Climate Smart Actions for Natural Resource Managers Workshop
Case Study: STRAW Climate Smart Stream Restoration

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Lead Agency/Organization and Partners: The STRAW (Students and Teachers Restoring a Watershed) Project of PRBO Conservation Science collaborates with resource conservation districts, the Natural Resource Conservation Service, federal, state and county agencies and land trusts to complete restoration projects in partnership with schools. In the last 20 years, STRAW has included over 30,000 students in the restoration of approximately 25 miles of riparian habitat in the northern San Francisco Bay Area. Its goals are to empower students, support teachers, restore the environment, and reconnect communities.

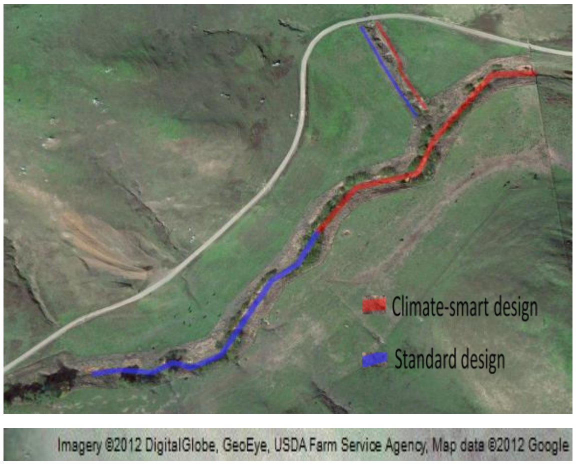
Project Description: We are developing and implementing climate smart streamside restoration designs that can accommodate changes in temperature and precipitation (usually warmer and drier), changes in extreme events (*i.e.*, more frequent drought and more intense precipitation events), and disrupted wildlife and plant phenology. The overarching goal is that restoration projects will be designed with enough elements to be effective regardless of future climatic scenarios. In addition, we want to include the greater public in active adaptation to climate change.

Approach to Vulnerability Assessment: We used a literature review **(**http://data.prbo.org/apps/bssc/uploads/Ecoregional021011.pdf), a vulnerability assessment of California birds **(**http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0029507), and expert opinion to identify vulnerabilities of streamside vegetation and the wildlife that use it. Based on this assessment, we identified two major vulnerabilities (1) increased plant mortality associated with extreme weather events and other disturbances (*e.g.*, more frequent droughts, floods, and (to a lesser extent) fire and (2) vulnerability of wildlife to phenological mismatches – when the seasonality of plant resources (*e.g.*, fruits the birds feed on) do not occur at the time they are needed (*e.g.*, during bird migration).

Adaptation Actions: To help us develop climate smart restoration designs, we created a tool that describes plant life history characteristics related to these vulnerabilities. The tool is a simple matrix with a list of plants and whether or not they tolerate full sun, wet conditions, dry conditions, are fire adapted, provide a wildlife food source, and the timing (by month) of the food source. Using this tool, we have developed climate smart restoration designs that have plant species with wider environmental tolerances, and address vulnerability to disrupted phenology. We expect that these new

STRAW students implementing our climate-smart design in Marin County, CA.

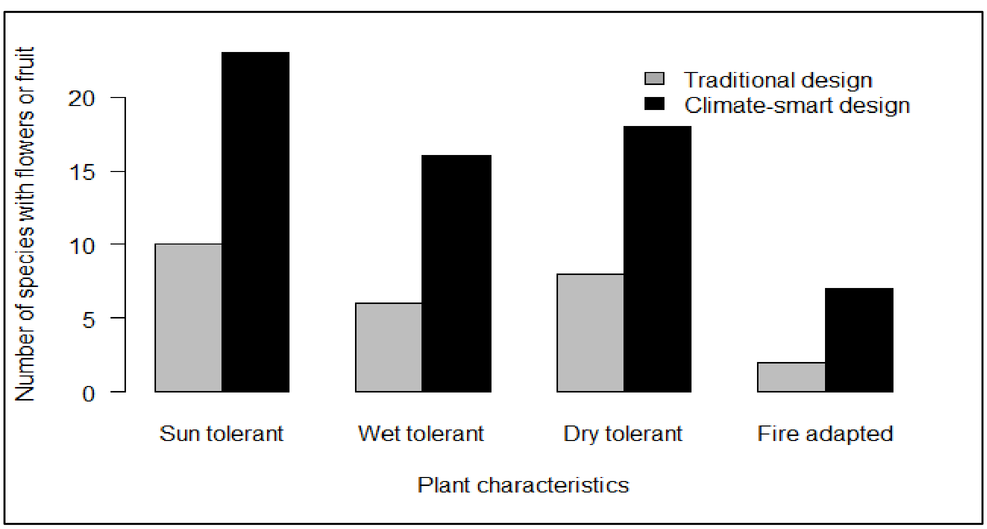
planting palettes will increase the survival of restored vegetation under future climatic conditions and provide more robust resources for wildlife as the climate changes.

