Building Landscape Connectivity for Climate Adaptation:

MAYACAMAS TO BERRYESSA CONNECTIVITY NETWORK (M2B)

FINAL REPORT

Pepperwood PRESERVE

A Technical Report of Pepperwood's Dwight Center for Conservation Science
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October 2018

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ABSTRACT: The Mayacamas to Berryessa Landscape Connectivity Network (M2B) is a public-private collaboration between land trusts, open space and park districts, State and Federal land managers, and ecology researchers dedicated to landscape-level conservation of Northern California's inner Coast Ranges. This team formed thanks to support provided by the California Landscape Conservation Partnership's Place-based Climate Adaptation Program. Pepperwood serves as the team's backbone organization and via this project facilitated the application of recent advances in habitat mapping, landscape linkage analyses, and climate threat assessment to advance a multi-county (including Sonoma, Napa and Lake) habitat connectivity roadmap spanning from the Mayacamas Mountains to the new Snow Mountain-Berryessa National Monument. Results are informing site-specific habitat corridor action plans to advance protection and enhancement of habitat linkages key to biodiversity and watershed health by members of the network steering committee and their home organizations. The project provides a model of how to co-create meaningful connectivity data products to inform ground-based conservation of habitat corridors critical to climate resilience, watershed integrity, and health of forests and wildlife.

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INTRODUCTION

M2B Project Overview

The Mayacamas to Berryessa Landscape Connectivity Network (M2B) is a public-private collaboration between land trusts, open space and park districts, State and Federal land managers, and ecology researchers dedicated to landscape-level conservation of Northern California's inner Coast Ranges. Pepperwood serves as the team's backbone organization and facilitated the application of recent advances in habitat mapping, landscape linkage analyses, and climate threat assessment to advance a multi-county (including Sonoma, Napa and Lake) habitat connectivity roadmap spanning from the Mayacamas Mountains to the new Snow Mountain-Berryessa National Monument. The network is generating site-specific habitat corridor action plans to advance protection and enhancement of habitat linkages key to biodiversity and watershed health.

Keeping landscapes connected via habitat linkages or "corridors" is the most frequently recommended approach to maintain ecosystem resilience in the face of climate change (Heller and Zavaleta 2009). The benefit of landscape connectivity is that it protects our water resources in an increasingly arid region and provides room for plants and animals to adjust their locations in response to a warming climate as needed to survive. M2B engages local land conservation agencies across county borders in the co-creation of data-based tools critical to advancing on-the-ground climate resilience projects based on landscape structure, ecology, expert knowledge, and potential climate benefit of landscape linkages. This collaboration provides much-needed coordination to effectively leverage conservation efforts across the region designed to protect and manage our land, water and plant and animal life in the face of an uncertain future.

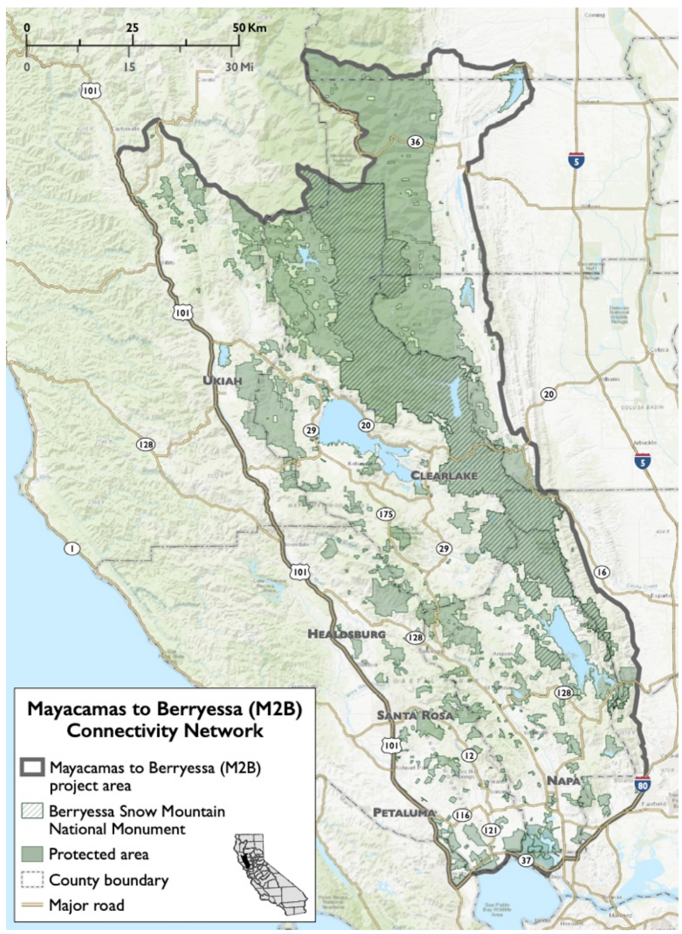


Figure 1. Map of the M2B project area, overlaid with protected areas (green) and Berryessa Snow Mountain National Monument (hatched).

The spatial data generated by this project are complemented by a companion *M2B Methodology Report* (Gray et al. 2018f) a set of linkage-specific parcel-scale reports (Gray et al. 2018a, 2018b, 2018c, 2018d, 2018e, 2018g), and an outreach brochure to support linkage funding and implementation. In the M2B region, parcel-scale acquisition and stewardship will be largely advanced by private land trusts and public open space districts in concert with State and Federal land management agencies. The formation of the M2B institutional network empowers local agencies and organizations to work more effectively, and in a more coordinated fashion, to advance on-the-ground connectivity and climate resilience in the Mayacamas to Berryessa Coast Ranges. Our analytical results are designed to be scalable and reproducible throughout the State of California.

M2B Project Partners

The Mayacamas to Berryessa Connectivity Network (M2B) is comprised of a coalition of conservation practitioners, land managers, decision-makers, and scientists working together to better understand and address climate resilience across connectivity networks. The steering committee included 16 members representing eight organizations: Audubon Canyon Ranch (Sherry Adams, Michelle Cooper, and Jeanne Wirka), McLaughlin Reserve (Catherine Koehler), Lake County Land Trust (Thomas Smythe), Land Trust of Napa County (Mike Palladini), Sonoma County Ag + Open Space (Karen Gaffney, Alex Roa, and Allison Schichtel), Sonoma County Regional Parks (Hattie Brown), Sonoma Land Trust (Wendy Eliot, Trevor George, Ann Johnston, and Tony Nelson), and the United States Bureau of Land Management (Kay-Leigh Barnitz and Jim Weigand). The science team consisted of Drs. Lisa Micheli and Morgan Gray (Dwight Center for Conservation Science at Pepperwood), and Dr. Adina Merenlender (UC Berkeley). The project management team consisted of Drs. Lisa Micheli and Tosha Comendant (Dwight Center for Conservation Science at Pepperwood).

Key Findings for the Region

By integrating landscape and climate analyses with expert knowledge of field conditions and conservation opportunities, the project team identified six habitat corridors key to climate resilience and ripe for implementation action. Our M2B data products and supporting documentation provide a template for advancing conservation of these six priority corridors and serve as a resource for future corridor initiatives in the region. The formation of a durable social network, with all steering committee members opting to maintain the network beyond the horizon of this project's funding, is a testimony to the effectiveness of our stakeholder engagement model. The result is a viable framework for place-based networking for both data and people to advance landscape-scale climate resilience.

In terms of advancing the field of climate connectivity science, our analyses of regional climate projections show clear differences between trends for summer and winter variables, highlighting the importance of accounting for seasonality in Mediterranean climates with a coastal influence in connectivity planning. Overall, cooler summer temperatures were found in the western portion of the study area closer to the coast, whereas the cooler winter temperatures were found inland to the east.

The effect of seasonality was also apparent in our evaluation of future climate spaces and the linkages that offer the greatest climate benefit in degrees of net cooling differ between the two temperature variables. Thus, while mean annual temperature can be informative for some analyses, in locations with topographic and climatic diversity, evaluating seasonal temperatures for both summer and winter. The novel methods to assess "climate benefits" developed here identified shrinking "climate spaces," i.e. where cooler conditions are likely to be extinguished over time in the landscape, and quantified the net "cooling benefits" available to organisms via linkage features of the protected area network (see the companion methodology report, Gray et al. 2018f for details).

We analyzed terrestrial (structural) and riparian linkage potential independently of each other to maintain clarity regarding different functional pathways through the region's topographic landscape facets. These analyses permit conservation planners to consider individual species' habitat preferences, life cycles, and mode of dispersion or movement. These two sets of analyses can quantify existing connectivity and directly inform conservation management and planning by identifying functional linkages for resource planning and corridor implementation. When we compared the overlap between both terrestrial and riparian linkages, we found some overlap between the linkages in the southern portion of the study area that features more urban development and smaller remaining protected areas, such that stream corridors often provide the last options for functional corridors.

Implications for Long Term Planning

A key take home message of this project is that successful science-management collaborations require true "co-creation" of applied data products. In particular, it is extremely important to engage conservation users at the project outset, to define key management challenges and goals, prior to designing a framework for analysis. In this case, we built on a regional dialog which has been in process since before the release of a set of Bay Area Critical Linkages (Penrod et al. 2013). The message from practitioners was that tools needed to be transparent in terms of a continuous assessment of linkage potential across the landscape (instead of displaying just derived "corridor" pathways), integrate riparian connectivity, and generate meaningful results at the parcel-scale, which is the scale of local conservation action. By augmenting this dialog with a focus on climate resilience, and engaging stakeholders in a two-year process to really dive deep into the variable distribution of climatic attributes throughout the region, including projected patterns of change, this project has built stronger capacity within each member organization to tackle the climate resilience challenge in all aspects of their long-term planning.

