Central Coast Regional Profile

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A report prepared by the Science Advisory Panel
for the California Wildfire and Forest Resilience Task Force

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Cover photos:

Top: View of oak woodland near Shell Creek Road in San Luis Obispo County; Joe Christianson.
Left: Conservation grazing at Fort Ord National Monument in Monterey County; Bob Wick, BLM.
Right: Redwood trees resprout after 2020 CZU Lightning Complex fire in Big Basin Redwoods State Park; Kristen Shive.
Bottom: Coast redwood foliage drips with fogwater at Purisima Creek Redwoods Open Space Preserve; Alan Grinberg.

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Central Coast Regional Profile

The State of California, U.S. Forest Service, and regional partners are collaborating to respond to the wildfire and climate crises that have significantly impacted, and are projected to continue to impact, California's natural and human communities. The primary goal of this response is to identify the scale and types of management needed by 2025 to meet these interrelated crises and restore resilience to California's diverse ecosystems. The expected outcomes are to reduce the risk of catastrophic wildfire and enhance community resilience that is also climate informed. To achieve this goal, capacity to plan and implement socially acceptable land management activities at ecologically meaningful scales must increase. This will require state, federal, regional, and local partners working across jurisdictional boundaries to develop integrated plans that are consistent with local objectives, projects, and strategies. Regional Profiles, such as this report, have been developed as one of the resources to assist with this effort.

The Science Advisory Panel of the California Wildfire and Forest Resilience Task Force (WFRTF) developed the Regional Profile series in order to provide insight, both social and ecological, for community and ecosystem resilience to wildfire in each of the state's four diverse regions (see Fig. 1). The content of each Regional Profile is informed by the best available scientific information, as well as the experience and perspectives of diverse stakeholders from the region. Each Regional Profile also showcases products of the Regional Resource Kit (RRK), which provides publicly-available mapped data. The RRK is another resource being developed for the WFRTF by an interagency collaboration to support state and regional planning efforts to achieve socio-ecological resilience.

The Regional Profile and RRK build upon the Pillars of Resilience Framework, which resulted from a collaborative stakeholder process organized through the Tahoe-Central Sierra Initiative. The Framework is structured around ten desired outcomes, termed 'Pillars of Resilience', that reflect key social and ecological values. Each pillar is characterized by regionally-specific metrics, which can be used to assess, plan for, measure and monitor progress toward achieving objectives on a landscape. In this way, the Framework provides a common platform for tracking progress towards statewide goals while meeting regionally-specific needs.

Figure 1. Boundaries of the four state regions, as delineated by the Task Force, and the boundaries of the 10 counties included within the Central Coast region.

PC: C. Andreozzi

Actions that benefit one pillar may also benefit other pillars or may result in tradeoffs. For example, fuel treatments that reduce wildfire hazard to communities ("Resilient and Fire-Safe Communities") may also protect water resources ("Water Security") or may negatively impact wildlife habitat ("Biodiversity Conservation"). Additionally, management needs and priorities likely vary at both the regional and sub-regional scales. To navigate this complexity, it is important that decision-makers understand the priorities and values of local communities and stakeholders. Each Regional Profile includes stakeholder input gathered via an anonymous survey about priority areas of investment for achieving resilience, as well as focused interviews with regional experts and leaders about key issues, barriers, and opportunities for increasing resilience to wildfire. To assess how community members' experiences and perspectives varied across the region, survey respondents were asked to identify the primary county where they live or work (Fig. 1).

For the purposes of the Regional Profile stakeholder survey, we modified the ten Pillars of Resilience to eight categories: Healthy and resilient forests, Healthy and resilient shrublands, Resilient and fire-safe communities, Air quality, Water security, Biodiversity conservation, Carbon storage, and Economically robust communities (Fig. 2). The following sections provide a Central Coast-specific overview of how each of these categories are impacted by the interrelated crises of wildfire and climate change, as well as opportunities for increasing resilience. Each section also includes highlights from the 784 survey responses and the 32 interviews, and finally, example assessments of current resource conditions. Our intention is to provide foundational background information for the Central Coast region; share findings that summarize stakeholder perspectives on the region's key issues; and describe select metrics being used to assess each pillar, to help land managers and decision-makers understand how data and metrics provided in the Regional Resource Kit can be applied to achieve desired outcomes.

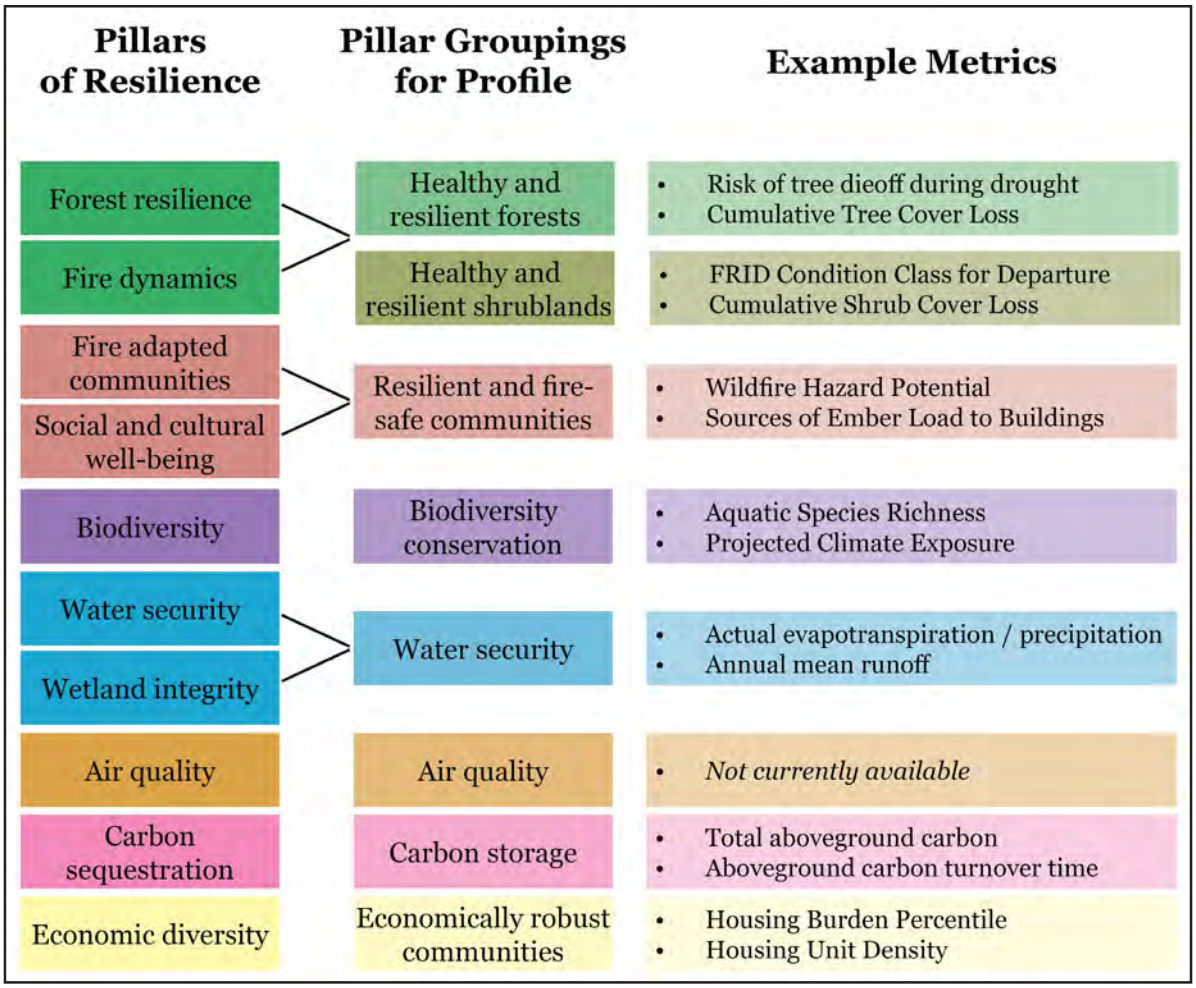


Figure 2. The original ten pillars of resilience were modified into eight pillar groupings to gather stakeholder input via surveys and interviews. These eight groupings form the organizational basis for this document. Each pillar includes metrics for assessing current resource conditions. The metrics listed here are examples showcased in this profile, but additional metrics and data are provided in the Regional Resource Kit.

The Central Coast Region

The Central Coast Region includes 10 counties (see Figure 1) that are home to over 7.7 million people. Nearly 90% of this population live within the densely populated San Francisco Bay Area, whereas populations in the southern Central Coast counties (Santa Cruz, San Benito, Monterey, and San Luis Obispo) are spread over a relatively undeveloped landscape known for agriculture and tourism. The Central Coast region has a long history of conservation which is reflected today in the extensive open space and agricultural land that has been preserved. However, managing this land and its rich biological resources is made increasingly challenging by climate change, as well as development pressures associated with regional population growth.

The Central Coast is a mosaic of diverse land types; oak woodlands, mixed conifer forests, coastal chaparral, and herbaceous grasslands exist in close proximity and provide important ecosystem services. This diversity evolved under both natural and human influences. For example, coastal fog creates microclimates that can support significantly different plant and animal communities across relatively small areas. Coastal influences on temperature and moisture also buffer vegetation from the higher summer temperatures and drought experienced inland, enabling the persistence of iconic species such as coast redwood trees. The Central Coast landscape is also heavily shaped by indigenous land stewardship. For example centuries of cultural burning cultivated the oak woodlands and coastal prairies that we see today. That historical stewardship was disrupted by European settlement, but there are now increasing efforts to restore native ecosystems by incorporating Traditional Ecological Knowledge into land management.

The complexity of the Central Coast landscape also complicates efforts to manage it. Different ecosystems evolved to have different responses to fire. For example, some native plants, such as bishop pine and Morro manzanita, depend on high-intensity, stand-replacing fire for seed germination but also require long fire-free periods for stands to mature. In contrast, many species of California oak trees and native grasses have evolved to withstand frequent, low-intensity fire that kills competing species. Land managers must be aware of these different adaptations and plan treatments that can increase ecological resilience to fire across diverse habitats.

