



A How-to Guide and Metadata for the Riparian Restoration Design Database *Marin and Sonoma Counties*

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John J. Parodi, Leia Giambastiani, Nathaniel E. Seavy,
Isaiah M. Thalmayer, Eliza Lasky, and Thomas Gardali

Conservation science for a healthy planet

3820 Cypress Drive, #11 Petaluma, CA 94954

T 707.781.2555 | F 707.765.1685

pointblue.org

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This document is a companion to the Riparian Restoration Design Database, available at www.pointblue.org/restorationtools. Its purpose is to provide general information on how to use the database to design riparian restoration planting projects in a manner that prepares them for the consequences of climate change. It also provides metadata on each plant characteristic assessed including why it was chosen, how it was defined, and how it was scored.

WHY

The revegetation of riparian areas is an important tool for protecting water quality and providing habitat for riparian-associated wildlife (Gardali et al. 2006, Lennox et al. 2009). Climate change puts an additional premium on riparian restoration (Seavy et al. 2009). To be successful, restoration practitioners need to consider the projected consequences of climate change. In addition to the practical need for projects to be successful in a range of future climate scenarios, planning for climate change is beginning to be required for grants, contracts, and permits.

WHO

The Riparian Restoration Design Database is designed to help restoration practitioners, the regulatory community, and land managers make sound climate-smart decisions when selecting plant species for riparian restoration projects.

WHERE

The Riparian Restoration Design Database is suited for riparian areas in Marin and Sonoma counties, California.

WHAT AND HOW

To help restoration practitioners select riparian plants that are resilient to extreme weather events and to reduce the threats of phenological mismatches, we have developed a database of plant characteristics. This Design Database or “tool” has two components. The first describes the tolerances that each plant species has to a variety of conditions that might ensure survival in a future with increasingly frequent and extreme weather events. The second describes resources each plant species provides for wildlife and the months in which each species provides flowers and/or seeds. The Riparian Restoration Design Database can be modified by adding species to fit your project.

The Riparian Restoration Design Database helps restoration practitioners develop planting designs that (1) reduce the vulnerability of a project area to extreme weather events by increasing the capacity of the restoration to rebound from longer and/or more frequent periods of drought, floods, and fire and (2) reduce the vulnerability of wildlife to phenological mismatches by selecting species that provide resources (cover, food) throughout much or all of the year. It can be used to develop planting palettes to meet climate change project specific restoration goals (e.g., Does the project include any species that are drought tolerant? How many?) and/or to add ecological redundancy to a design (e.g., Does this project include multiple species that flower in January?). As noted above, the Riparian Restoration Design Database can be modified by adding plant species to fit your project’s goals.

DATA DEFINITIONS

Tolerates full or partial sun

Why: The future climate of Marin and Sonoma counties will be warmer and drier in the summer than it is currently (Micheli et al. 2010, PRBO 2011). Because many species that can tolerate full sun are also relatively drought tolerant, selecting species with this attribute may increase survival.

Definition: Species in this category can tolerate being in full sun or part sun/shade; not full shade. Plants that typically experience more than four hours of sun are included here. Coastal plants in full sun are frequently subjected to fog which can act similar to shade, but can also tolerate days with no fog and full sun. Therefore, they are considered plants that tolerate full sun.

Published information and expert opinion indicate that:

- Y – Plant can tolerate full or partial sun (more than four hours of sunlight)
- N – Plant cannot tolerate full or partial sun (more than four hours of sunlight)
- ? – Information unavailable, inconclusive, or of inadequate quality

Tolerates clay soil

Why: In Marin and Sonoma counties, soil can frequently have a substantial amount of clay. Although clay does retain moisture well, it can be challenging for plant establishment due to its expansive nature (cracking in summer months) and it can cause slow root growth. Hence, while not necessarily a specific climate change plant characteristic, we judged it important to include because of its importance in project design and plant survival.

Definition: Species in this category have evolved to thrive in heavy clay soils.

Published information and expert opinion indicate that:

- Y – Plant occurs and thrives clay soil
- N – Plant does not occur or thrive in clay soil
- ? – Information unavailable, inconclusive, or of inadequate quality

Tolerates wet conditions

Why: Although most climate models predict increased ambient air temperatures and overall drier soil conditions in the summer, many also predict more extreme, erratic precipitation events and some project wetter conditions in the winter (Micheli et al. 2010, PRBO 2011). By incorporating species that tolerate or thrive in wet conditions into planting designs with species that tolerate dry conditions, practitioners can address the uncertainty in the future precipitation patterns.

Definition: Species in this category can persist in high moisture conditions throughout the calendar year.

