today, capacity limits are no longer viewed as the preeminent management strategy, but rather one of many strategies (Marion 2016). That shift in thinking was summarized in a recent policy guidance document on the use of visitor capacity as a management tool, *"...research and managerial experience have revealed that managing the number of visitors in an area is only one tool within a suite of strategies that can be used to achieve and maintain desired conditions. Effective visitor use management is often more about managing factors such as the types, timing, and location of visitor activities and associated visitor behaviors (IVUMC 2016a)."* Current best practice is consistent with the conceptual approach defined in the Compact that look to varied environmental standards and required management actions to achieve those standards (IVUMC 2016b).

Modification of the Environmental Threshold Standards

TRPA Resolution 82-11 instructs that the threshold standards:

"...shall be reviewed by staff and the Governing Body at the time of adoption of the Regional Plan to assure that the Regional Plan and the environmental threshold carrying capacities are consistent, and shall be reviewed at least every five years thereafter by the most appropriate means. After such review, the pertinent environmental threshold standards shall be amended where the scientific evidence and technical information indicate:

- a) two or more threshold standards are mutually exclusive; or*
- b) substantial evidence to provide a basis for a threshold standard does not exist; or*
- c) a threshold standard cannot be achieved; or*
- d) a threshold standard is not sufficient to maintain a significant value of the Region or additional threshold standards are required to maintain a significant value."*

The TRPA Regional Plan Goals and Policies and Code of Ordinances provide no specific process for the revision of threshold standards. Since 1987, selected threshold standards have been amended eight times with the most recent amendments occurring in 2012. The process for amending Resolution 82-11 has typically included the following steps:

1. Developing a proposed action for the amendment and administrative record evidence;
2. Vetting and refining proposed threshold standard amendments with partners and stakeholders;
3. Preparing environmental documentation and making findings according to the TRPA Regional Plan (Code of Ordinances– Chapters 2, 3, and 4) and Resolution 82-11 (using reasons for amendment as listed above);
4. Holding public hearings (at Advisory Planning Commission and Governing Board); and,
5. If approved, incorporating new or revised standard into Exhibit 1 of Resolution 82-11.

Assessing the Threshold Standards: A Proposed Methodology

“If we could first know where we are, and whither we are tending, we could then better judge what to do, and how to do it.”

- Abraham Lincoln

As Lincoln suggests, to know where to go next we first need a firm understanding of where we stand today. Extensive guidance and numerous national and international examples exist for the establishment and review of indicators and standards. Where existing standard and goals exist, the starting point for revision is generally an assessment of the existing system. While there are many models for best practice, there is no universally agreed upon set of criteria. The recommendations for this assessment are the product of a review of over 20 national and international models for standards and the development of monitoring and evaluation systems to identify the criteria most relevant to an assessment of the threshold standard system.

The assessment methodology proposed here is defined by a set of questions designed to identify strengths and weaknesses in the current threshold standard system. Each standard would be subjected to each question of the assessment. The questions emerged from a synthesis of both the academic and applied monitoring and evaluation literature. These sources ranged from guidance documents published by the most recognizable international environmental and development organizations such as the United Nations, Centers for Disease Control and Prevention, Global Environment Facility, and Conservation Measures Partnership, to leaders of national professional organizations such as the American Evaluation Association and major restoration programs such as those managed by U.S. Environmental Protection Agency. The proposed assessment does not include all criteria identified in any of the individual models. Rather it seeks a balance between the comprehensiveness of the assessment and redundancy in the information gained through applying the criteria in conjunction with the other criteria in the assessment.

The assessment would consist of two parts. The first would assesses the individual standards against criteria drawn from the SMART framework commonly used to set goals and evaluate progress in project and employee management. The second set, “standard categorization,” would provide additional context for individual standards and provide insight into how the standard fits into the larger threshold system framework.

The SMART acronym was coined in 1981 to describe desirable qualities for management objectives. SMART stands for Specific, Measurable, Achievable, Realistic, and Time-bound (Doran 1981). While the SMART criteria emerged from the human resources management field, they have become common in the conservation and environment field and have been adopted by the Global Environment Facility, the International Union of Concerned Nations, and the United Nations Evaluation Group.

The SMART framework is designed to enable objective and informative evaluation of the effectiveness of programs and actions. Goals that are SMART enable the development of reporting structures that:

1. Promote accountability for the achievement of objectives through the assessment of outcomes and the effectiveness of activities and policies.
2. Accelerate attainment through improved resource allocation and decision making and promotion of learning and knowledge sharing among partners.