Furthermore, climate change, invasive species, novel pathogens, and human-caused ignitions are interacting to create environmental conditions that are different from what was historically experienced. Similar to other regions of California, the Central Coast is projected to experience warming temperatures and longer dry periods in the future. A longer dry season could increase fire frequency and severity and expanding the wildland-urban interface to provide additional housing makes it more likely that fire will impact human communities.

Efforts to increase ecological and community resilience to wildfire and climate change will require reestablishing Indigenous stewardship practices alongside new approaches that are tailored to modern challenges. It will also require greater capacity to conduct landscape-scale stewardship by collaborating across property boundaries. Numerous partnerships

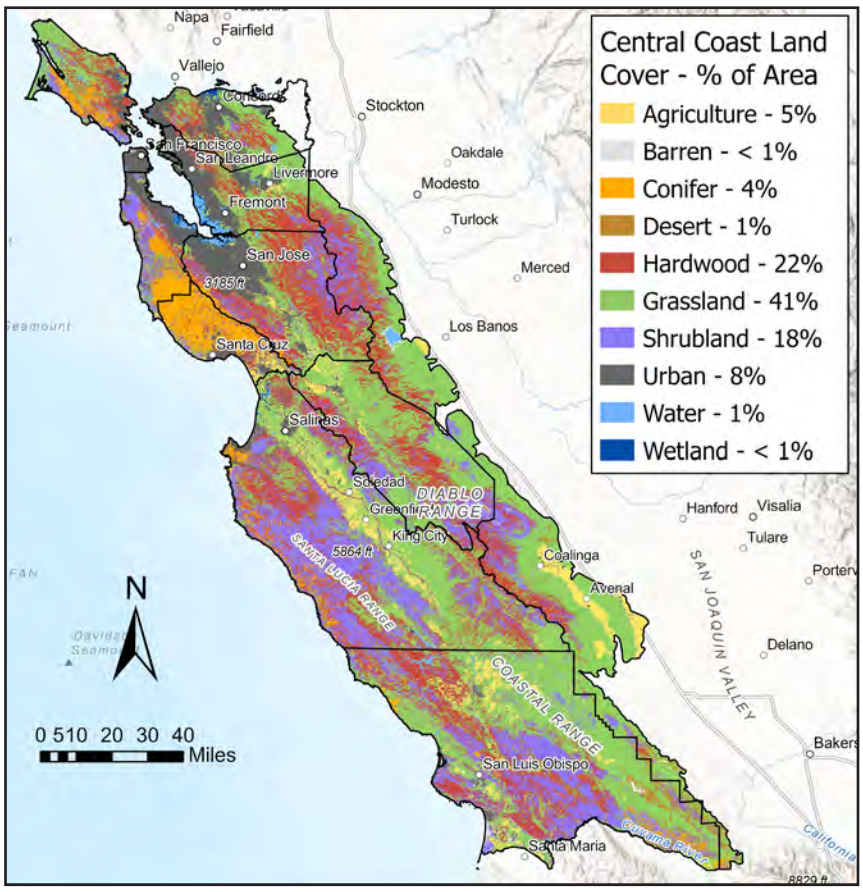


Figure 3. Map uses data included in the Regional Resource Kit (RRK) to show the distribution of land cover types in the Central Coast region. RRK data offers an updated version of the statewide 2015 FVEG data to incorporate recent wildfire and other disturbance that has occurred.

and other initiatives across the Central Coast region are already increasing this capacity. A few examples of current collaborations, such as the Central Coast Prescribed Burn Association, Marin Wildfire Prevention Authority, One Tam, and Santa Cruz Mountains Stewardship Network, are highlighted in this profile [see 'Resilient and Fire-Adapted Communities' and 'Water Security'].

Many programs take a holistic approach to manage fire risk and consider strategies that can offer multiple co-benefits. However, some of these actions have tradeoffs. For example, many exotic species have invaded or even type changed native habitat, changing the fire dynamics of the ecosystem and creating hazardous conditions for nearby communities. Removing invasive plants can increase wildfire resilience, but it might be detrimental to the animal species that use these plants for habitat, such as the migratory monarch butterflies that roost in eucalyptus trees. Understanding the costs and benefits associated with different actions can enable land managers and decision-makers to better reconcile these tradeoffs and gain public support to ultimately increase resilience across the region.

Healthy and Resilient Forests

Forests and woodlands make up a quarter of the land cover of the Central Coast region and provide vital ecosystem services, including protecting the health of key water sources, sequestering carbon, and offering recreational opportunities. Managers are challenged to respond to multiple threats to these ecosystems, including climate change, invasive species, novel pathogens, development of natural lands, and changing wildfire regimes. Threats and management priorities vary by forest type.

Oak Woodlands

Oak woodlands are a culturally and ecologically important ecosystem of the Central Coast. For thousands of years they have provided resources to human communities and have served as important wildlife habitat. Oak woodlands primarily occupy foothills and valleys in the region, and they are dominated by one or more oak tree species with an herbaceous or shrub understory. The most common species in the region are blue oak, coast live oak, and valley oak. Each species has different evolutionary adaptations to its environment. For example, as its name implies, coast live oak is better adapted to coastal conditions than other oak trees; in fact, 80% of California's coast live oak woodland is found in the Central Coast region.

Stakeholder Input

Throughout the profile we will be sharing findings from stakeholder engagement in *'Stakeholder Input'* boxes like this one. This includes survey results, as well as key findings from interviews with land management experts and others who interact with a broad variety of stakeholders in their work to increase ecosystem and community resilience to wildfire.

Survey results shown here and throughout the profile include all survey respondents. Additional survey results showing response for each subregion can be found in the Appendix.

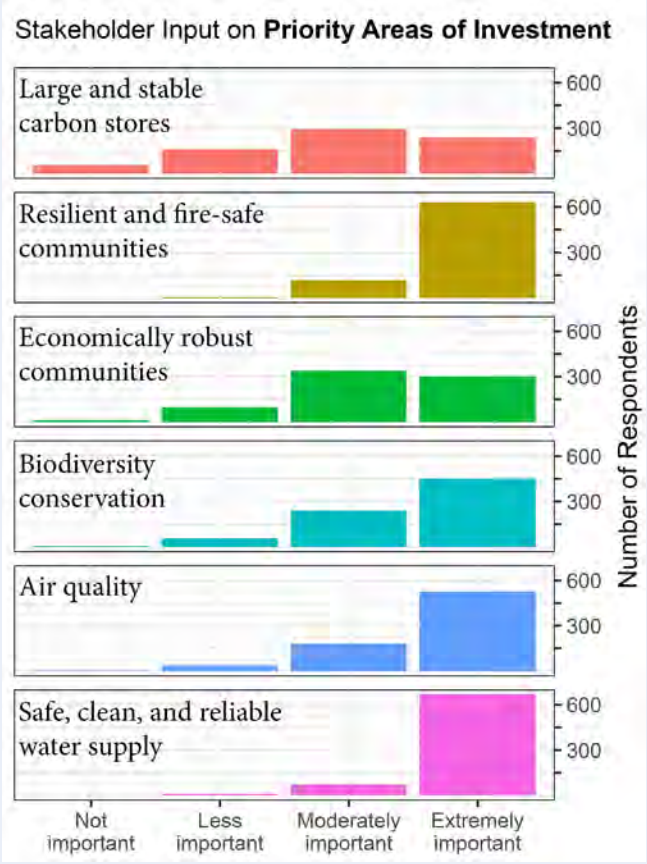


Figure 4. Central Coast stakeholders provided input on the importance of investment across six pillar categories beyond 'Healthy and resilient forests' (Fig. 5) and 'Healthy and resilient shrublands' (Fig. 7). 'Safe, clean, and reliable water supply' and 'Resilient and fire-safe communities' emerged as the top-priority outcomes to invest in. Air quality was also rated as a high priority. 'Carbon storage' was considered to be of less priority. However, all outcomes had a mean response ranging from 'moderately important' to 'extremely important,' which highlights the importance of considering all of these values when developing regional plans.

For at least 3,000 years, ancestral land managers used frequent fire to manage oak woodlands for

Oak woodlands provide valuable resources for ecological and human communities, including recreation opportunites for these hikers at Sunol Regional Wilderness, a regional park in Alameda County. Photo credit: Chelsea Andreozzi

resource benefits, such as improving acorn crops and stimulating the growth of plants used for weaving baskets. Oak woodlands are adapted to this high-frequency, low-intensity fire regime, which benefited oak trees over competing species, such as shrubs and conifers. This stewardship ended in the 19th century when European colonization displaced Indigenous peoples and outlawed cultural burning. However, ranchers also burned oak woodlands to increase forage production for livestock until mid-20th century fire suppression policies prohibited burning. Decades of fire suppression and a decline in grazing have led to increased tree density, encroachment by shrubs and conifer species, and a more homogenous fuel landscape that can sustain higher intensity fire over larger areas. The introduction of invasive grasses has further stressed these critical systems as they outcompete native species, diminish ecosystem services, and are often more flammable than the native species they replace. These conditions further increase the risk of larger, more severe fires occurring.

Central Coast oak woodlands are also threatened by emerging diseases, pests, and climate change. Sudden oak death (SOD) is an infectious disease caused by the water mold Phytophthora ramorum, which has killed millions of tanoaks and oak trees, primarily coast live oak, in coastal California forests since the late 1990s. Significant oak mortality has also been caused by recent severe droughts. Tree mortality increases both surface fuel loads and standing dead trees on the landscape. Management actions that restore low-severity fire back into these systems, reduce fuel loads, and remove invasive species will increase the resilience of oak woodlands to future climate change, invasive species, and novel pathogens.