The bridge between our regional analyses and local action are the specific linkage reports (Gray et al. 2018a, 2018b, 2018c, 2018d, 2018e, 2018g) developed to address site-specific habitat corridor projects prioritized by engaged conservation actors. It was a conscious choice on the part of the steering committee not to generate a map of "habitat corridors" for the entire region. Instead we offer continuous maps of "linkage potential" based on landscape and climate features that can be used in-house by practitioners for ongoing planning needs, and then present public-facing visualizations of "habitat corridors" that have been adopted for near term implementation (including the linkages between Pepperwood and Modini-Mayacamas Preserves, across Alexander Valley, between Shiloh Ridge to Mark West Springs, from Clear Lake to Mount Konocti, and the three branches of the "Heart of the Mayacamas," centered on Mount St Helena and spanning the Mayacamas to Berryessa ranges).

These site-specific habitat corridor "linkage reports" were developed in concert with detailed input from the implementation teams to produce numerous and diverse data visualizations scaled to the areas of interest. These reports also provide parcel-scale assessments of up to hundreds of individual parcels comprising these key corridors. This information provides the opportunity to target and/or evaluate specific acquisition or stewardship opportunities. It also provides a wealth of information to promote project implementation on the part of partners or investors, with a unique focus on climate adaptation value. Given that many funders are interesting in investing in climate resilience, this information will raise the priority of identified corridors.

We anticipate that these results will also inform regional action plans, and project data is presently being expanded to include all of Sonoma County to enable Ag + Open Space to integrate results into the "Vital Lands Initiative" guiding their acquisition priorities for decades to come. With interest by neighboring stakeholders in an expansion of this approach across the 101 Highway to the Marin, Sonoma and Mendocino Coasts, this project has the potential to strengthen landscape connectivity across the emerging landscape-level stewardship networks emerging in the region from the Pacific Coast to Central Valley, and provide a viable model for the state of California as a whole.

In the wake of the 2017 fire season, the M2B network found itself in the unique role of one of the only organizations spanning all the counties impacted by the October 2017 Northern California wildfires. A landscape-level approach to forest management, with a focus on reducing accumulated fuel (e.g., understory vegetation that has built up in the absence of fire), will be needed to coordinate across jurisdictions and land ownerships. It is an unanticipated outcome that habitat corridors identified by the M2B network could now also serve as a vehicle for fire resilience planning and implementation. Specifically, the linkages and corridors are being

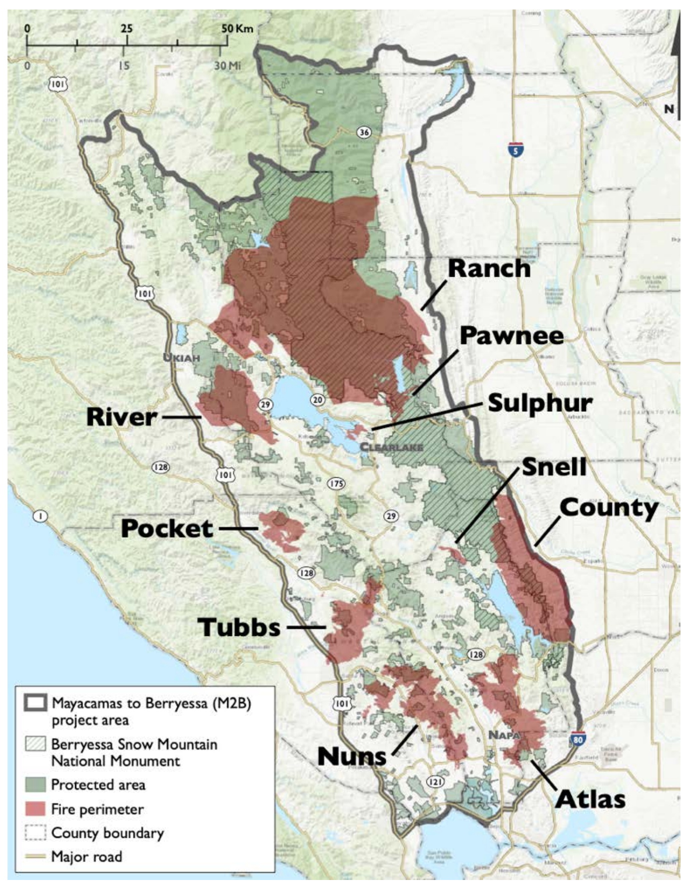


Figure 2. Map of the M2B study area, overlaid with major fires (red) that have occurred in 2017 and 2018.

evaluated through the lens of improving regional fire resilience to enhance climate adaptation, including elements such as forest thinning, fuel breaks, and emergency access and implementation.

STAKEHOLDER ENGAGEMENT

Successful climate change adaptation requires building social *and* physical landscape linkage networks and cultivating a shared understanding of how land use and climate change will influence future connectivity. In the M2B region, parcel-scale acquisition and stewardship will be advanced primarily by private land trusts and public open space districts in concert with State and Federal land management agencies.

The M2B network is a coalition of conservation practitioners, land managers, decision-makers, and scientists from Sonoma, Napa, and Lake Counties that provides a documented model for empowering local agencies and organizations to work more effectively, and in a more coordinated fashion, to achieve landscape-level conservation objectives. The network approach facilitates dialogue, captures and translates results into collective conservation action, with firm yet flexible project management support on the part of the network "backbone organization" to keep the entire process on track.

From the outset, representatives from land trusts, parks and open space districts, and state and federal land managers shaped the design and evaluation of the M2B products through regular, highly interactive meetings to ensure that our questions and deliverables remained relevant to stakeholders and partners. Stakeholders were actively involved throughout the entire project life cycle for the creation of data products (e.g., connectivity, climate, focal linkage) as well as messaging materials (Figure 3).

The Pepperwood team worked closely with these stakeholders through a series of regular in-person meetings (Figures 4 – 5). Supplementary engagement methods included a pre-project survey, use of a project management tool for sharing correspondence and interim products, and screen-sharing webinars between in-person meetings. Using this highly collaborative and iterative approach to methods development and refinement with a cohort of engaged land managers allowed us to exploit the benefits of early engagement, which gave us the flexibility to respond to feedback on project design and implementation through a co-creative process. This approach ultimately increased the compatibility between the data products and the needs, planning, and management workflows of end-users.

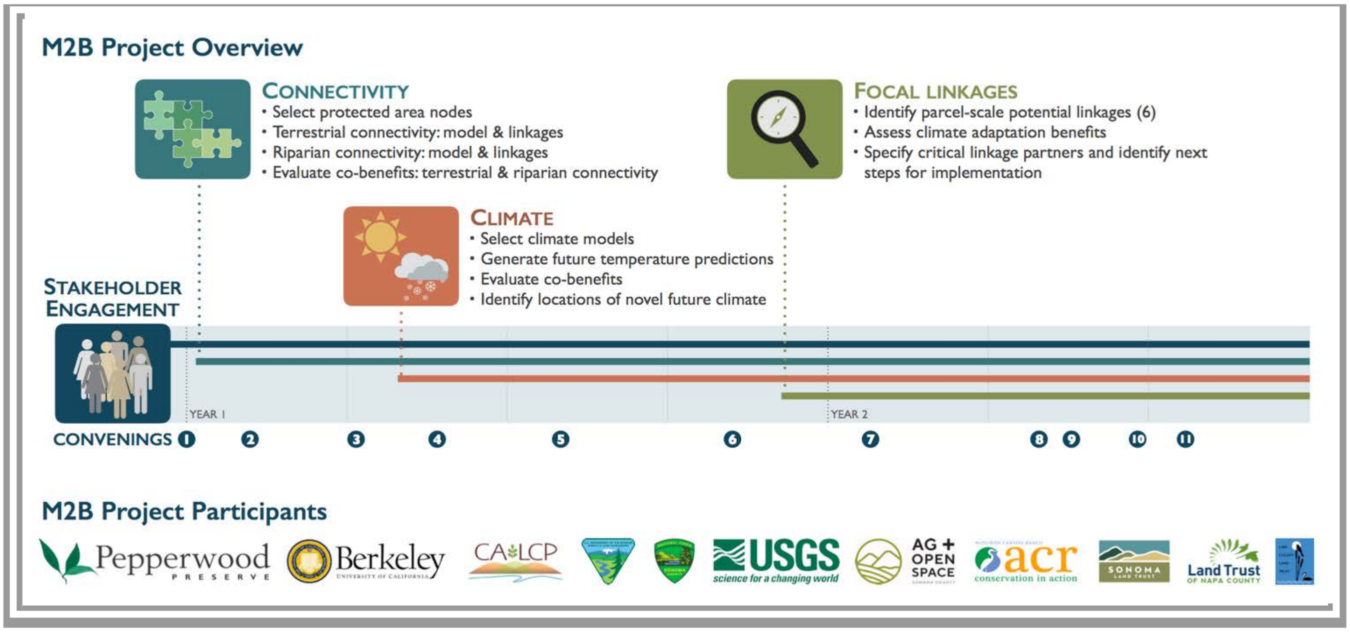


Figure 3. Overview of the workflow for the M2B project, showing stakeholder engagement throughout the project.

A central goal throughout the process was to maintain an applied science focus by defining key management questions for each jurisdiction at the onset of the project, and then refining those questions throughout the project duration. Stakeholder meetings were held to jointly engage key managers and key vulnerability assessment analysts in an open dialogue that was facilitated by a project manager with training and experience in both arenas. The overall stakeholder engagement process included the steps listed below, with many allowances for feedback throughout.