TRPA is committed to collaborative adaptive management of regional programs through the Plan-Do-Check-Adjust cycle (PDCA). At the heart of effective implementation of the PDCA is understanding how effective the implemented actions have been in facilitating the desired outcomes. The provision of high quality information that informs management is a primary objective of the threshold evaluation reporting process.

How the application of SMART principles helps support more effective management is best illustrated with an example, the one below is drawn from *Measures of Success* (Margoluis & Salafsky 1998):

Original goal: Reduce incidents of harvesting of undersized marine resources.

Assessing the above goal against the SMART criteria, we identify that the original goal does not meet the SMART criteria for being specific, measurable or time-bound. The goal is ambiguous (not-specific) because “undersized marine resources” is not formally defined and there is no specified target for the desired reduction in incidents of harvesting. This ambiguity could cause different evaluators or stakeholders to reach different conclusions about whether the goal has been attained. The ambiguity could also confound measurement of the goal. The goal also specifies no timeline against which to assess progress towards attainment.

Revised goal: By the end of the third year of the project, reduce incidents of harvesting snappers, groupers and conch in violation of community council defined size limits to fewer than 15 per month.

The revised goal addresses the issues identified in assessing the original goal against the SMART criteria by formally defining the previously ambiguous parts of the original goal and specifying a formal target and desired attainment date. By addressing the ambiguity in the goal, the revisions ensure that evaluation of the goal will provide decision makers with the information they need to track progress towards attainment.

While the SMART framework includes “time-bound” as an attribute, time-boundedness is not included in the assessment framework proposed here. Criteria such as “time-bound” may be essential for evaluation of projects or establishment of goals for individuals, but may not be applicable to the establishment of standards for ambient environmental conditions. Air and water quality standards of the EPA, the State of California, and the State of Nevada detail desired conditions, but the rules themselves do not include a “time-bounded” element. This approach is

also consistent with guidance from institutions like the Global Environment Facility (GEF) that apply the full SMART framework to their monitoring and evaluation criteria, but require only that project and programs objectives be specific and measurable (GEF 2010).

The threshold standards are a mixture of environmental standards, restoration goals, directives to engage in specific action, broad guidance, and narrative statements. This fusion of types poses a challenge for the design of an assessment framework that is relevant to all of the standards. The assessment framework outlined below is intended to be comprehensive in its coverage, but in creating a comprehensive assessment framework the relative importance of individual criteria varies across standard types.

For example, consider the differences between three standards below:

1. Carbon monoxide - *Maintain carbon monoxide concentrations at or below 6 parts per million (7 mg/m³) averaged over 8 hours*
2. Littoral loading - *reduce the dissolved inorganic nitrogen loading to Lake Tahoe from all sources by 25 percent of the 1973-1981 annual average*
3. Nearshore attached algae - *support actions to reduce the extent and distribution of excessive periphyton (attached) algae in the nearshore (littoral zone) of Lake Tahoe*

The carbon monoxide standard establishes a limit and specifies a desired environmental condition in a manner similar to a regulatory standard. The littoral loading standard specifies a load reduction target, but not specify desired ambient conditions. The attached algae standard provides general direction, but establishes neither a specific target nor the desired ambient state of the system.

While the intent of all three standards may be appropriate, because of the nature of each, no single set of criteria is universally applicable to the assessment of all three. Differentiating between the types has implications for the relevance of individual criteria within the assessment and for design of larger monitoring and evaluation systems. Because of the importance of understanding the focus of each element in the threshold standard system, type differentiation is included as part of the assessment framework to provide decision makers insight into which criteria are most relevant for which types of standards.

After assessing each of the standards against the SMART framework based criteria, a second set of questions is proposed, which are referred to as standard categorization questions. These questions are intended to group standards in ways that provide additional insight into the basis of individual standards and how the standard fits into the larger threshold system. Categorization questions are intended to be combined with the SMART based criteria to help decision makers strengthen the threshold standard system and the information provided by the threshold evaluation. For example, the first question in the standard categorization assessment classifies standards based on where they fit in a simplified results hierarchy. Application of this assessment question to the aforementioned carbon monoxide, littoral loading, and attached algae standards would result in the identification that each was directed at different levels of the results hierarchy. The attached algae standard is directed at inputs, the nearshore loading standard is directed at intermediate results, and the carbon monoxide standard is outcome based.