Coast Redwood Forests

Coast redwood forests are an iconic ecosystem of the Central Coast that are increasingly vulnerable to emerging threats. Coast redwoods persist in a narrow band along the California coast, reaching the southern limit of their range in Monterey County. Coast redwood trees and many other plants in this highly-specialized ecosystem are adapted to absorb fog water through their leaves, and fog water sustains these forests during the dry summer months. If fog frequency declines in the future due to climate change and urban heat island effects, redwood forests may be increasingly drought stressed.

Coast redwood trees are adapted to both low and high-severity fire. Their thick bark protects living tissue, and they have the capacity to resprout from their truck even after wildfire consumes their crowns. These trees can live for over 2,000 years and grow over 320 ft tall, making them the tallest trees in the world. However, few of these ancient trees still exist because redwood is one of the most valuable trees for timber. Over 95%

of the existing California coast redwood ecosystem has been logged at least once, and younger forests are denser and more homogeneous than mature forests.

The prevalence of sudden oak death (SOD) in coastal forests is an emerging threat to the redwood ecosystem. Although coast redwood trees are not susceptible to the pathogen, they frequently co-occur with tanoak trees which have suffered as high as 90-100% mortality in some impacted areas. Dead tanoak trees increase fuel loads and can increase the risk of higher-severity fire because fire can move from the surface to the canopy by using the standing dead trees as a ladder. A study of the 2008 Basin Fire in Big Sur, Monterey County found that standing, disease-killed tanoaks caused crown fires and significantly contributed to elevated redwood mortality from the fire.

The largest surviving stands of old-growth redwoods on the Central Coast are found in Big Basin Redwoods State Park (Big Basin), which is also notable for being California's oldest state park. In August 2020, the CZU Lightning Complex Fire burned across 86,509 acres of forest lands in San Mateo and Santa Cruz Counties, including burning more than 97% of Big Basin, at much higher severity than historically occurred. This fire was followed by two years of extreme drought, which further stressed the surviving trees. A study using satellite data found that two years post-fire, the majority of the evergreen forest canopy in Big Basin had not recovered, demonstrating that even ancient forests are under significant threat from the compounding threats of climate change and fuel accumulation.

Regional organizations such as Save the Redwoods League and Sempervirens Fund are leading efforts to restore the health of redwood ecosystems and to adapt redwood forests to climate change and other emerging threats. Management actions in this ecosystem include applying prescribed fire to reduce fuels; thinning dense, young forests to encourage the growth of mature habitat characteristics; and protecting properties that might serve as important climate refugia for redwoods and associated species in the future.

Stakeholder Input

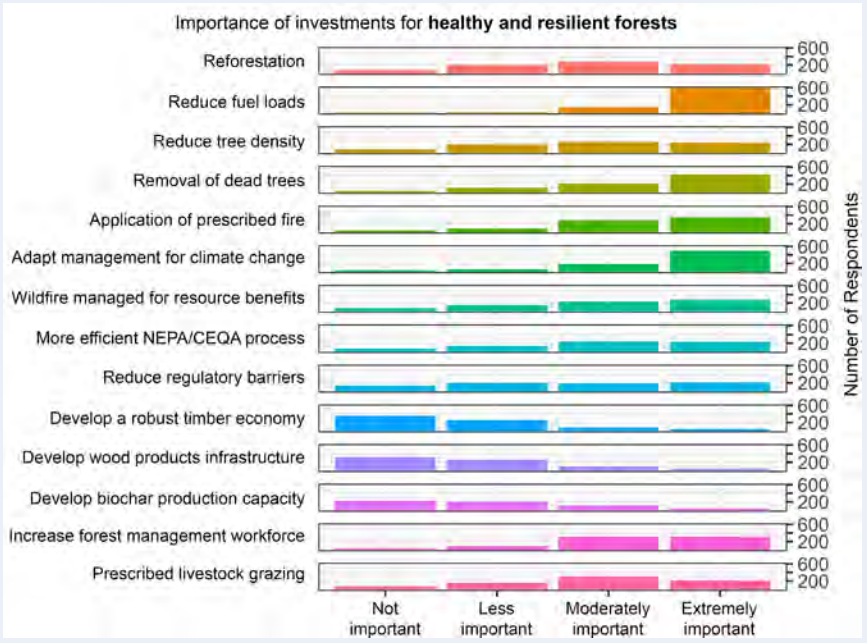


Figure 5. Survey respondents considered the top priority area of investment for achieving healthy and resilient forests to be reducing fuel loads, followed by adapting management for climate change. Removing dead trees and applying prescribed fire were also on average rated highly, followed by increasing forest management workforce. Developing a robust timber economy, wood products industry and biochar capacity were considered on average to be 'less important.' However, only 591 of the 784 respondents provided a rating for the question about biochar production, suggesting less public familiarity with that topic.

Interview findings: When asked what the key issues were to achieving ecological resilience in the region, many interviewees detailed concerns about how regional forest and woodland ecosystems were not adapted to modern disturbance regimes. Long-term fire suppression policies that were intended to protect forests from burning up have led to unprecedented levels of fuel accumulation, increasing the risk of a higher intensity fire than regional forests and woodlands are evolutionarily adapted. While many of these ecosystems are adapted to fire, there is an intensity threshold at which fire can kill mature trees and impede ecosystem recovery, and we do not yet know what the long-term impacts of those high-intensity fires will be. Interviewees perceived that there was also a persisting tendency to apply knowledge and models established in other systems of California to the Central Coast region, and there is a need to better understand fuel management approaches should be applied to habitat such as oak woodlands and redwood forests. Regional forests and woodlands are also showing signs of increasing mortality and stress due to climate-driven changes, and there is a need to anticipate how species will be affected to adaptively manage for the future.

Current Conditions

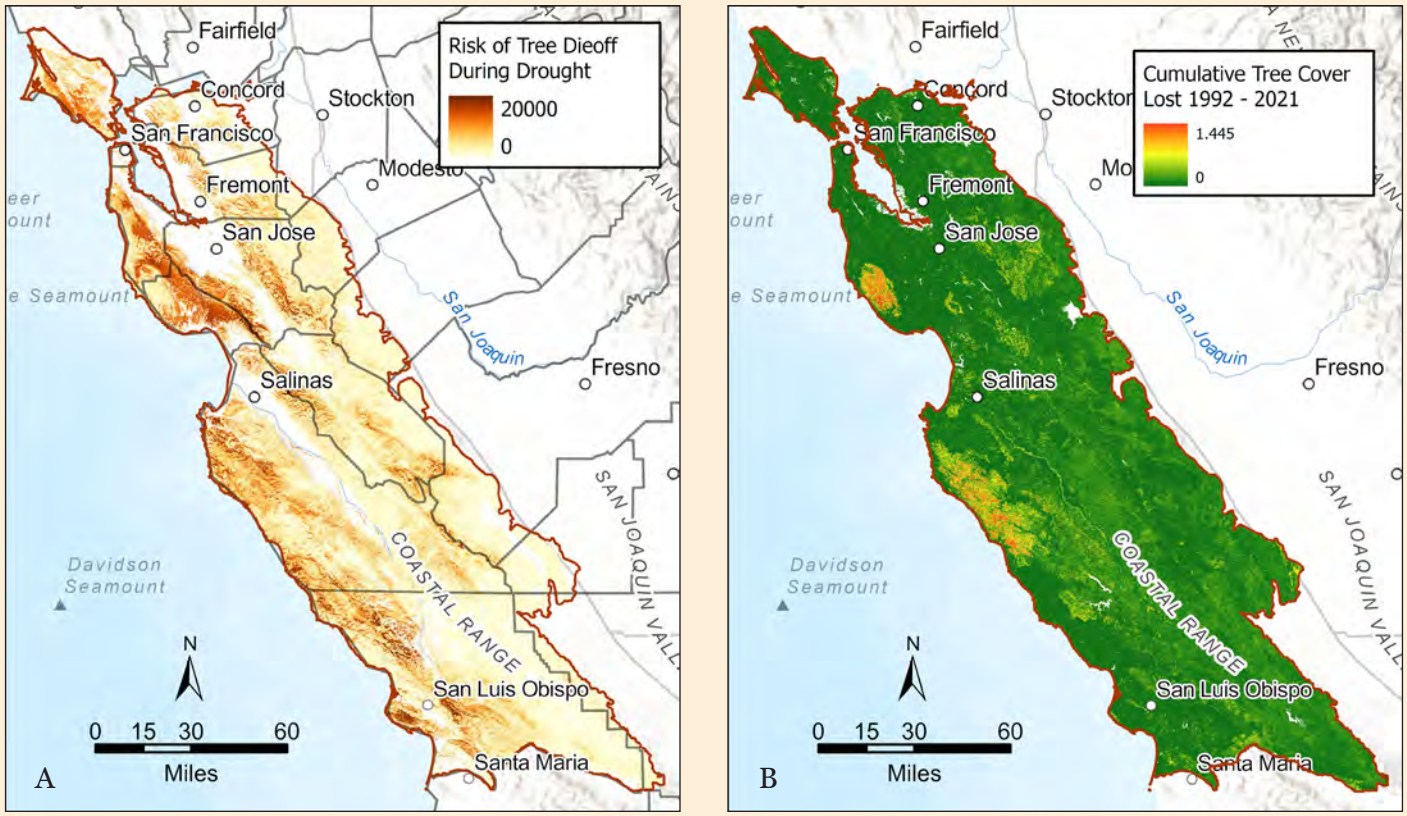


Figure 6. Risk of tree dieoff during drought (A) can be used as a metric of forest health and resilience; understanding how this risk varies across the landscape can help managers prioritize actions to reduce density of trees and alleviate moisture stress for remaining trees or to identify likely locations of high fuel buildup from dieoff. This metric is presented as a dimensionless index ranging from 0 to ~20,000. Low values indicate minimal risk of dieoff during drought, because there are few trees in the pixel and or there is ample local moisture even during periods of drought. High values indicate significant risk of tree dieoff during drought, as a result of both a high density of trees at the site and insufficient local moisture. In the Central Coast, eastern Santa Cruz and San Mateo Ccounties have dense areas with a high risk of tree dieoff during drought; patches of high risk are also found down the coast of Monterey and San Luis Obispo Counties. The RRK also includes data on cumulative tree cover loss (B) from fires, management, and dieoff. This metric is measured as an absolute value, ranging from 0 to 1; though values can exceed 1 if multiple disturbances occurred.