The extensive and iterative stakeholder engagement process used by the M2B network can provide a model for groups in other regions working with local government and natural resource management agencies. These technical methods also provide a model of how to evaluate connectivity and prioritize locations for climate resilience. A primary benefit of this project to managers was having direct access to the scientists who created the models, and therefore know the limitations of the data. In turn, the scientists learned about new dimensions of projected change that would not have been discovered without this collaborative exploration.

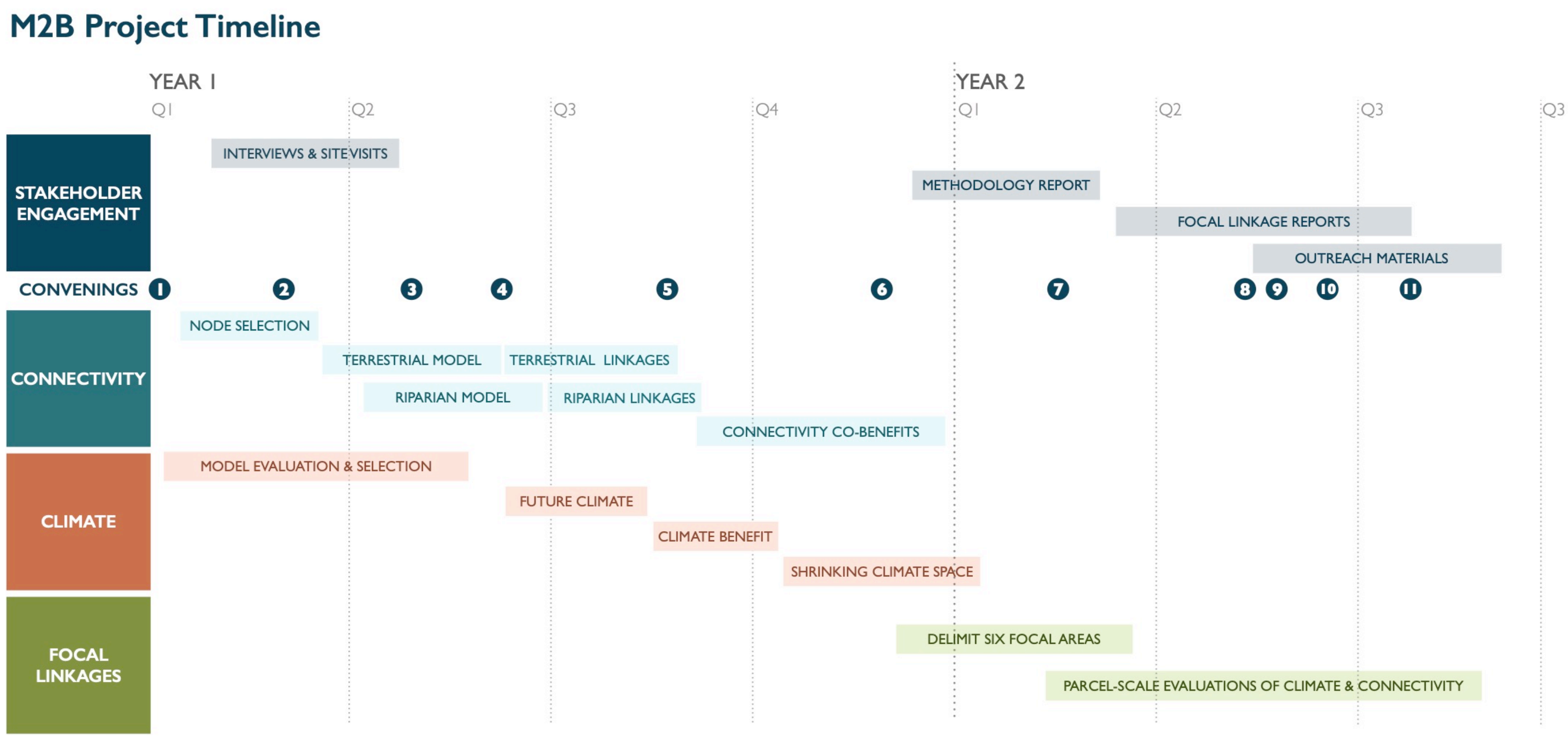


Figure 4. M2B project timeline illustrating how stakeholder engagement was integrated with the connectivity and climate analyses throughout the project's duration. Details about each of the 11 stakeholder convenings are summarized in Figure 5.

Summary of M2B Stakeholder Convenings

	Convening	Emphasis	Objectives and Outcomes	Date
1	**M2B project kick-off: Define project goals & outcomes**		• Review and refine project goals and outcomes with input from partners about their specific goals and concerns. • Learn how members of the group would like to work together regarding level of input and group structure(s). • Review draft partner coordination workflow and adjust with partner input to define meeting schedule • Introduce Basecamp for project management and as a team communications tool.	December 2016
2	**Methods for connectivity & climate analyses**		• Finalize M2B project area boundary. • Review proposed methods for evaluating connectivity and climate resilience.	March 2017
3	**Stakeholder forum**		• Summarize key conservation and management issues for each stakeholder. • Identify local pinch points within the M2B project area.	April 2017
4	**Connectivity analyses**		• Finalize protected area nodes (CPAD+) for connectivity analyses. • Review terrestrial methods and results. • Review riparian methods and results.	May 2017
5	**Climate analyses**		• Finalize terrestrial and riparian linkages. • Review current and future climate trends for the M2B project area. • Review cooling benefit results for each terrestrial linkage. • Launch internal spatial data repository on Data Basin.	August 2017
6	**Integrating connectivity & climate analyses**		• Summarize the concept of climate space. • Describe methods for evaluating shrinking and novel climate spaces. • Review shrinking and novel climate space results. • Summarize the implications of changing climate space for land management. • Identify linkage priorities based on connectivity and climate co-benefit results.	November 2017
7	**Focal linkage priorities**		• Discuss focal linkage priorities identified by stakeholders. • Finalize selection of focal linkage priorities (n = 6). • Brainstorm content for messaging materials.	February 2018
8	**Heart of M2B linkage** (sub-committee)		• Review preliminary results for the Heart of M2B linkage analyses. • Refine and finalize extent for the Heart of M2B linkage analyses.	May 2018
9	**Pepperwood to Modini Mayacamas linkage** (sub-committee)		• Review preliminary results for the Pepperwood to Modini Mayacamas linkage analyses. • Refine and finalize extent for the Pepperwood to Modini Mayacamas linkage analyses.	May 2018
10	**Portfolio report extravaganza**		• Overview of the 6 focal linkage analyses. • Summarize the climate connectivity results for each focal linkage. • Discuss next steps for the M2B Connectivity Network.	June 2018
11	**Indian Valley ACEC linkage** (sub-committee)		• Review preliminary results for the Indian Valley ACECs linkage analyses. • Refine and finalize extent for the Indian Valley ACECs linkage analyses.	July 2018

Figure 5. Table listing the 11 stakeholder convenings held throughout the duration of the M2B project, detailing the emphasis, objectives, and outcomes of each meeting.

REGIONAL CLIMATE CONNECTIVITY ANALYSES AND DATA PRODUCTS

The M2B project advances the field of climate connectivity modeling by demonstrating novel methods to assess fine-scale climate projections in the context of landscape heterogeneity in order to inform connectivity project prioritization and habitat corridor designs. Our results illustrate how three metrics of functional connectivity (i.e., terrestrial, riparian, and climate) can be used at regional and local scales – in combination or independently – to identify parcels of high conservation value that provide connectivity benefits today and under future climate scenarios.

M2B network scientists and land managers are co-creating habitat corridor plans based on the following considerations:

- Identification of habitat corridors based on terrestrial connectivity of natural habitats, primarily along mountain ranges, between existing protected areas.
- Quantification of habitat corridor climate benefits, enabling species to escape rising temperatures by using corridors, based on state-of-the art high-resolution climate projections.
- Translation of mapping products to site-specific habitat corridor action plans, to guide priorities for land acquisition, easements, and habitat restoration.

The innovative scientific methods supporting the M2B network have been documented in *Methodology for Building Habitat Connectivity for Climate Adaptation: Mayacamas to Berryessa Connectivity Network (M2B)* (Gray et al. 2018f). Data products are shared via partners and visible to the public via Data Basin (databasin.org).

Landscape Connectivity

We evaluated landscape connectivity and predict optimal corridors to connect habitat patches using a node-based method to identifying potential connections between existing protected areas. To evaluate terrestrial and riparian connectivity, we used Linkage Mapper (McRae & Kavanagh 2011) to create cost-weighted distance maps and least-cost corridor maps between adjacent pairs of protected areas with areas greater than 50 acres. Protected area locations were collated from the California Protected Area Database (calands.org), amended to include additional properties managed by participating stakeholders (CPAD+).

As a cost surface for the terrestrial connectivity linkages, we used the inverse of the ecological integrity permeability model output as an approximation of the degree of human modification (Theobald 2013; Dickson et al. 2016) (Figure 6). Linkage Mapper was used to generate least cost paths (LCP) and linkages between perimeters of adjacent protected areas to show the most cost-effective route between a source and destination protected areas. Linkage Mapper specifications were set to include all potential connections, exclude linkages that intersect nodes, and final linkages were clipped to a cost-weighted distance of 10 km for visualization.