Published information and expert opinion indicate that:

- Y – Plant is known to occur and thrive wet conditions year round
- N – Plant is not known to occur and survive in wet conditions year round
- ? – Information unavailable, inconclusive, or of inadequate quality

Tolerates dry conditions

Why: In the Bay Area, many climate models project that conditions in the future will be drier during the summer (Micheli et al. 2010). Considering these projections, we need to plan for projects to experience extended periods of limited soil moisture.

Definition: Species in this category have evolved to thrive in low moisture conditions throughout the calendar year.

Published information and expert opinion indicate that:

Y – Once established, plant is known to occur and thrive without water during the summer and fall

N – Once established, plant is not known to occur and survive without water during the summer and fall

? – Information unavailable, inconclusive, or of inadequate quality

Evergreen

Why: Climate change is impacting both animal migration and the timing of the availability of resources that animals rely on. Empirical observations, modeling, and vulnerability analyses suggest that migratory wildlife may be vulnerable to climate change if their migration schedules become mismatched with the timing of their food resources (e.g., Memmott et al. 2007, Gardali et al. 2012). Evergreen vegetation provides resources and especially cover from predators year round. For that reason, we include species that provide shelter throughout the calendar year, allowing for cover from predators regardless of timing variations resulting from a changing climate. They also provide year-round shade, which may benefit stream temperature as well.

Definition: Species in this category have leaves present throughout the calendar year, and are not deciduous.

Published information and expert opinion indicate that:

Y – Plant has evergreen leaves

N – Plant does not have leaves all year

? – Information unavailable, inconclusive, or of inadequate quality

Fire Adapted

Why: Warming temperatures and increased aridity may lead to more frequent fires in Marin and Sonoma counties (Micheli et al. 2010). Because many of our California native plants have evolved in concert with natural wildfire regimes, including these species in restoration designs can increase the ability of vegetation to persist after fire. Potential fire adaptations include the ability to resprout from the roots, tubers or rhizomes, tolerance of the seed to fire including serotinous seeds, bark thickness, tall crowns, and bud protection.

Definition: Species in this category are tolerant of occasional exposure to fire, and may require fire during some component of its life cycle.

Published information and expert opinion indicate that:

Y – Plant is adapted to fire

N – Plant is maladapted to fire

? – Information unavailable, inconclusive, or of inadequate quality

Wildlife Fruit, Nectar and Seed Source

Why: If a goal of your restoration project is to provide food resources for both resident and migratory wildlife, planting species known to provide abundant resources under various climatic conditions may be important. In addition, climate change has the potential to create new “novel” assemblages of wildlife that might use a project in ways that have not been observed (Ko 2014). A component of climate-smart restoration could be to ensure that project designs include multiple sources of forage that fill as many niches as possible. Note that a critical component of this characteristic is timing of fruiting, flowering, seeding – see below.

Definition: Species in this category provide a food resource (nectar, berries, and/or seeds) available or known to be used by wildlife at some point during their lifecycle.

Published information and expert opinion indicate that:

- Y – Plant produces nectar, berries and/or seeds known to be used by insects and wildlife
- N – Plant does not produce nectar, berries and/or seeds known to be used by insects and wildlife
- ? – Information unavailable, inconclusive, or of inadequate quality

Insectary Plant

Why: Insects provide many services to ecological systems; they are critical for pollination of both native and agricultural landscapes, and provide food for other organisms. For example, they provide a critical source of protein during nesting season for birds. By including species that provide resources for insects under a range of climate conditions, projects can promote a large and diverse population of insects that will enhance the ecological benefits.

Definition: Plant species is used by insects, known to play a role in an insect’s lifecycle, and/or be beneficial to insects through food or shelter.

Published information and expert opinion indicate that:

- Y – Plant is known to be used or beneficial to insects
- N – Plant is not known to be used or beneficial to insects
- ? – Information unavailable, inconclusive, or of inadequate quality

Seed and Flower Phenology

Why: Climate change will modify existing ecological systems, assemblages, and processes in unpredictable ways. Empirical observations, modeling, and vulnerability analyses suggest that migratory wildlife may be vulnerable to climate change if their migration schedules become mismatched with the timing of their food resources (e.g., Memmott et al. 2007, Gardali et al. 2012). Considering that ecological patterns such as migration and plant phenology are subject to unpredictable changes, long-term project success may be enhanced by providing food resources for wildlife regardless of future scenarios. One way to maximize the potential for success is to ensure that the plants provide resources over the entire calendar year (or nearly so). Doing so will ensure that there are resources available that may buffer species from phenological mismatches in riparian systems.

Definition: Plant species included in the Riparian Restoration Design Database currently provide resources during the months outlined in the accompanying table.

Published information and expert opinion indicate that:

- F – Plant is known to flower during the indicated month(s)
- S – Plant is known to seed during the indicated month(s)
- F/S – Plant is known to seed and flower during the indicated month(s)

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Harold Appleton, Registered Forester and Erosion Control Specialist. Prunuske Chatham Inc.

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