Mixed Hardwood-Conifer Forests

Various other hardwood and conifer tree species also occur in the Central Coast region, including serotinous (closed cone) pine species, such as Monterey pine, bishop pine, knobcone pine. These species are highly adapted to a low-frequency, high-intensity fire regime because they depend on the heat of a fire to remove competition, open their cones, and release their seeds. Historically, lightning-ignited fires occurred on the Central Coast every 50 to 100 or more years and provided this necessary disturbance. If fire occurs too frequently then these species do not have sufficient time to mature and develop their canopy seed bank, which is critical for post-fire recovery. The years following fire are a critical period for these ecosystems as the seedlings need rain and milder conditions to regenerate. Extended droughts as a result of climate change could lead to a failure of regeneration following a severe fire, and the area may transition to a different habitat type.

Serotinous pines trees, such as endemic Monterey pine shown here, are adapted to regenerate after stand-replacing fire but seeds need sufficient time to mature. Photo credit: Dianejp

Fort Ord National Monument in Monterey County includes maritime chaparral and grasslands and provides habitat to an array of endangered plant and animal species. Photo credit: Bob Wick, BLM

Healthy and Resilient Grasslands and Shrublands

Grasslands cover 41% of the Central Coast region, while shrubland ecosystems cover 18%. Most of the region's grasslands have been highly disturbed by human activities, especially agriculture, and are now almost entirely dominated by non-native annual grasses and forbs. In contrast, less than 1% of grassland cover in the region is coastal prairie, a native perennial grassland that grows along the Pacific coast from Southern California to Southern Oregon. Many of the native coastal prairie species are adapted to use fogwater, which gives them a competitive advantage of exotic annual species. This highly-endangered ecosystem relies on disturbance for its persistence. Historically, large herbivores, such as Tule elk, were a primary source of disturbance. For at least 1,200 years Indigenous stewardship maintained coastal prairies through cultural burning, which occurred as frequently as every 1 to 5 years.

After Indigenous burning practices were eliminated by European colonization, livestock and wild ungulate grazing continued to maintain coastal prairie, but this ecosystem became increasingly vulnerable to encroachment by other native species such as coyote brush and Douglas fir, which can result in conversion to other habitat types. Much of this ecosystem has also been lost to urban and agricultural development, and there are concerns that coastal prairie will also be vulnerable to climate change, especially if summer fog frequency declines. Current efforts to conserve coastal prairie include applying prescribed grazing, prescribed fire, and mechanical treatments to remove encroaching conifers, shrubs, and exotic species and to promote native species.

Another endangered ecosystem, coastal sage scrub, occurs in similar coastal areas as coastal prairie but its range only extends north to Marin County. Coastal sage scrub will commonly replace coastal prairie in the absence of disturbance. However, coastal sage scrub is also vulnerable to invasive species encroachment, overgrazing, and elevated nitrate levels in soil due to air pollution. Too-frequent fire due to human ignitions can convert coastal sage scrub to non-native grasslands. Management actions to help restore coastal sage scrub include applying mechanical treatments to reduce invasive species, planting native species, and protecting natural lands from development.

Maritime chaparral is another key shrubland ecosystem along the Central Coast. It is dominated by manzanitas and native wild lilacs (ceanothus) and generally occurs within or near oak woodlands and conifer forests. This vegetation type is fire-dependent because many maritime chaparral species are obligate

Stakeholder Input

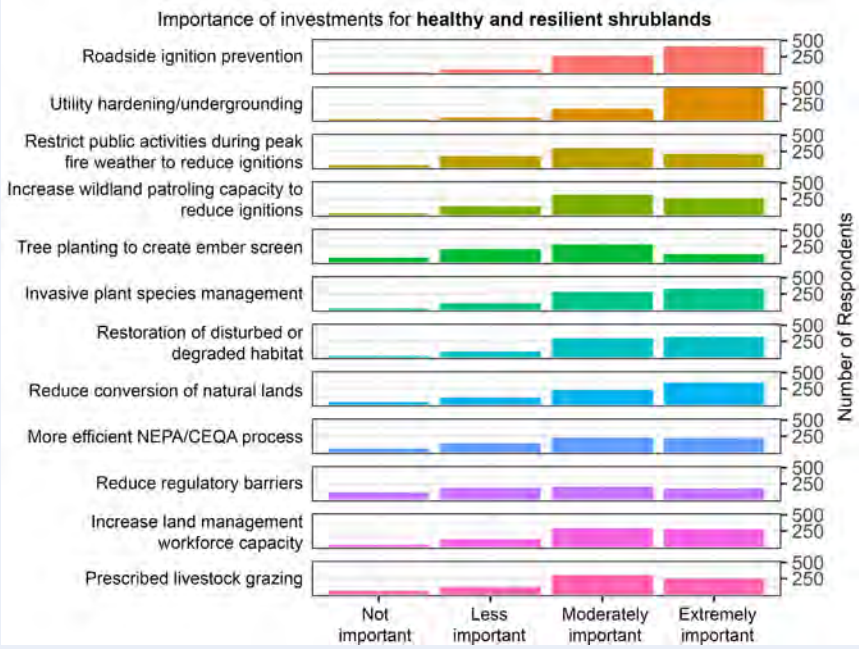
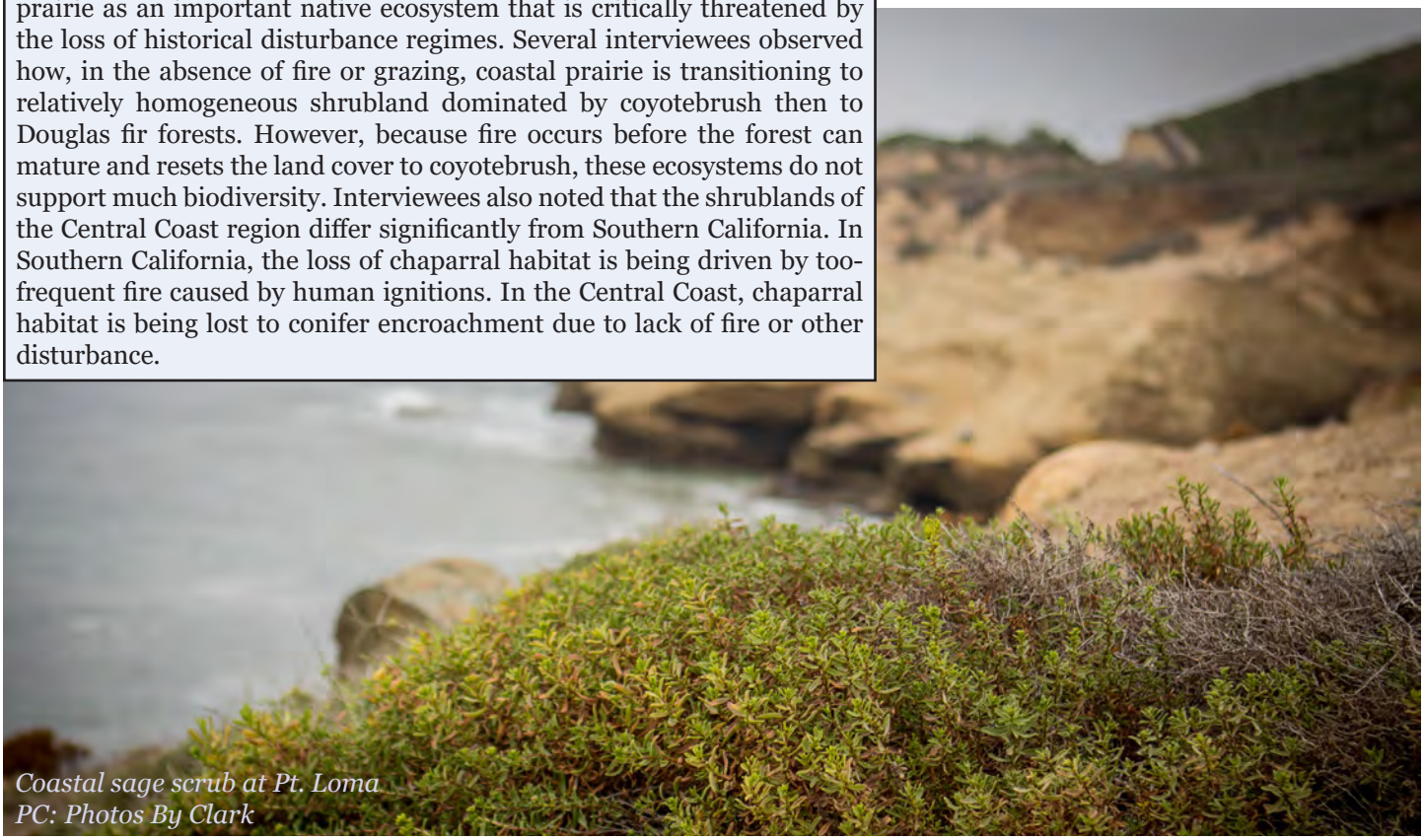


Figure 7. Stakeholders responded that the top priority areas of investment for achieving healthy and resilient shrublands were utility hardening/undergrounding and roadside ignition prevention. Invasive species management, habitat restoration and reducing land conversion were also rated more highly than other areas. Survey respondents rated reducing regulatory barriers and planting trees to create ember screens to be less important than other potential areas of investment.

Interview findings: When asked about the key issues related to ecological resilience to wildfire, many interviewees highlighted the coastal prairie as an important native ecosystem that is critically threatened by the loss of historical disturbance regimes. Several interviewees observed how, in the absence of fire or grazing, coastal prairie is transitioning to relatively homogeneous shrubland dominated by coyotebrush then to Douglas fir forests. However, because fire occurs before the forest can mature and resets the land cover to coyotebrush, these ecosystems do not support much biodiversity. Interviewees also noted that the shrublands of the Central Coast region differ significantly from Southern California. In Southern California, the loss of chaparral habitat is being driven by too-frequent fire caused by human ignitions. In the Central Coast, chaparral habitat is being lost to conifer encroachment due to lack of fire or other disturbance.

seeders that require fire to germinate. However, like serotinous pines, the timing of fire return intervals is critical for species regeneration. One study of the endangered species Morro manzanita found that a fire return interval as long as 40 years could be too short for maritime chaparral species to build up sufficient seed banks for post-fire recovery. As a result, this rare vegetation community may be further endangered if fire frequency increases because of human ignitions or climate change.