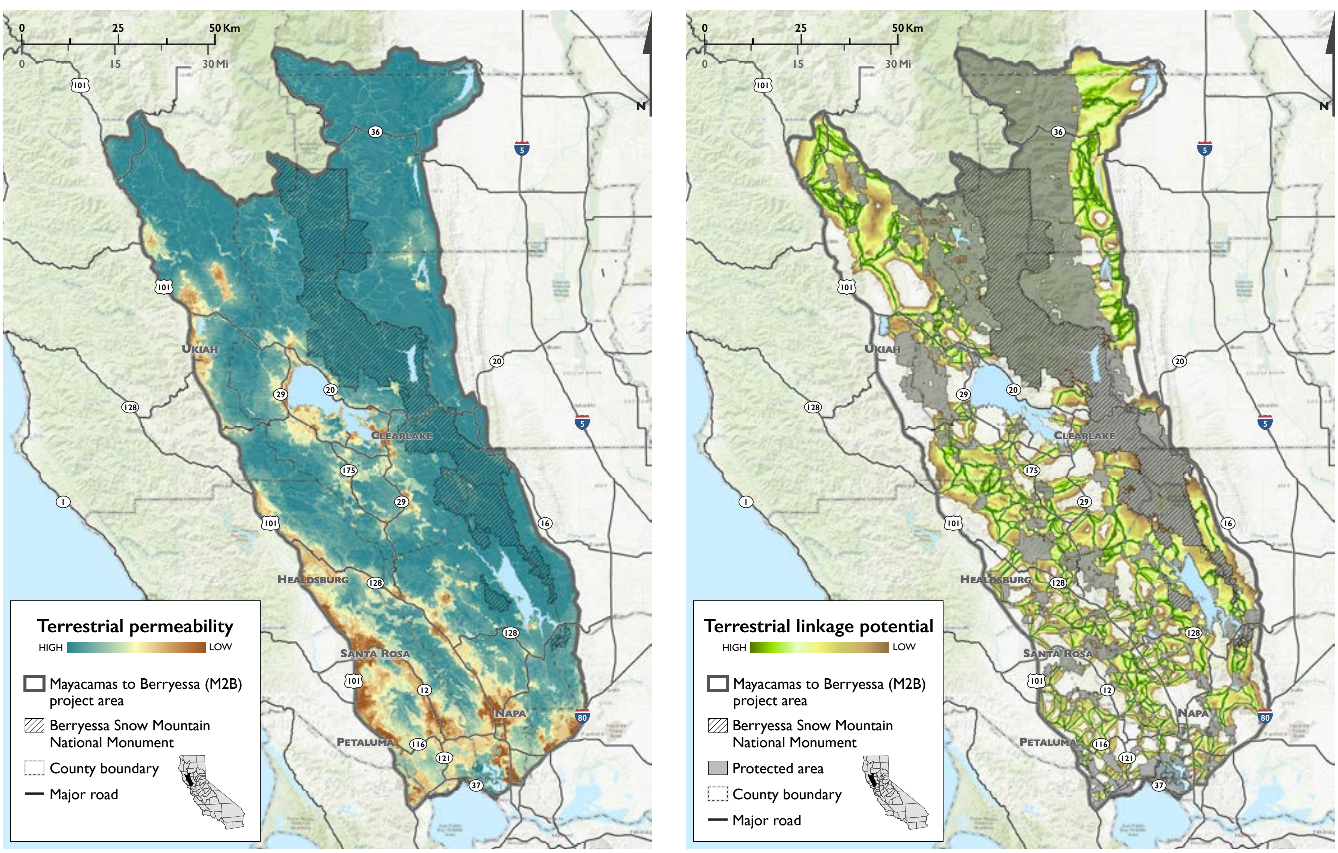


Figure 6. Map of the M2B project area overlaid with the terrestrial permeability surface (right) and the terrestrial linkage potential between protected areas (left).

Riparian Connectivity

For the riparian connectivity linkages, a resistance surface was created based on a terrain ruggedness index (Riley et al. 1999). The surface was modified to include topographically-defined creek corridors, and two landform types (valley bottom and narrow valley bottom; Theobald et al. 2015) to represent landscape features with zero cost for terrestrial wildlife movement (Figure 7). We used Linkage Mapper to generate linkages between perimeters of adjacent protected areas. Linkage Mapper specifications were set to include all potential connections, exclude linkages that intersect nodes, and final linkages were clipped to a cost-weighted distance of 1 km for visualization.

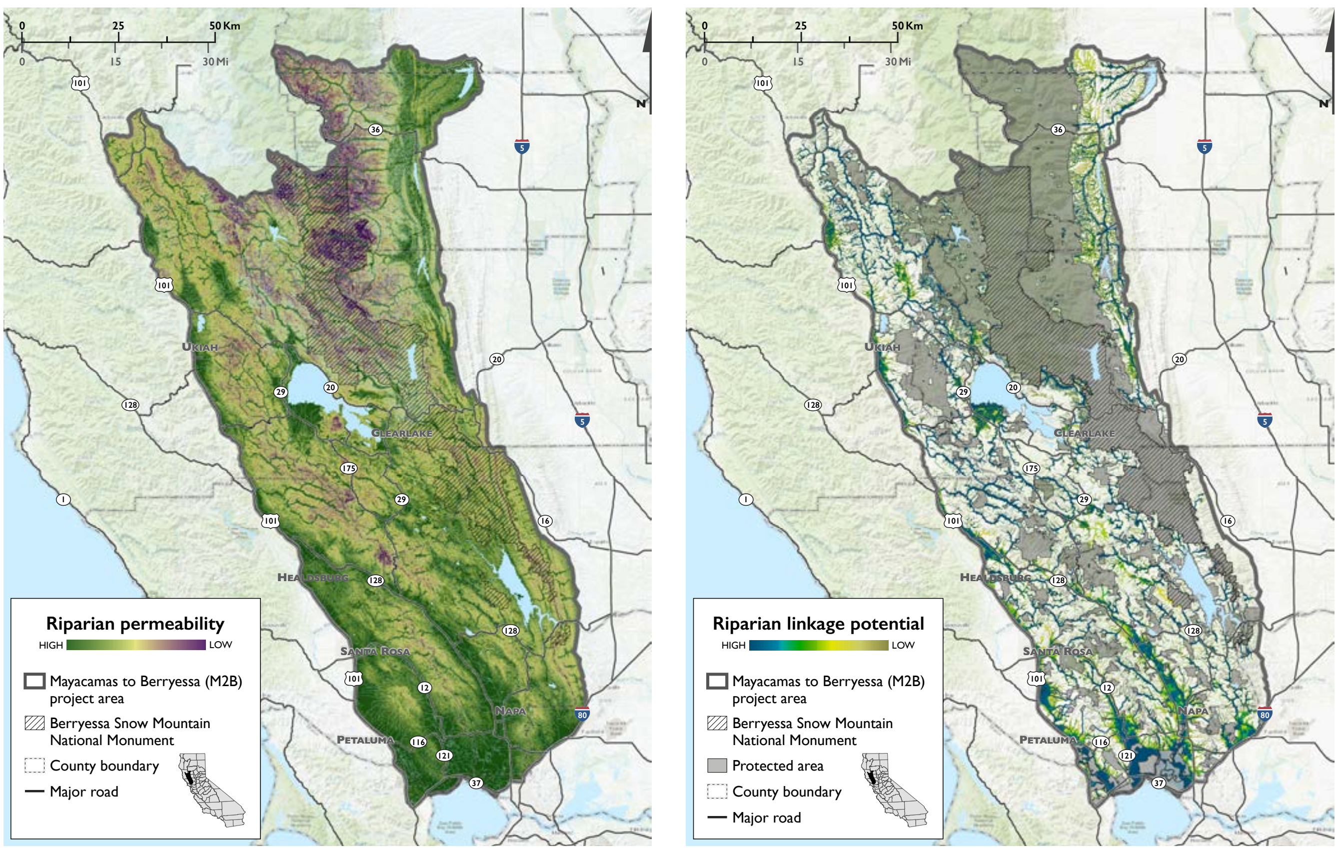
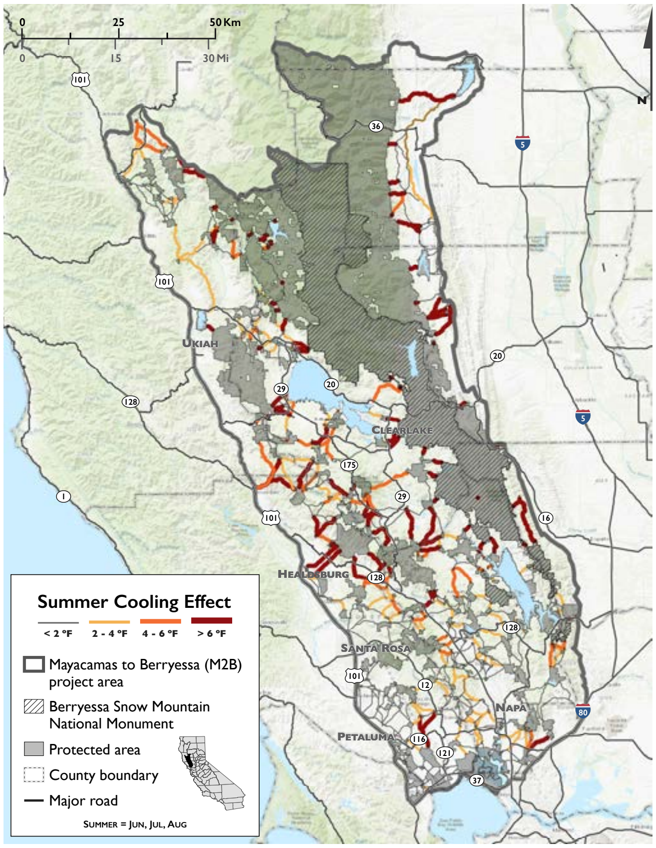


Figure 7. Map of the M2B project area overlaid with the riparian permeability surface (right) and the riparian linkage potential between protected areas (left).