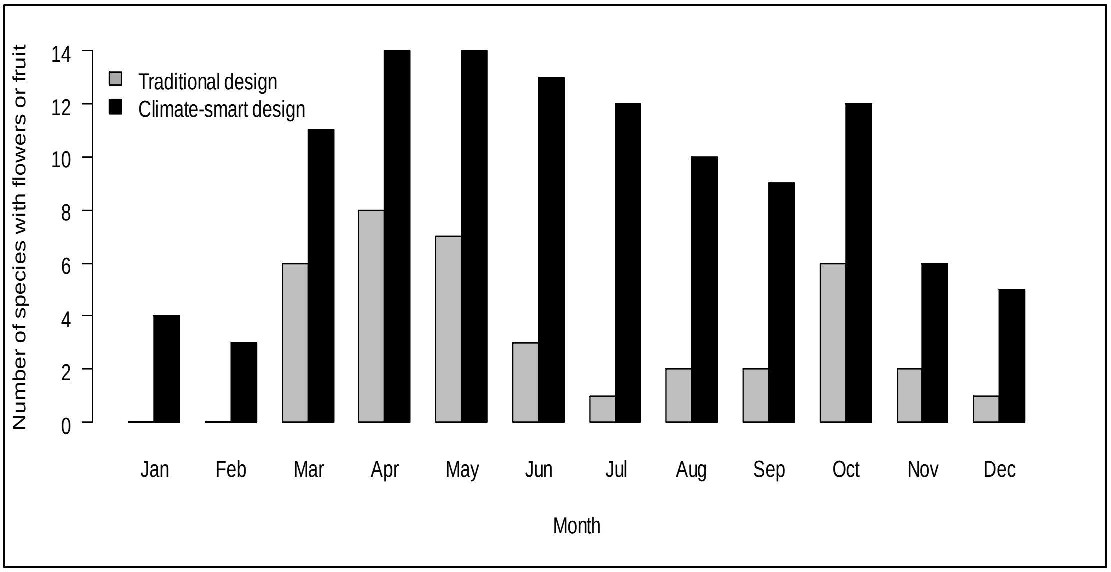


Implementation: With 282 students and 82 parents, we implemented a climate smart stream restoration project in coastal Marin County, California to explore how incorporating our two climate vulnerabilities into restoration design changes the way we do restoration. We restored half of a site using a traditional restoration design, contracting with a consultant to develop a planting palette as he has done with us for over 20 years. On the other half of the site, we used the climate smart planting palette (selecting species that would address our two identified vulnerabilities).

Using climate smart principles in our planning process resulted in a restoration design that was substantially different from the traditional design. Our climate smart design called for 24 species of trees and shrubs, whereas the traditional design called for only 10 species. Because these sections were relatively small, planting more species required higher planting densities in the climate smart restoration; 249 individual plants compared to only 123 individuals in the traditional restoration. Despite the fact that our climate smart restoration had roughly twice the number of species and density of trees and shrubs than the traditional restoration, the cost of the climate smart restoration was only 1.5 times that of the traditional design. Many of the additional species in the climate smart restoration were smaller and less expensive compared to those in the traditional restoration. This restoration site will receive three years of maintenance support (weeding, browse control and irrigation) as well as annual plant establishment and photo monitoring.

Comparisons between traditional and climate smart designs.





Monitoring and Management: How will we know if our climate smart restoration project is successful? There are some relatively simple short-term metrics of success that are not appreciably different from what we would do in a traditional restoration. We will monitor by the plant species for vigor and height class for at least three summers following the restoration. Similarly, we plan to implement long-term monitoring of the bird response to the project. In the short-term, we should be able to tell if (1) we have established a streamside vegetation community that has species that can survive environmental uncertainty and provide resources for wildlife, and (2) whether some of the species that are used less-frequently in traditional restoration designs are effective with regards to establishment. Over the long-term, we will be successful if these sites have consistent healthier vegetation and bird communities than sites with the standard restoration designs.

Lessons Learned: In terms of implementation, some of the species we hoped to install in the climate smart design were not available from nurseries, limiting the final project design. Also, to incorporate the increased number of species into projects, a larger minimum project size is necessary to provide adequate species redundancy and encourage self-propagation. This would also decrease costs, as planting densities could return to normal.

Normalizing restoration design to include climate change poses some additional regulatory challenges for projects with strict performance criteria. Using some un-tested species would be a risk that could discourage practitioners from implementing climate smart designs. Finally, there is a need to look beyond revegetation. In addition to changes for the plant community, climate change will also mean more extreme precipitation events that create extreme streamflows. In the future, we will work with engineers to investigate the cost, logistics, and implementation of designing in-stream engineering projects to withstand anticipated extreme precipitation events. This will both ensure that the in-stream infrastructure can withstand these events and also provide suitable habitat for aquatic organisms (*e.g.*, young salmonids) during exceptionally high flow events.

A critical lesson learned from this initial project is that the public, especially students and teachers, are inspired and hungry to take actions to adapt to climate change. Participating in this project was motivating and encouraged a hopeful path forward given the daunting threat of climate change. STRAW has been fortunate to engage the public in professional restoration projects for over 20 years. This project, however, was unmatched in the enthusiasm and hope that it gave to the participants.

For Further Information:

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