Coastal sage scrub at Pt. Loma
PC: Photos By Clark

Current Conditions

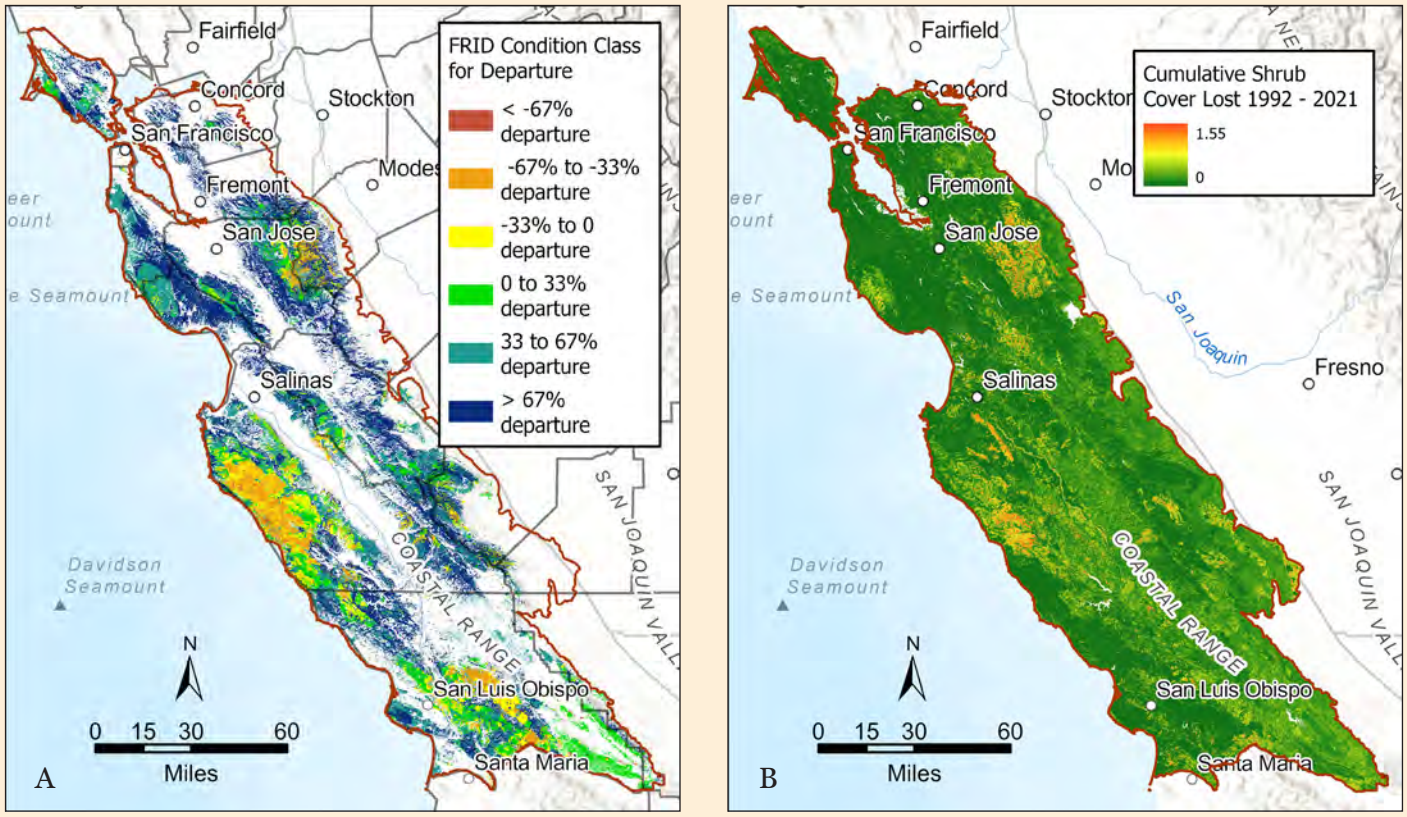


Figure 8. Fire Return Interval Departure (FRID) condition class (A) reflects the magnitude and direction of departure from the historical fire return interval on the landscape. A positive FRID value indicates fires are burning less frequently than historical regimes, while negative values indicate fires are burning more frequently than historical regimes. The greater the condition class value, the greater the departure from an area's historical fire return interval. In coastal Monterey and inland San Luis Obispo Counties, more negative FRID values reflect a significant increase in overly frequent wildfires; whereas in Marin, San Mateo, and Santa Cruz Counties more positive FRID values indicate fires have been burning less frequently than they did historically, in part due to modern suppression of wildfire and disruption of the cultural burning that historically occurred. Cumulative shrub cover loss (B) from fires, management, and dieoff is measured as an absolute value. These values range from 0 to 1; values can exceed 1 if multiple disturbances occurred. In the Central Coast, the greatest shrub cover loss is concentrated in eastern Santa Clara County and central Monterey County.

Resilient and Fire-Safe Communities

Lightning occurs less frequently in the Central Coast region than higher-elevation parts of the state, and moist coastal conditions further reduce ignitions. As a result, the historical fire return interval along the Central Coast would have been in the range of 50 to 100 or more years without the influence of cultural burning. The last major urban fire to occur in the San Francisco Bay Area was the October 1991 Oakland-Berkeley Hills Fire, which caused 25 fatalities and destroyed over 3,000 homes. Over thirty years later, many new residents have moved to the region. Population growth and demand for more housing has expanded the wildland-urban interface, increasing the probability of human ignitions in wildland vegetation and increasing the risk wildfires may impact communities. Land use planning to reduce development in areas of high wildfire hazard, as well as encouraging home hardening practices and the management of defensible space, are increasingly important tools for reducing the risk of fires impacting communities. Renters and residents of multi-family housing may have limited capacity to upgrade their building or manage surrounding property, and regional efforts will need to consider new strategies to help these communities become more fire-adapted.

The August 2020 CZU Lightning Complex Fire was a devastating wildfire, caused by an uncommon

lightning storm, that demonstrated the intensity and rate of spread potential for wildfires in the Central Coast region, along with the resulting impacts such an intense fire can have on local human communities and natural ecosystems [see 'Healthy and Resilient Forests']. As impacted communities continue to struggle with the challenges of rebuilding, there is heightened interest in also making neighborhoods, infrastructure, and natural lands more resilient to future fire. New collaborations with diverse partners have been critical to increasing capacity to work across property boundaries and achieve multiple benefits across the landscape. A prime example of this is the Santa Cruz Mountains Stewardship Network, which is made up of 24 organizations including diverse agencies, nonprofits, academia, business, community, and tribal groups. These organizations are working together to enhance natural ecosystem functions, adapt the landscape to climate change, and sustainably manage forest resources for future generations.

Stakeholder Input

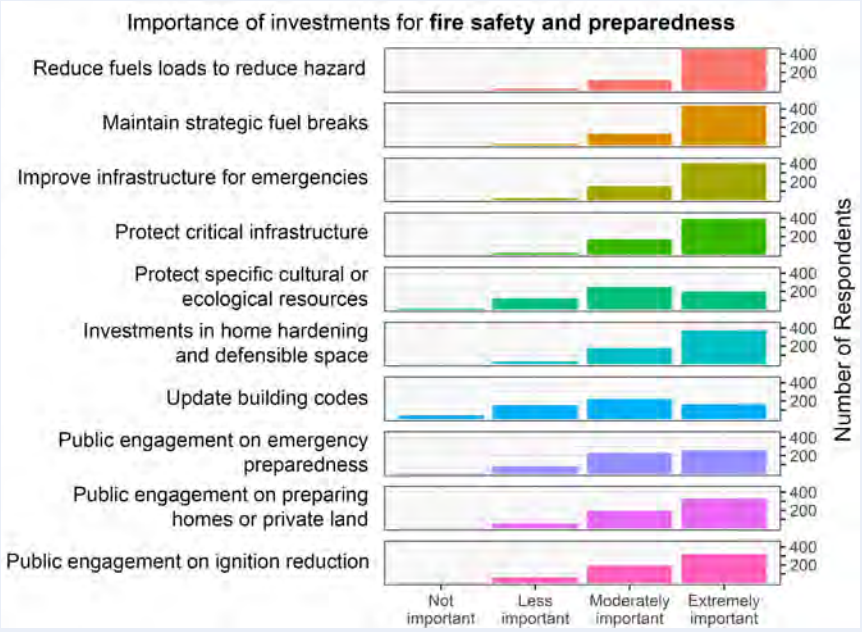


Figure 9. Reducing fuel loads and maintaining strategic fuel breaks, closely followed by improving infrastructure and protecting critical infrastructure, were all considered to be the most important areas of investment for increasing community safety and preparedness. Investments in home hardening and defensible space were also perceived to be highly important. There appeared to be less of a consensus on the importance of protecting specific resources and updating building codes.

Interview findings: When asked about the key issues related to community resilience to wildfire, many interviewees expressed safety concerns related to land development patterns and insufficient infrastructure, such as road access, for emergency response. Because wildfires were not historically considered a concern in this region, many communities developed in forested areas with steep topography and narrow roads. There are now efforts to make these communities more fire-adapted, but much more work needs to be done on private property, such as home hardening and defensible space. Several interviewees noted that there are limited resources to support this work because of restrictions on using public funding to benefit private property. As solutions to increase community resilience, interviewees recommended developing incentives for private property owner actions and increasing public engagement to help residents understand how they can take actions to protect their property and community.