Climate Connectivity

Connectivity and climate change research have called attention to global and continental patterns of climate change and provided projections of how species might respond. Recently conservation scientists have begun using global and continental climate models to evaluate climate connectivity among protected area networks, showing that linkages can provide climate benefits to networks (Martinuzzi et al. 2015), and how the matrix of human modification can influence climate connectivity (McGuire et al. 2016). Urban expansion around protected areas is projected to expand by 67% under business-as-usual conditions (Martinuzzi et al. 2015), highlighting the importance of predicting future land use change for biodiversity persistence within, and connectivity planning between, them. Consequently, there is a need to explore the interaction between changing land use and climate in climate connectivity analyses. Future analyses that include land use change projections and fire risks should be conducted.

To evaluate the extent to which the protected area network maintains climate connectivity, we calculated the potential climate benefit provided by each linkage between recent (1981-2010) and mid-century (2040-2069) time periods (Flint & Flint 2012; Pierce et al. 2015). Given the nuanced influence of temperature in California's ecosystem and economy, we evaluated mean summer maximum (average of June, July, and August means; JJA) and mean winter minimum (average of December, January, February means; DJF) temperatures. To calculate net cooling for each linkage, we found the difference between the lowest grid cell values for each temperature variable for all protected areas connected by a linkage. This value represented the net cooling the network presents over any one individual protected area. We assigned this value to the adjoining linkage to represent the added benefit of the network in maintaining access to cooler temperatures (Figure 8).



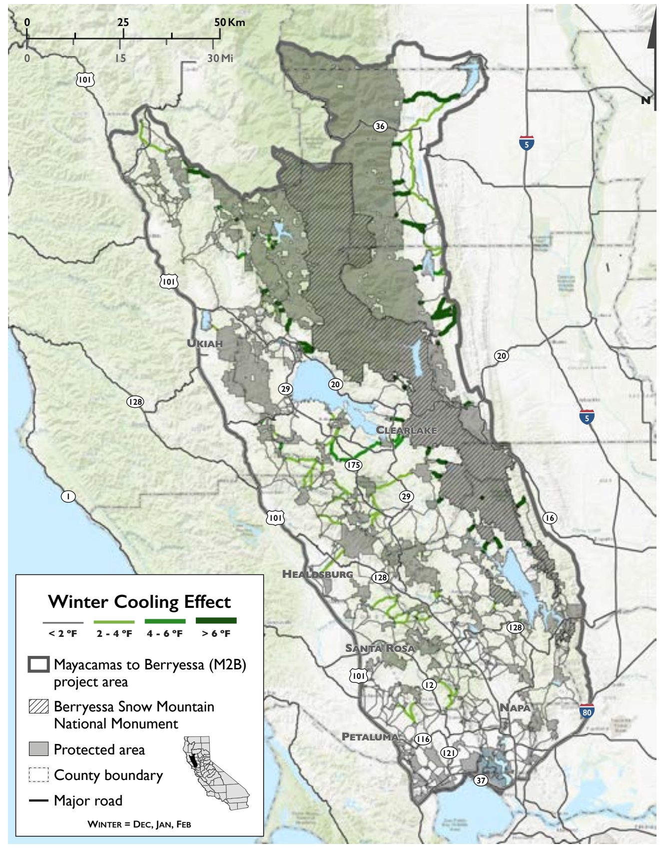


Figure 8. Map of the M2B project area overlaid with the projected cooling benefit for each terrestrial least cost path by mid-century for mean summer maximum (right) and mean winter minimum (left) temperature.

FOCAL CORRIDOR CLIMATE CONNECTIVITY ANALYSES AND DATA PRODUCTS

The habitat corridor projects vary in scale from a single linkage connecting two protected areas to a regional connectivity design comprised of multiple linkages between several protected areas (Figure 9). Guidance report documents for local practitioners are provided for each of the six corridor projects, and provide a template that can be further populated with fine-scale data queries and products to engage land managers and advance parcel-scale efforts. These corridor scale reports also include other project-specific data sources to complement the M2B connectivity and climate products.

Six focal corridors emerged as priority locations for the steering committee of the M2B network through an integration of local land management expertise and connectivity and climate models. Two focal corridors were in the north of the study area, one focused on linkages between Clear Lake and Mount Konocti, and the second on linkages between the Indian Valley Areas of Critical Environmental Concern within the Berryessa Snow Mountain National Monument. Four focal corridors were more centrally located, spanning the Mayacamas Mountains to Berryessa Range near Mount Saint Helena. These four focal corridors focused on linkages between Pepperwood and Modini-Mayacamas Preserves, between Shiloh Ridge and Mark West, across Alexander Valley, and across three branches of the "Heart of the Mayacamas" which centered on Mount Saint Helena and spanned the Mayacamas to Berryessa ranges.

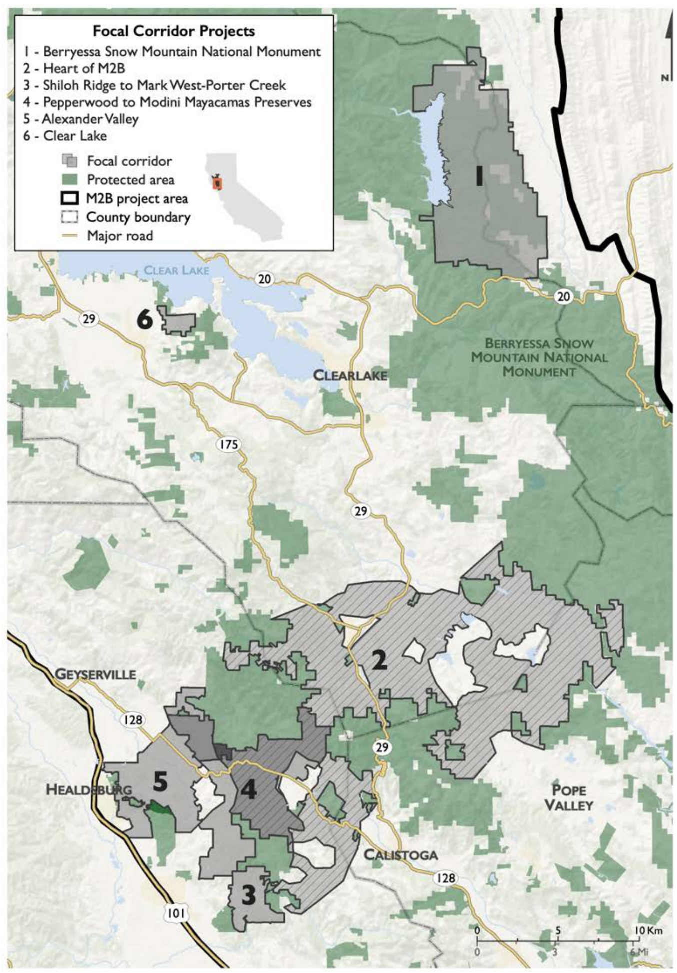


Figure 9. Six local corridor projects within the M2B project area identified as priority locations for climate connectivity resilience. Overlapping regions among the four centrally-located corridors are shown in dark gray, and the Heart of M2B corridor is hatched.

We conducted parcel-scale climate and connectivity analyses for each focal corridor, and summarized our findings in six site-specific habitat corridor action plans. The aim of each focal corridor report was to provide stakeholders with a site-specific connectivity and climate resilience assessment at the parcel scale that may be used to assess priority locations for conservation and restoration. Each report provided a summary of terrestrial and riparian connectivity and the potential climate adaptation benefits within the corridor as a whole, as well as for each parcel therein. Locations where connectivity or climate metrics were exceptionally high or low were described and identified with geographic coordinates (e.g., a location along a road with low terrestrial connectivity, a valley with cooler temperatures). We also identified parcels with high values for both terrestrial and riparian connectivity, as these locations have the potential to offer connectivity co-benefits. To complement the data summaries, each report also described the conservation benefits unique to each site, identified critical land management partners, and articulated potential next steps for linkage protection via habitat corridor conservation strategies to be implemented at the parcel scale.

Key Findings

The habitat corridor projects varied in scale from a single linkage connecting two protected areas to a regional connectivity design comprised of multiple linkages between several protected areas. The six habitat corridor projects emerged as a priority for the M2B steering committee as a result of an integration of local land management expertise with connectivity and climate models. Each corridor was defined and characterized to quantify the climate adaptation benefits of habitat corridor protection and enhancement. We then assessed the potential climate adaptation benefits of enhancing each potential linkage, quantified conservation benefits unique to each site, identified critical land management partners, and articulated potential next steps for linkage protection via habitat corridor conservation strategies to be implemented at the parcel scale.

A guidance report document for local practitioners was provided for each of the six corridor projects, which provides a template that can be further populated with fine-scale data queries and products to engage land managers and advance parcel-scale efforts for the linkage or applied at alternate sites of interest. Each report illustrates how three metrics of functional connectivity (i.e., terrestrial, riparian, and climate) can be used at a local scale – in combination or independently – to identify parcels of high conservation value that provide connectivity benefits today and under future climate scenarios. These linkage scale reports also include other project-specific data sources to complement the M2B connectivity and climate products. Data products are shared via partners and visible to the public via Data Basin (databasin.org).