Assessment Frameworks

The assessment frameworks are outlined in detail in tables 13.1 and 13.2 and each follow a common format. The first column, "assessment questions," briefly conveys what is being assessed to a general audience. The "description" column provides technical details for engaged audiences

to understand the rationale, usefulness, and applied or academic source of the question. The “rating” provides discrete groupings to help general audiences quickly discern the assessment of the standard. The “rating definitions” column provides the technical detail that defines each rating or category.

By working through the questions in tables 13.1 and 13.2, TRPA, partners, and stakeholders will gain insight into the evaluability of the existing threshold standards. The assessment is designed to transparently identify issues and opportunities to strengthen individual standards and the threshold system as a whole. The assessment will also provide the comprehensive information necessary to scope the magnitude or breadth of threshold standard review that decision makers can use to prioritize areas of inquiry and inform choices. The outcomes of the assessment are not prescriptive in nature; there is no single solution to address any issue highlighted during the assessment.

The recommended assessment questions are the product of a detailed review of national and international best practice and guidance for the establishment of the environmental goals and standards and guidance for development of monitoring and evaluation programs as well as reflection on the specific context and history of the threshold standards. The assessment process will allow TRPA and partners to assess the degree to which standards individually or as a system are consistent with best practice, can be objectively evaluated, or could benefit from additional review and strengthening.

The completion of the assessment is not an end point in and of itself. It is intended to provide information on the evaluability of the current threshold standards and to lay the foundation for the multi-phased initiative to review and update the threshold standard system. This information, in combination with the findings of the threshold evaluation report, guidance from the peer review, and input from partners and stakeholders, will be used to develop a process to strengthen the threshold standards system. The proposed assessment does not delve into why an individual standard exists or explore the merits of a standard relative to alternative standards with similar aims. Subsequent phases of the initiative are likely to address those questions and include wider inquiry that considers how well the standards in aggregate represent the values, concerns, and goals for the Region today.

The threshold standard system plays a critical role informing the design of policies, programs, and projects that impact Lake Tahoe’s environment, recreation, and economic opportunities. This assessment is the first step to create baseline information for strengthening the threshold system, and is aimed at integrating the best available science with the efficient allocation of resources to achieve the shared objective of preserving and protecting a national treasure.

Table 13.1: SMART-based criteria. *Questions to assess the extent to which the existing threshold standards are consistent with criteria based on the SMART framework for objective setting. SMART represents important criteria that have proven useful in defining indicators, however, organizations often ascribe slightly different definitions for each component of the SMART criteria.*

SMART-BASED CRITERIA			
ASSESSMENT QUESTION	DESCRIPTION	RATING	RATING DEFINITION
1. Is the standard specific ?	This question identifies where a lack of clarity in a standard may lead to misunderstanding or disagreement around attainment or progress towards attainment of a standard because the desired outcome is not clear. (Doran 1981; US EPA 2004; Stufflebeam & Shinkfield 2007; CDC 2009; GEF 2010; CMP 2013; IUCN 2015)	YES	The standard has a specific numeric target and baseline values are documented where necessary.
		NO	The standard has an unclear target or lacks a documented baseline value. Narrative standards receive this rating or standards that contain multiple sub-standards receive this.
2. Is the standard measurable ?	This question identifies standards where measuring progress towards attainment is complicated by a lack of clarity on what should be measured, or where there are no practical ways to measure the indicator. (Doran 1981; US EPA 2004; DRI 2006; Stufflebeam & Shinkfield 2007; CDC 2009; GEF 2010; CMP 2013; IUCN 2015)	YES	Indicators are unambiguous, clearly linked to the standard, and there are practical ways to measure them.
		NO	Appropriate indicators are not well specified, are impossible or impractical to monitor using existing methods, or questions surround monitoring methods.
3. Is the standard attributable ?	This question identifies standards less likely to provide information that informs local management decisions, because the desired outcomes cannot reasonably be credited to the activities anticipated. (Doran 1981; US EPA 2004; GEF 2010; CMP 2013; IUCN 2015)	YES	There is a clear link between actions being undertaken and changes in the standard indicator.
		NO	There is no clear link between management decisions in the Region and change in the standard indicator.
4. Is the standard achievable ?	This question identifies standards that are not likely to be achievable by the anticipated actions in a reasonable timeframe. (Doran 1981; US EPA 2004; GEF 2010; CMP 2013; IUCN 2015)	YES	It is likely that current actions or reasonably expected action will attain or maintain the standard or interim target.
		NO	It is unlikely that the standard or interim target can be achieved.
5. Is the standard relevant ?	This question identifies standards that have drifted from top level priorities of stakeholders or not providing	YES	The standard is highly relevant to current concerns in the Region, and the information derived by assessing the standard is regularly

SMART-BASED CRITERIA			
ASSESSMENT QUESTION	DESCRIPTION	RATING	RATING DEFINITION
	information that informs management decisions. (US EPA 2004; DRI 2006; Stufflebeam & Shinkfield 2007; GEF 2010; CMP 2013; IUCN 2015)		used to direct management in the Region.
		NO	The standard is not relevant to current concerns in the Region, and the information provided by assessing the standard does not regularly inform management.