Similar efforts to facilitate fire-adapted communities are being made in other parts of the region. The Marin Wildfire Prevention Authority and its member agencies are managing vegetation to reduce wildfire hazard, improving evacuation safety, and providing funding and technical support to reduce fire risk on private property. Local agencies such as Resource Conservation Districts are leading and supporting similar projects in counties throughout the region. Community-based organizations such as Fire Safe Councils are also providing public education and mobilizing residents to prepare their homes and neighborhoods against the threat of wildfire.

Additional efforts are focused on reintroducing prescribed fire to the landscape to mitigate the risk of higher severity wildfire. The Central Coast Prescribed Burn Association serves San Benito, Santa Cruz, and Monterey Counties by leading and participating in private-land burning, as well as offering prescribed fire training and public education on home hardening and defensible space. Audubon Canyon Ranch's Fire Forward program offers trainings and support for prescribed burning in Marin and Sonoma Counties.

Initiatives to get "good fire" back on the landscape have also created new opportunities for cultural burning and the incorporation of Traditional Ecological Knowledge into landscape management. The Amah Mutsun Land Trust has been partnering with agencies and other organizations to bring indigenous stewardship back to the Amah Mutsun Tribe's traditional territory. They have been collaborating with Pinnacles National Park since 2006 and, in 2011, they were able to implement

Audubon Canyon Ranch's Fire Forward program leads trainings to increase capacity to conduct prescribed fire. Photo credit: Sashwa Burrows

the first burn for cultural purposes in their territory in over 200 years. The Amah Mutsun Land Trust has since partnered with other organizations to introduce cultural burning in other areas, such as Midpeninsula Regional Open Space District's preserves and the San Vincente Redwoods preserve managed by the Sempervirens Fund and Peninsula Open Space Trust. The Federated Indians of Graton Rancheria (FIGR) are another Tribe that is reintroducing cultural burning and other indigenous stewardship practices into the management of their traditional territory by partnering with organizations such as Audubon Canyon Ranch. In 2021, FIGR and the National Park Service entered an agreement to co-manage Point Reyes National Seashore, which will promote the reintegration of Traditional Ecological Knowledge into the stewardship of this traditional Coastal Miwok territory.

Stakeholder Input

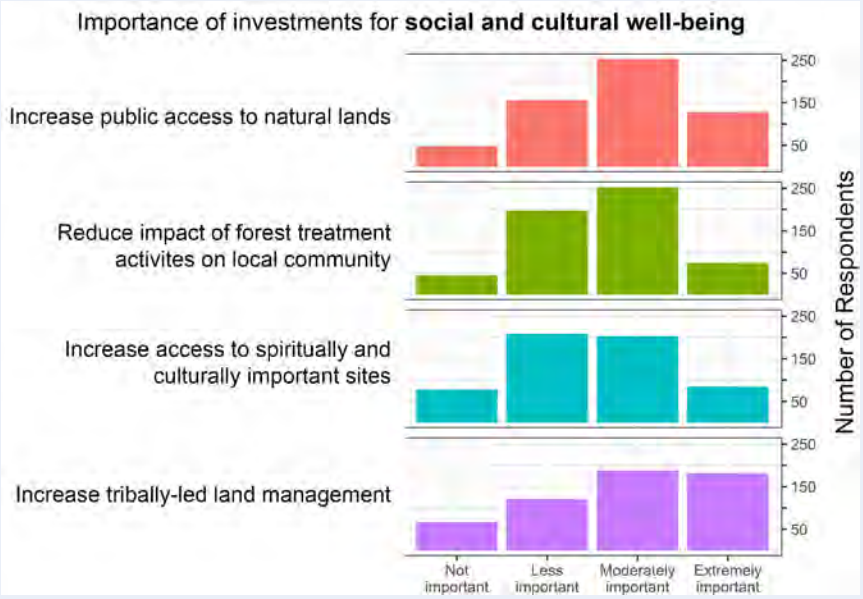


Figure 10. Survey respondents were also asked to consider investments focused specifically on social and cultural well-being. All potential areas of investment for increasing community well-being were rated on average as less than moderately important. However, increasing tribally-led land management, followed by increasing public access to natural lands, was on average rated slightly higher and had a higher response rate of 'extremely important.'

Interview findings: Many interviewees highlighted how indigenous land stewardship practices were instrumental in shaping the landscape of the Central Coast that we see today and how the suppression of cultural burning disrupted historical disturbance regimes. New partnerships with Tribal communities are reintroducing cultural burning and increasing tribally-led land management on public and private lands. However, one interviewee noted that grant funding constraints, including project deadlines and metrics focused on acreage treated, can be barriers to engaging and integrating Tribes into decision-making and land management processes.

Current Conditions

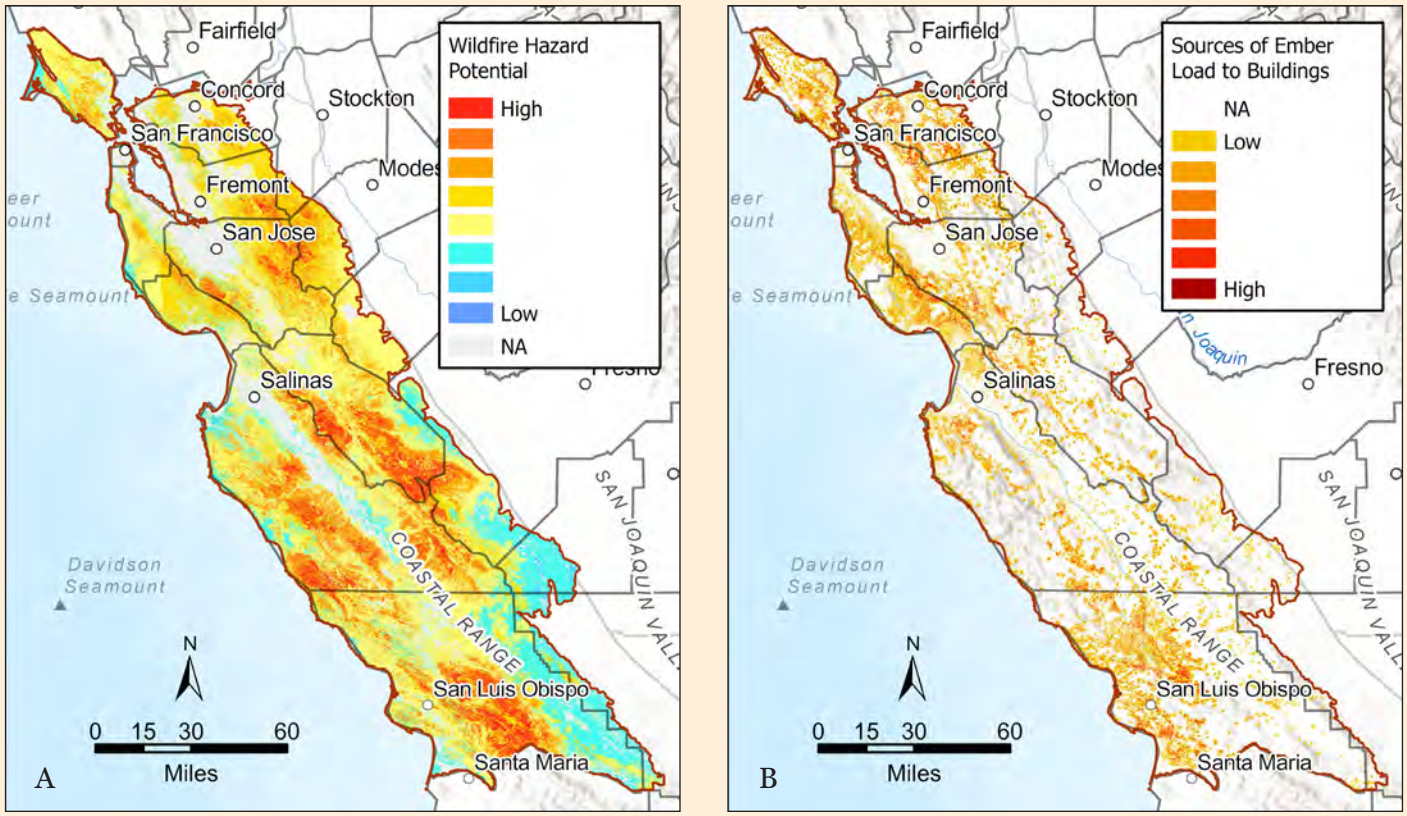


Figure 11. To support and create fire-adapted communities, we must understand the threats a community faces from wildfires. Measuring wildfire hazard potential (A) can help prioritize locations of fuel treatments. In the Regional Resource Kit, this metric focuses specifically on potential for fires that may be difficult for suppression operations to control. High potential for wildfire hazard exists in all of the Central Coast counties. Hazard potential is especially high and concentrated in southern San Benito, Monterey, and San Luis Obispo Counties. During a wildfire, embers often spread the fire, potentially carrying it from wildlands and into communities. Source of ember load to buildings (B) is a relative index metric that incorporates burn probability, local vegetation and topography, as well as models that track the travel of embers from sources to downwind areas. The resulting map layer shows relatively how many embers are predicted to land at a location with buildings. Areas along the wildland-urban interface tend to be at especially high risk of exposure to embers. Understanding how embers are likely to spread during a fire and the amount of embers that may be carried can help communities prioritize where investment in building hardening is needed to resist ignition.

Native and exotic habitats coexist in close proximity across the Central Coast region. At Sibley Volcanic Regional Preserve in Alameda County, invasive eucalyptus trees border shrublands and grasslands that have also been invaded by non-native species, complicating land management for biodiversity and wildfire resilience. Photo credit: Chelsea Andreozzi

Biodiversity Conservation

The Central Coast region's mosaic of ecosystems supports incredible biodiversity resources, including many endemic species. Many sensitive species depend on Central Coast habitat and are threatened by long-term consequences of suppressing cultural burning and stewardship, including the impacts of changing fire regimes, such as the occurrence of higher intensity fire.