Considerations for Corridor Implementation

Advancing the vision of wildlife friendly habitat can be achieved through an implementation strategy with the following primary phases:

- Engaging land owners and management through outreach and education
- Filling critical data and information gaps about resource use, ecological function, and permeability
- Providing guidance for maintaining and enhancing habitat permeability within habitat cores and along the corridor

- Acting to protect and enhance the corridor with a broad range of tools including acquisition, easement, restoration, community education, and stewardship best practices
- Integrating emerging landscape-level strategies for forest management and wildfire resilience into habitat corridor implementation

Outreach and Engagement of Land Owners

As part of the M2B project, we developed a fact sheet and an outreach brochure providing summaries of key stewardship and policy messages that emphasize the value of habitat corridors for wildlife and landscape resilience, water security, and scenic value. At a broad level, the recommendations in our outreach brochure include using wildlife friendly fencing, maintaining natural vegetation and habitats in undeveloped areas and along creeks, keeping pets indoors and eliminating wildlife attractants, using best management practices to minimize risks to livestock, and minimizing night lighting and unnecessary noise.

The outreach materials contain standardized terminology for partners of the connectivity network to use and customize as needed. These messages may be integrated into print, digital, and in-person engagement of critical individual and institutional partners. By effectively engaging the community of private and public land managers, parcel by parcel, we will build momentum and adoption of an enduring habitat corridor stewardship strategy.

Neighbor to neighbor communication is important in securing trust and engagement, especially in rural communities. We could use informal tools like neighborhood gatherings and listening sessions to explore ideas and strategies. The effectiveness of this approach is currently being demonstrated by Audubon Canyon Ranch's Mountain Lion Project, for example, which reaches out to landowners who report lion sightings via local social networks such as Nextdoor (https://nextdoor.com). In addition to engaging with neighborhood organizations, we could maximize the value of citizen science initiatives as a vehicle for landowner education and engagement, including platforms such as iNaturalist (https://www.inaturalist.org) and the California Roadkill Observation Network (http://www.wildlifecrossing.net/california/).

The *Critical Linkages: Bay Area and Beyond* (Penrod et al. 2013) and *Sonoma Valley Wildlife Corridor Project* (Sonoma Land Trust 2014) provide a framework for compelling outreach messages and strategies to work with land owners of key parcels to better support wildlife movement and recognize participants as corridor champions. These methods could be applied to engage with city and county decision makers and agencies to keep them apprised on opportunities to leverage public processes including climate adaptation and fire recovery and resilience initiatives. Additionally, outreach to California state agencies such as CalTrans, California State Parks, and California Department of Fish and Wildlife would further the successful implementation of the corridors.

Filling Critical Data and Information Gaps

In the next stages of the corridor implementation, we could build from this analysis and prioritization to fill additional data and information gaps. Addressing these gaps would help us test assumptions about permeability, animal movement, vegetation communities, fire, resource use, and community support. Key questions include the following:

Resource Use and Policy

- What are the attitudes of private land owners and residents towards local wildlife?
- What is the frequency and type of wildlife-livestock conflict?
- Are there new individuals and organizational partners to include in the corridor project?
- Are there planning processes, policies, or funding mechanisms that can be enhanced to better support the corridor?

Corridor Use

- What terrestrial species currently occur within the corridor?
- What pathways are focal animals using between the protected areas?
- Which creeks are providing open passage for animal movement?
- Is there a difference in species composition and occupancy between the protected areas?
- Are there key areas that provide critical food, water, or cover for target species in the corridor?
- How are plant communities predicted to transition in and out of the corridor?
- What are the main threats associated with invasive species?
- Are there opportunities for vegetation management, restoration, or enhancement?

Permeability and Road Ecology

- Which overpasses, underpasses, and culverts are being most heavily utilized?
- Are there parcel scale impediments to movement (e.g., topography, roads, type of road crossings, fences, outdoor lighting, domestic pets, or other human impacts?)
- Are there opportunities for wildlife friendly fence improvements?
- Are additional roadway enhancements needed to meet best practices for wildlife crossings?
- What is known about the frequency and locations of roadkill in the corridor?
- How do fire history, vegetation condition, and the impact of human activities influence the resilience of the habitat within the linkage?

Climate and Wildfire Resilience

- Are there locations within the preserves that are well-suited to act as climate refugia?
- Where would additional refugia increase the climate resilience of the protected areas?
- What opportunities exist to connect summer and winter climate refugia?
- Where are target forest treatments needed to increase drought and fire resilience?

To fill these data and knowledge gaps we could prioritize questions with partners and stakeholders, aggregate existing data, conduct iterative analyses, disseminate results, and measure outcomes.

Maintaining and Enhancing Habitat Permeability

Rural development in this region has enormous potential to fragment the remaining wildlands that provide refugia for wildlife, community separators, and open space amenities. Habitat fragmentation resulting from land conversion is one of the main threats to biodiversity (Hoffmann & Sgrò 2011; Foley et al. 2011), and agricultural expansion is the primary reason for conversion worldwide (Tilman 2001; Foley et al. 2011; Tilman et al. 2011). Fragmentation increases “edge habitat” by dividing of one continuous block of natural habitat into one or more smaller remaining fragments of habitat, resulting in a human-created edge where the natural habitat ends and abuts the human-altered parts of the landscape. The hard-edged boundaries that often result from human disturbance have a stronger negative impact compared to more natural transitional edges (Mesquita et al. 1999). The most overt impacts of habitat fragmentation on wildlife include restricting animal movement (Riley et al. 2006), reducing habitat quality and quantity (Prugh et al. 2008; Öckinger et al. 2009), or increasing human disturbance (Merenlender et al. 2009). Mammalian carnivores, particularly mountain lions, bobcats, and coyotes, are particularly vulnerable to extinction due to habitat fragmentation. It is estimated that worldwide terrestrial mammalian carnivores have declined between 95 – 99% (Berger et al. 2001). The disappearance of top predators can cause a cascade of effects on trophic dynamics and community organization within an ecosystem (Estes et al. 2011). Further, in habitats where carnivores have been retained or restored, they can buffer against invasion of non-native species (Wallach et al. 2010) and climate change (Wilmers et al. 2006). The built environment, especially roads and urban and suburban development, can also reduce the ability of existing wildlife to move across this landscape (Fu et al. 2010; Tannier et al. 2012).

Agriculture is the dominant development pattern in the study area, and, by some accounts, one of the fastest growing land use types in the United States (Theobald et al. 2012). Land conversion for agricultural use can mean that diverse stands of native vegetation are replaced with large parcels growing a single crop. This conversion can be especially detrimental to wildlife when the native vegetation includes mature trees that provide canopy cover. Canopy cover has been shown to be integral for functional connectivity (Tremblay & St. Clair 2009; Caryl et al. 2013) and, thus, gene flow (Munshi-South 2012; Jha & Kremen 2013) across taxa. In a study investigating the correlation between patch size and mesocarnivore (e.g. coyote, bobcat, gray fox) occurrence in northern California, Reed (2007) found that the frequency of mesocarnivore detections increased with the size and contiguity of adjacent patches of contiguous natural vegetation. Additionally, there is a clear conservation conflict between agricultural expansion and wildlife conservation. For example, increased extinction risk and decreased species diversity were predicted by Dobrovolski et al. (2013) for 245 mammalian carnivore species worldwide in the face of projected agriculture development.

To identify local issues influencing the protected areas in each corridor project, we solicited input from stakeholders. We included a summary the information provided by stakeholders in the linkage reports, to provide context about each protected area and help inform corridor implementation strategies. The reports included information about the major vegetation types and specific biological, riparian, geological, ecological features unique to the protected area. When available, we described existing conservation priorities and management plans, as well as potential threats to ecological integrity from the surrounding area.

Our aim with each linkage report was to create a product that may be used to further corridor implementation for climate connectivity resilience. To lay the groundwork for implementation, we concluded each linkage report with a section that scoped and prioritized protection and management opportunities. We worked with stakeholders to identify potential planning, development, or conservation projects within or surrounding the protected areas that may offer opportunities to implement conservation activities, as well as potential partners to engage for corridor each corridor.

SUMMARY OF M2B PRODUCTS

Data Products

The following data products are publicly available in the Mayacamas to Berryessa (M2B) Connectivity Network gallery on Data Basin (https://bit.ly/2O6WhCH). See Appendix B for additional information about each data product.

- Protected area nodes (CPAD+) in the Mayacamas to Berryessa (M2B) study area
- Least cost paths for structural (terrestrial) connectivity
- Linkage potential for structural (terrestrial) connectivity - perimeter
- Mean summer maximum temperature (JJA): Cooling benefit of linkages
- Mean winter minimum temperature (DJF): Cooling benefit of linkages
- Linkage potential for riparian features
- Linkage potential for structural (terrestrial) connectivity
- Parcels in the Mayacamas to Berryessa (M2B) study area
- Permeability surface for naturalness (ecological integrity index)
- Permeability surface for riparian features
- Mean summer maximum temperature (JJA): Future distribution
- Mean summer maximum temperature (JJA): Increase by mid-century
- Mean summer maximum temperature (JJA): Recent distribution
- Mean winter minimum temperature (DJF): Future distribution
- Mean winter minimum temperature (DJF): Increase by mid-century
- Mean winter minimum temperature (DJF): Recent distribution

Messaging Materials

The M2B network is developing a standardized vocabulary for communicating key science concepts to public and private landowners about the climate adaptation value of keeping natural and working landscapes connected. This vocabulary and basic messaging materials will support a consistent outreach effort via diverse partners across the region, including local Resource Conservation Districts and extension agents.