Table 13.2: Standard categorization questions. Standard categorization questions are intended to group standards in ways that may be insightful to decision makers but do not always have an innate positive or negative quality. These categorization questions are intended to be combined with SMART-based criteria to provide additional insight into standard content and help focus on attention.

STANDARD CATEGORIZATION			
ASSESSMENT QUESTION	DESCRIPTION	RATING OR CATEGORY	RATING DEFINITION
1. Focus: What is the standard designed to measure (Activities, intermediate results, or ultimate outcomes)?	This question groups standards by type to provide additional insight about the chain of cause and effect, allowing a better understanding of the use and need for the standard. To provide strong program evaluation it is crucial to measure outcomes but it may be difficult to measure these end points due to time lag or challenges in attributing results to management activity. In these cases, it can be valuable to establish standards for intermediate results or activities completed. (DRI 2006; GEF 2010; CMP 2013; IUCN 2015)	Activity/Strategy/ Input	An activity standard defines a target for an activity or strategy that is expected to positively contribute to an outcome of intermediate result. Miles of roads treated (an Environmental Improvement Program performance measure) is an activity based measure that is expected to reduce pollutant load in stormwater, which will improve water quality in the lake.
		Intermediate Results	An intermediate result standard refers to a product that occurs along a chain of cause and effect that is expected to eventually lead to the desired outcome. Stormwater pollutant load is an intermediate result which is expected to lead to improved water quality.
		Outcomes	An outcome standard measures the

STANDARD CATEGORIZATION			
ASSESSMENT QUESTION	DESCRIPTION	RATING OR CATEGORY	RATING DEFINITION
			environmental condition or other result that is the desired end point. Secchi depth indicator of lake clarity is an outcome standard of water quality threshold category.
2. Science-based: Is the standard well supported by settled science or the most recent evidence?	This question assesses the strength of evidence for the existing standard. Many standards were adopted in 1982. New evidence and scientific research has emerged since then. In some cases, there is support for the standard, in other cases the evidence suggests a modification of the objective establish in 1982. (DRI 2006)	YES	The latest science supports the standard.
		NO	Since the standard was adopted additional research has emerged that suggests the standard needs to be revisited. Partner agencies managing similar resources have amended their standards/goals more recently than the TRPA standard and the two standards are not consistent.
3. Redundant: Do other standards measure similar content?	This question looks at the individual standard in the context of the whole threshold standards system to assess if multiple standards that relate to the same entity or objective. Redundancy can increase reporting costs and lead to confusion on goals and objectives. (DRI 2006)	YES	Other standards relate to the same entity.
		NO	The standard relates to a unique entity.
4. Reliable and Credible: Can reliable and credible information be	This question relates to the information available to assess status and trend of conditions relative to	YES	The information sources used to evaluate the standard are well documented, impartial and quality assured.

STANDARD CATEGORIZATION			
ASSESSMENT QUESTION	DESCRIPTION	RATING OR CATEGORY	RATING DEFINITION
gathered to assess the standard?	the standard and the extent to which information is reliable and credible. (DRI 2006; Stufflebeam & Shinkfield 2007)	NO	The information sources used to evaluate the standard are not available, likely contain bias, or quality assurance is inadequate.
5. Cost Feasible: How costly is it to monitor the standard?	A categorization of the total costs to monitor the standard for the time interval for each threshold evaluation (four years). Costs include rough estimates of personnel, supplies, analysis and reporting. This question provides decision-makers with a general understanding of the cost to monitor standards. (DRI 2006; GEF 2010; CMP 2013; IUCN 2015)	High	More than \$150,000 ¹ for each threshold evaluation.
		Med	\$20,000 to \$150,000 ¹ for each threshold evaluation.
		Low	Less than \$20,000 ¹ for each threshold evaluation.

¹Cost range categories may be subject to revision.

Chapter 13 Conclusions & Recommendations References

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