Though wildfires always alter a habitat, whether the changes sustain or degrade the habitat depends on how closely the fire characteristics match the historical patterns these systems evolved with. This applies to riparian habitat, where typically wet conditions reduce fire likelihood and intensity. Riparian forests can experience high severity if unusual conditions like drought, high fuel loads, exotic plant species, or wind-driven fires interact. When riparian habitat burns at high severity, the resulting loss of canopy cover can increase the temperature of aquatic habitat and make it unsuitable for species with sensitive thermoregulatory requirements, including native salmonids and endangered amphibian species, to complete their life cycles. A study of a California coastal stream found that one year after tree cover was lost to wildfire, stream temperatures of burned areas were elevated up to 1 °F compared to unburned areas and this increased metabolic stress on thermally-sensitive steelhead trout. As a result, those sections of stream sustained lower fish biomass due to starvation, mortality, or emigration to more suitable habitat. The loss of vegetation cover and burning of soil can also increase erosion and runoff following fire, which can threaten water quality. Post-fire landslides and debris flows can directly kill aquatic species and destroy breeding habitat. Increased sedimentation post-fire can also reduce the abundance and diversity of sensitive aquatic insects, which can have rippling effects for food webs.

Management actions that restore natural processes and the health of these ecosystems can increase resilience to wildfire and benefit biodiversity. However, current regulatory processes may inadvertently limit the pace and scale at which projects can occur. For example, fuel treatment projects that are done by state and local government agencies or which are funded by these agencies must be reviewed under the California Environmental Quality Act (CEQA). This includes projects that are intended to promote native habitat restoration and benefit sensitive species. The intention of regulatory processes is to minimize environmental impacts and protect biological resources by reviewing potential impacts before projects occur. However,

projects often take at least 1-2 years to receive permits. During this time unplanned wildfire can impact the area that was going to be treated, or the costs and timeline of the regulatory process can become prohibitive to work being done. In response to this issue, the state of California launched an initiative called "Cutting the Green Tape" to increase the pace and scale of environmental restoration by streamlining permits and otherwise improving regulatory processes and policies for environmentally beneficial projects.

Vegetation treatments that benefit native habitat restoration can also come into conflict with other public goals, such as aesthetic values and species conservation. Managing non-native eucalyptus trees is a primary example of this. Millions of eucalyptus trees were planted in California between 1856 and the 1930s because its fast growth and large size suggested that it would be beneficial for lumber production, but the wood turned out to be unsuitable for this purpose. The trees persisted and, over time, invaded native ecosystems. Eucalyptus trees are more flammable and also shed more limbs, bark and leaves than native tree species, contributing to hazardous fuel accumulation for wildfires and higher risk of fire spread to adjacent areas. The combustion of eucalyptus vegetation is believed to have significantly contributed to the intensity and spread of the 1991 Oakland Hills fire. However, eucalyptus removal is a source of public contention because the trees are also valued for their aesthetic properties and the habitat some trees provide for biodiversity, such as endangered monarch butterflies. Land managers in areas with significant eucalyptus stands must manage conflicting public interests to meet multiple objectives.

Stakeholder Input

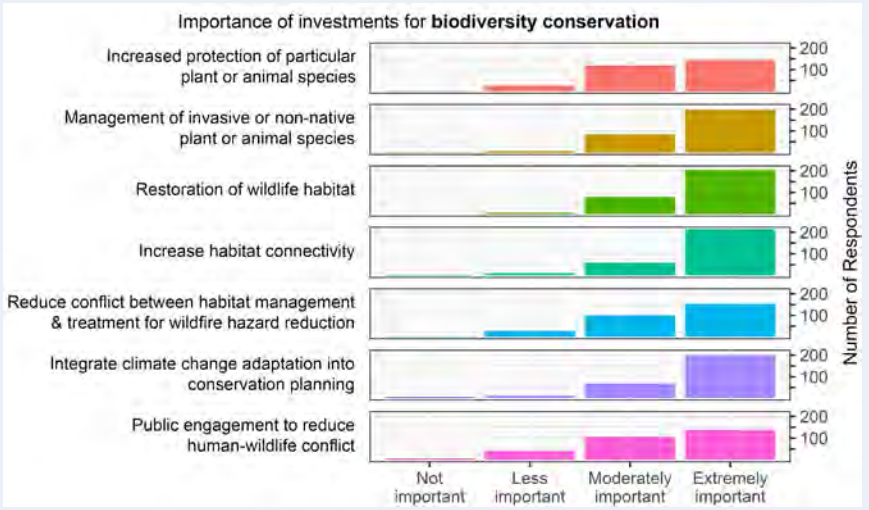


Figure 12. All potential areas of investment for achieving biodiversity conservation were considered on average to be at least moderately important. Top priorities were managing non-native or invasive species, restoring wildlife habitat, increasing habitat connectivity, and integrating climate change adaptation into conservation planning. Restoring habitat and increasing connectivity were not only on average higher, but also were rated as "extremely important" by most respondents.

Interview findings: Interviewees discussed how management to increase fire resilience for both ecosystems and communities can be more complicated due to many sensitive species being present in the region. The presence of threatened and endangered species can make it hard to get permits to do ecologically beneficial work or restrict when and how work can be done. In doing so, regulations that protect threatened and endangered species may promote single-species conservation rather than enabling holistic management. For example, several interviewees throughout the region discussed the challenge of removing exotic eucalyptus trees to reduce wildfire hazard because some of the trees provide habitat for monarch butterflies, which can lead to planned projects being halted by environmental litigation. Several interviewees recommended public education on the role of active vegetation management in promoting biodiversity and ecosystem health.

Oak woodlands provide important habitat to endemic species like Nuttall's woodpecker. This bird forages in a tree at Lake Lagunitas reservoir in Marin County. Photo credit: Veit

Current Conditions

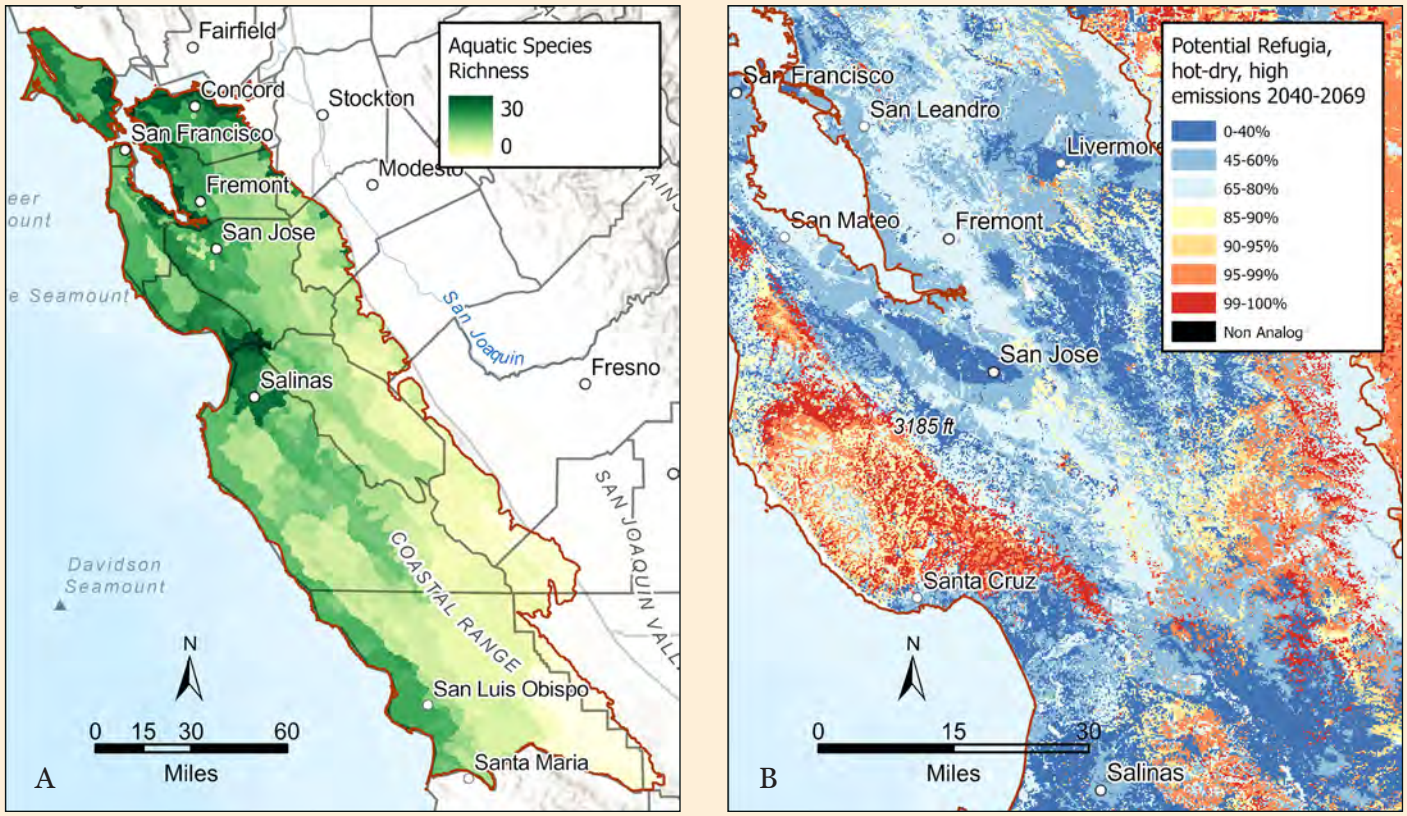


Figure 13. Assessing biodiversity can include metrics such as the richness of native species in different habitats, such as riparian areas (A), as well as the degree of climate change a habitat type is predicted to experience (B). Aquatic species richness measures the total number of potentially present native fish, aquatic invertebrates, aquatic amphibians, and aquatic reptiles in each watershed. In some regional watersheds, such as those in southern Santa Cruz or northern Contra Costa counties, as many as 30 native aquatic species may be present. Generally, coastal watersheds have higher species richness than inland watersheds. Climate exposure is a measure of the level of climate change that the dominant vegetation group of an area is expected to experience. It is calculated by projecting future climate conditions and comparing them to what the vegetation group currently experiences across its range. Areas with less than 80% exposure values are considered to be less stressed because climate conditions will be similar to what was historically commonly experienced. These less stressed areas might offer important refugia for the persistence of plants and animals threatened by climate change. In contrast, areas with >95% or "Non-Analog" exposure values are projected to be more stressed by climate change because that are at the edge or outside the range of what that vegetation type historically experienced. Predicting future climate exposure can help resource managers to adaptively manage for climate change.