Methodology Report

Gray M, Micheli E, Merenlender AM. 2018. Methodology for Building Habitat Connectivity for Climate Adaptation: Mayacamas to Berryessa Connectivity Network (M2B). Santa Rosa CA. 51 pp.

Corridor Reports

Gray M, Comendant T, Micheli ER, Cooper M, Johnson A, Roa A, Schichtel A, Merenlender AM. 2018. Building habitat connectivity for climate adaptation across Alexander Valley. A technical report by the Dwight Center for Conservation Science at Pepperwood, Santa Rosa CA. 52 pp.

Gray M, Comendant T, Micheli ER, Koehler CE, Smythe TR, Merenlender AM. 2018. Building habitat connectivity for climate adaptation between Clear Lake and Mount Konocti. A technical report by the Dwight Center for Conservation Science at Pepperwood, Santa Rosa CA. 50 pp.

Gray M, Comendant T, Micheli ER, Weigand J, Barnitz K, Merenlender AM. 2018. Building habitat connectivity for climate adaptation between the Indian Valley Areas of Critical Environmental Concern. A technical report by the Dwight Center for Conservation Science at Pepperwood, Santa Rosa CA. 55 pp.

Gray M, Comendant T, Micheli ER, Cooper M, Merenlender AM. 2018. Building habitat connectivity for climate adaptation between Pepperwood and Modini Mayacamas Preserves. A technical report by the Dwight Center for Conservation Science at Pepperwood, Santa Rosa CA. 53 pp.

Gray M, Comendant T, Micheli L, Brown H, Merenlender A. 2018. Building habitat connectivity for climate adaptation between Shiloh Ridge and Mark West-Porter Creek. A technical report by the Dwight Center for Conservation Science at Pepperwood, Santa Rosa CA. 52 pp.

Gray M, Comendant T, Micheli ER, Johnston A, Brown H, Johnston A, Koehler CE, Palladini M, Smythe TR, Merenlender AM. 2018. Building habitat connectivity for climate adaptation through the heart of the Mayacamas to Berryessa Region. A technical report by the Dwight Center for Conservation Science at Pepperwood, Santa Rosa CA. 138 pp.

CONCLUSION

By including conservation practitioners during methods development and results dissemination, we increased the compatibility between generated data products and the needs, planning, and management workflows of end-users. Our results thus show how to create science-based, scalable visualization tools to support local and regional conservation fundraising efforts. The resulting high-resolution data products capturing regional riparian, terrestrial, and climate connectivity can now be used to design habitat corridor protection projects protecting and enhancing linkages between large private, state, and federally-owned protected land.

With a greater understanding of the role connectivity of within and between protected areas, we are supporting effective approaches to ecosystem climate change adaptation in a regional context, by. By engaging diverse stakeholders to shape the analysis and interpret model results, these products are advancing effective implementation actions, such as land acquisition, easements, infrastructure retrofits, wildlife road crossings, and habitat restoration, at the parcel-scale of conservation action.

These tools may be critical in effectively engaging private landowners, who hold approximately 75% of undeveloped lands in the project area. Taken as a whole, we provide a model framework that can be refined and expanded across the U.S. to enhance connectivity and climate resilience. In this way, we aim to synchronize the timing of connectivity science and outreach, a recommended approach to reduce delays in enacting connectivity plans and their implementation (Brodie et al. 2016).

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APPENDICES

Appendix A. Terminology

California Protected Areas Database Plus (CPAD+): A database of protected areas (>50 acres in size) comprised of lands owned in fee and protected for open space purposes from the California Protected Area Database (CPAD; calands.org) augmented with additional properties managed by participating stakeholders. In this report, the protected area database (CPAD+) is a combination of CPAD listings that are greater than 50 acres in size and additional properties of interest managed by participating stakeholders.

Average summer monthly maximum temperature (JJA Tmax; June, July, August): The average summer maximum temperature in the three warmest months of the year (June – August), which is a prime determinant of heat wave extremes, and an important contributor to potential evapotranspiration and aridity.

Average winter monthly minimum temperature (DJF Tmin; December, January, February): The average minimum temperature over the three coldest months of the year (December – February), which is a prime determinant of frost and freeze frequency, and chilling hours for winter dormant plants.

Future climate: In general, a future climate refers to climate conditions generated by global circulation model. In this project, we use future climate to describe the projected temperature surface at 30-m resolution derived from the 30-year average of temperatures for 2040 – 2069 generated by the CNRM-CM5 model using representative concentration pathway 8.5 (Flint & Flint 2012; Pierce et al. 2015).

Habitat corridor: Designated patches or strips of habitat that allow wildlife to safely move between larger blocks of habitat. Highly permeable corridors consist of continuous habitat or landscape linkages connecting core areas that permit all species and other resources (e.g., water) to move easily between these wildland blocks. In this report, a habitat corridor specifically refers to an implementable project area identified by the stakeholders.

Large patches: A large, contiguous extent of natural habitat that is used as a node for linkage or connectivity analysis. In this report, we define large patches as areas greater than 5000 acres in size that are comprised of continuous, unprotected, and undeveloped (e.g., no agriculture or roads) wildlands.

Least cost path (LCP): The predicted movement path between two locations that accounts for the influence of the landscape, which is represented as a resistance (cost) surface based on environmental factors (e.g., landscape integrity, climate, topography, or vegetation type). Thus, a least cost path represents the route between a source and destination with the fewest obstacles and least resistance to movement. In this report, a least cost path is a linear element that is the symbolic representation of the highest linkage potential (described below) between nodes across the landscape.

Linkage potential: The potential for connectivity between natural habitat patches (e.g., protected areas, nodes) used to identify locations that facilitate the movement of multiple species and maintain ecological processes. In this report, the linkage potential is used to evaluate the quality of the landscape between protected area nodes and is represented as linkage potential surfaces.

Matrix: The physical setting and context of the landscape within which corridors and habitat patches are situated. In this report, the matrix is a component of the landscape, altered from its original state by human land use, which may vary in cover from human-dominated to semi-natural. Corridors and habitat patches are embedded in the matrix.

Naturalness: An index of ecological integrity that estimates the degree of human modification based on stressors such as land use, land cover, as well as the presence of, use of, and distance from roads. In this report, naturalness is defined using an index of human modification based on stressors such as land use, land cover, and presence, use, and distance from roads (Theobald 2013; Dickson et al. 2016; data provided by The Nature Conservancy).

Net cooling benefit: A quantification of the availability of relatively cooler temperatures within a designated area. We calculated the net cooling benefit for each linkage by calculating the absolute difference between the minimum temperature values for each adjoining protected area.

Nodes: Patches of contiguous habitat (i.e., protected areas) that are used as start and end points for linkage or connectivity analysis. In this report, the nodes are protected areas within the CPAD+ database, described above.

Permeability: The degree to which regional landscapes, encompassing a variety of natural, semi-natural and developed land cover types, are conducive to wildlife movement and sustain ecological processes. In this report we use two indices of landscape permeability: (1) Naturalness, as described above, and (2) a combined model derived using three indices of habitat fragmentation: median patch size effect (Reed 2007), mean parcel size effect, and road effect (Forman 2000).

Recent climate: In this project we use future climate to describe the 30-year average of temperatures from 1981 – 2010 based on 800 m PRISM data spatially downscaled to 30-m using the gradient-inverse distance squared approach (Flint & Flint 2012; Pierce et al. 2015).

Resistance surface: A data layer used in connectivity modeling to approximate the difficulty of movement between locations while considering the influence of the landscape (e.g., landscape integrity, temperature, topography, or vegetation type), where a high value is considered highly resistant to movement or resource flow.

Riparian connectivity: A measure of connectivity based on enduring physiographic features of ruggedness, topography, and landforms presumed to be important for terrestrial, aquatic, and riparian resource flow that is used to inform linkage potential, least cost paths, corridors, and pathways. Locations with a high value facilitate terrestrial, aquatic, and riparian resource flow.

Terrestrial connectivity: A measure of terrestrial connectivity based on the physical arrangements of habitat patches, disturbance, or environmental elements presumed to be important for terrestrial wildlife movement that is used to inform linkage potential, least cost paths, corridors, and pathways. Locations with a high value facilitate terrestrial wildlife movement. Our earlier analyses referred to this metric as “structural connectivity”, which is an interchangeable phrase for “terrestrial connectivity”.

Appendix B. M2B Data Products on Data Basin

Data name	Description	Format	Use
CPAD+ nodes in the Mayacamas to Berryessa (M2B) study area	Protected area locations within M2B study area used for connectivity analyses (n = 302).	Polygon	Delineate least cost linkage
Least cost paths for structural (terrestrial) connectivity	Least cost paths (LCPs) connecting the CPAD+ nodes for structural (terrestrial) connectivity within the M2B study	Line	Delineate least cost linkage Climate benefit
Linkage potential for structural (terrestrial) connectivity - perimeter	Perimeter of potential linkage pathways between structural (terrestrial) features within the M2B study area.	Polygon	Delineate least cost linkage
Mean summer maximum temperature (JJA): Cooling benefit of linkages	Climate benefit for mean summer (June, July, August; JJA) maximum temperature offered by connected CPAD+ nodes within the M2B study area.	Line	Delineate least cost linkage
Mean winter minimum temperature (DJF): Cooling benefit of linkages	Climate benefit for mean winter (December, January, February; DJF) minimum temperature offered by connected CPAD+ nodes within the M2B study area.	Line	Delineate least cost linkage
Linkage potential for riparian features	Potential linkage pathways for riparian features between the CPAD+ nodes within the M2B study area.	Raster	Connectivity benefit
Linkage potential for structural (terrestrial) connectivity	Potential linkage pathways between structural (terrestrial) features within the M2B study area.	Raster	Connectivity benefit
Parcels in the Mayacamas to Berryessa (M2B) study area	Parcel boundaries within the M2B study area.	Polygon	Connectivity benefit Climate benefit
Permeability surface for naturalness (ecological integrity index)	Structural (terrestrial) permeability derived using an index of ecological integrity within the M2B study area.	Raster	Connectivity benefit
Permeability surface for riparian features	Riparian permeability derived using the enduring physiographic features of ruggedness, topography, and landforms within the M2B study area.	Raster	Connectivity benefit
Mean summer maximum temperature (JJA): Future distribution	Future/mid-century (2040-2069) mean summer (June, July, August; JJA) maximum temperature generated using CNRM-CM5 climate scenario (RCP 8.5) (Flint & Flint 2012; Pierce et al. 2015) within the M2B study area.	Raster	Climate benefit
Mean summer maximum temperature (JJA): Increase by mid-century	Increase in mean summer (June, July, August; JJA) maximum temperature between recent (1981-2010) and future/mid-century (2040-2069) time periods generated using CNRM-CM5 climate scenario (RCP 8.5) (Flint & Flint 2012; Pierce et al. 2015) within the M2B study area.	Raster	Climate benefit
Mean summer maximum temperature (JJA): Recent distribution	Recent (1980-2010) mean summer (June, July, August; JJA) maximum temperature (Flint & Flint 2012; Pierce et al. 2015) within the M2B study area.	Raster	Climate benefit
Mean winter minimum temperature (DJF): Future distribution	Future/mid-century (2040-2069) mean winter (December, January, Feburary; DJF) minimum temperature generated using CNRM-CM5 climate scenario (RCP 8.5) (Flint & Flint 2012; Pierce et al. 2015) within the M2B study area.	Raster	Climate benefit
Mean winter minimum temperature (DJF): Increase by mid-century	Increase in mean winter (December, January, Feburary; DJF) minimum temperature between recent (1981-2010) and future/mid-century (2040-2069) time periods generated using CNRM-CM5 climate scenario (RCP 8.5) (Flint & Flint 2012; Pierce et al. 2015) within the M2B study area.	Raster	Climate benefit
Mean winter minimum temperature (DJF): Recent distribution	Recent (1980-2010) mean winter (December, January, Feburary; DJF) minimum temperature (Flint & Flint 2012; Pierce et al. 2015) within the M2B study area.	Raster	Climate benefit

Appendix C. M2B Project Workplan

CA-LCC Mayacamas to Berryessa Connectivity: Final Report			
Category	**Task**	**Notes**	**Completion Date**
Deliverable	Interim Progress Report to CA-LCC	Interim Financial (SF425) and Progress Reports to CA-LCC	8/29/17
Deliverable	Year 1 Fact Sheet to CA-LCC	A summary of accomplishments in year one.	12/31/17
Deliverable	Methodology Report		5/24/18
Deliverable	Presentation/poster	Presented at North American Congress for Conservation Biology (NACCB) 2018	7/23/18
Deliverable	Finalize pubic Data Basin galleries and launch	Final data products are online; will launch as "public" at conclusion of project.	10/28/18
Deliverable	Final performance report	Dissemination of project methods and outputs via CA-LCC outlets.	10/28/18
Deliverable	Final financial report		10/28/18
Deliverable	Final invoice		10/28/18
Deliverable	Focal corridor reports (n=6)	Focal corridor reports will address priority geographic focus areas, provide metrics for linkage alternatives in terms of connectivity and conservation benefits, and define a road map for moving forward in those areas with local partners	10/28/18
Deliverable	Outreach brochure		
Stakeholder Engagement	Steering Committee Meeting 1	Kickoff meeting	11/23/16
Stakeholder Engagement	Steering Committee Meeting 2	Project overview	3/3/17
Stakeholder Engagement	Steering Committee Meeting 3	Identify local pinchpoints	4/28/17
Stakeholder Engagement	Steering Committee Meeting 4	Review terrestrial methods and results	6/2/17
Stakeholder Engagement	Meeting to get feedback on protected area GIS products		7/6/17
Stakeholder Engagement	Sonoma County stakeholders meeting	Solicit input for defining focal corridors	7/6/17
Stakeholder Engagement	Steering Committee Meeting 5	Review riparian methods and results	8/4/17
Stakeholder Engagement	Steering Committee Meeting 6	Review climate methods and results	11/14/17
Stakeholder Engagement	Steering Committee Meeting 7	Proposed focal linkages and portfolio report structure	2/14/18
Stakeholder Engagement	Steering Committee Meeting 8	Heart of M2B linkage: Review proposed linkage	4/26/18
Stakeholder Engagement	Subcommittee meeting for Heart of M2B focal corridor	Heart of M2B linkage: Review revised linkage	5/4/18
Stakeholder Engagement	Steering Committee Meeting 9	Focal linkage extravaganza	6/7/18
Stakeholder Engagement	Subcommittee meeting for National Monument focal corridor	National Monument linkages	7/13/18
Data Management	Data prep: study area boundary	Draft shared with stakeholders 3/3/2017; final 3/15/2017 to facilitate data gathering	3/3/17
Data Management	Science and Data Team coordination meeting	Kick off and roles and responsibilities moving forward	3/10/17
Data Management	Data preparation: climate data	Science team will get climate data for the study area at finest spatial grain possible and co-develop climate metrics with stakeholders (PCA, analogs or simpler).	3/27/17
Data Management	Revise CA-LCC Data Management Plan online		4/5/17
Data Management	Data preparation: land use data	Science team will review various options for a resistance surface based on the built environment.	6/2/17
Data Management	Data preparation: riparian data		6/2/17

Category	Task	Notes	Completion Date
Data Management	Distribution of GIS products to all partners through Data Basin		6/15/17
Data Management	Define Data Basin project structure		12/22/17
Data Management	Revise Data Management Plan to update terminology	call scheduled TC, MG 12/28	12/27/17
Data Management	Update metadata on Data Basin	Add a summary paragraph about M2B project to all data layers; revise climate descriptions.	2/15/18
Data Management	Develop data release strategy	Determine which data on Data Basin will be made publicly available and when, propose specific data layers to leave in and omit	2/28/18
Data Management	Create public galleries for data sharing on Data Basin	Three galleries: climate connectivity benefits, protected area nodes (CPAD+), permeability and connectivity	6/19/18
Focal Corridors	Draft focus area priority locations for connectivity action plans	Local partner teams will create site-specific adaptation strategies	1/1/18
Focal Corridors	Final focus corridors for siting connectivity action plans	Local partner teams will create site-specific adaptation strategies	2/1/18
Focal Corridors	Draft reports for focal corridors (n=6)		3/15/18
Focal Corridors	Focal corridor report: Heart of M2B		7/30/18
Focal Corridors	Focal corridor report: Clear Lake		7/30/18
Focal Corridors	Focal corridor report: National Monument		7/30/18
Focal Corridors	Focal corridor report: Alexander Valley		7/30/18
Focal Corridors	Focal corridor report: Shiloh to Mark West		7/30/18
Focal Corridors	Focal corridor report: Pepperwood to Modini Mayacamas Preserves		7/30/18
Outreach & Summary Products	Draft key messaging text for outreach brochure	Information needed: the key contents and takeaways intended for the messaging materials	2/15/18
Outreach & Summary Products	Finalize outreach brochure		10/28/18
Outreach & Summary Products	Draft Methodology Report to CA-LCC: identify landscape-level priorities	Provide a melded science-management criteria for identifying regional landscape level connectivity priorities.	12/31/17
Outreach & Summary Products	Review Methodology Report		1/10/18
Project Management	Work plan review meeting		2/15/17
Project Management	Develop draft work plan		2/17/17
Project Management	Work plan review meeting		2/22/17
Project Management	Work plan review meeting		3/8/17
Project Management	CA-LCC Coordination	Call-interview, inititation of data management plan	3/22/17
Project Management	Work plan review meeting	CA-LCC data plan meeting	3/22/17
Project Management	Work plan review meeting		4/5/17
Project Management	Work plan review meeting		4/19/17
Project Management	Work plan review meeting		5/3/17
Project Management	Work plan review meeting		5/17/17

Category	Task	Notes	Completion Date
Project Management	Work plan review meeting		5/31/17
Project Management	Work plan review meeting		6/14/17
Project Management	Work plan review meeting		6/28/17
Project Management	Work plan review meeting		7/12/17
Project Management	Work plan review meeting		8/8/17
Project Management	Work plan review meeting		8/23/17
Project Management	Work plan review meeting		9/6/17
Project Management	Work plan review meeting		9/20/17
Project Management	Work plan review meeting		10/4/17
Project Management	Work plan review meeting		10/18/17
Project Management	Work plan review meeting		11/1/17
Project Management	Work plan review meeting		11/15/17
Project Management	Work plan review meeting		11/29/17
Project Management	CA-LCC Coordination	Review 2017 progress	12/13/17
Project Management	Work plan review meeting		12/14/17
Project Management	Work plan review meeting		12/27/17
Project Management	Draft year one fact sheet		12/31/17
Project Management	Work plan review meeting		1/10/18