One example of a Central Coast amphibian that is vulnerable to wildfire impacts is the federally threatened California red-legged frog which has been eliminated from 70 percent of its former range. It is now primarily found in the Central Coast region, living in coastal riparian habitat from Marin County to San Luis Obispo County. Photo credit: Anton Sorokin

Marin Municipal Water District does vegetation work across the watershed to increase resilience to wildfire and protect important water resources for its 190,000 customers. Photo credit: David Baron

Water Security

In addition to the ecological impacts that wildfire can have on aquatic habitat [see 'Biodiversity Conservation'], wildfire also threatens water security. Some of these impacts can persist long after the fire is extinguished and evacuated residents have returned home.

When fire burns vegetation cover and exposes bare soil, the landscape becomes more prone to runoff and erosion which transports ash, debris, and sediments into streams. This can affect community water supplies and also impact downstream ecosystems [see 'Biodiversity Conservation']. Some of the pollutants that are eroded or leached can be especially harmful to human health and aquatic organisms, including mercury, lead, and other metals that are released when structures and other artificial materials burn. Moderate and high severity wildfires can alter soil properties and make the soil less permeable for up to 2-4 years after being burned. This further increases runoff as well as the risk of flooding.

In some cases, wildfire removes the vegetation cover that stabilized steep slopes, which can increase the risk of debris flows - fast-moving landslides that generally occur after intense rain or rapid snowmelt. Risk of debris flows remains elevated for several years following fire, and areas with steep topography, including areas where the 2020 CZU Lightning Complex fire burned the Santa Cruz Mountains, may be especially susceptible. Extreme precipitation events, such as the recent atmospheric rivers that occurred in winter 2022-2023, are projected to intensify under climate change, making it more likely that damaging debris flows will impact this region in the future.

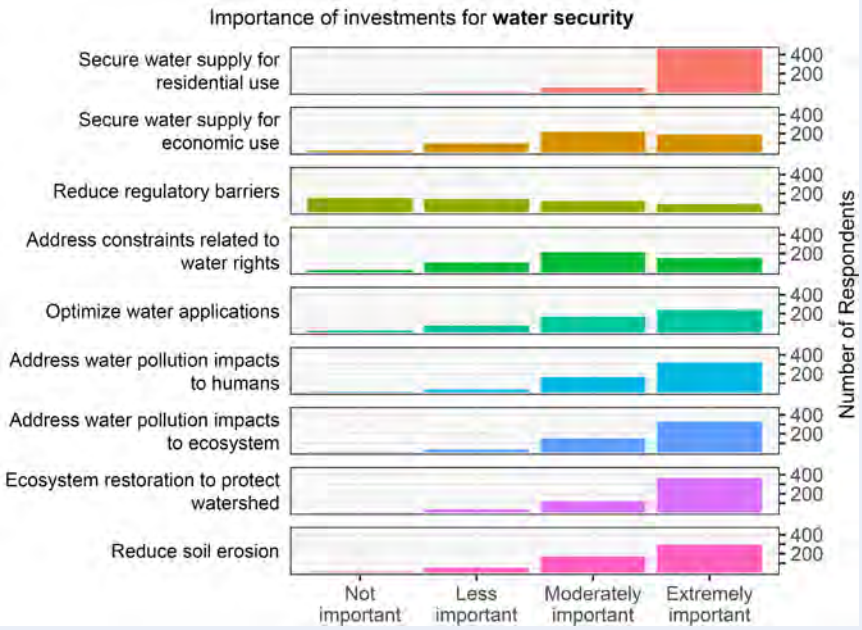
Fire can directly damage critical infrastructure, such as water treatment plants, facilities and reservoirs. When plumbing infrastructure burns or becomes depressurized, water distribution systems can become contaminated with dangerous volatile organic compounds, such as benzene. The August 2020 CZU Lightning Complex fire burned several miles of above-ground plastic distribution pipes, along with creek diversions, storage tanks, and other infrastructure. Afterward benzene and other volatile organic compounds were detected in parts of the water distribution system. Repairing infrastructure and ensuring safe water quality took weeks – and in some cases, months – to get drinking water back to impacted areas.

Central Coast water agencies and other organizations are taking proactive measures to mitigate wildfire risk and increase the resilience of community water resources. For example, the Marin Municipal Water District (Marin Water), which serves 190,000 customers and sources most of its water from local reservoirs, is managing vegetation throughout the watershed to reduce fuels in strategic locations and facilitate emergency response and suppression activities. Marin Water coordinates with the Marin County Fire Department to conduct prescribed burning to reduce the likelihood of future high severity fire and to promote ecological health. Marin Water is also a member of One Tam, a partnership of four public agencies and the nonprofit Golden Gate National Parks Conservancy that is collaborating to steward the Mt Tamalpais watershed. One Tam is an example of how water security can be pursued in tandem with other goals, such as forest health and public access to recreation, through landscape-level partnerships.

Stakeholder Input

Figure 14. Securing water supply for residential use was rated as the top priority for investing in regional water security. Ecosystem restoration to protected watersheds, and addressing water pollution impacts to both humans and ecosystems were also rated as highly important. Public survey respondents considered reducing regulatory barriers to be lower priority than other areas of investment.

Interview findings: Regional wildfire resilience projects are coordinating with other watershed management projects to promote water security. One interviewee described how following the 2020 CZU Lightning Complex Fire, there was a big effort to address potential runoff and water quality impacts from burned properties to community water and fish-bearing streams.



Current Conditions

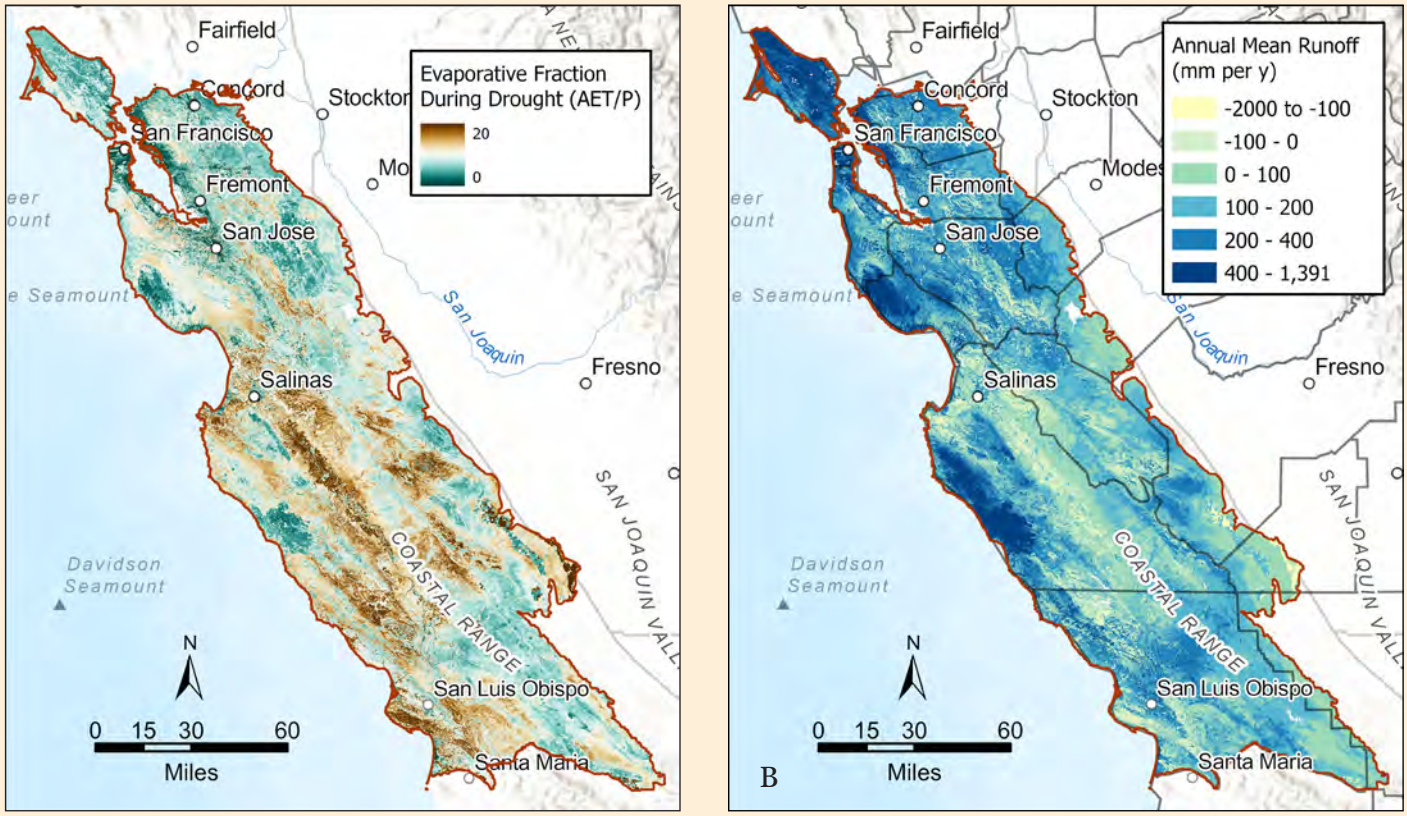


Figure 15. Water security can be assessed in terms of actual evapotranspiration/precipitation (AET Fraction) (A) and annual mean runoff (B). Actual evapotranspiration is the combined amount of water that evaporates from the land surface in addition to the water that is lost as vapor from plants. AET Fraction represents the percentage of water needed by plants that is met by precipitation during a severe 4-year drought. Values > 1 indicate moisture stress driven by shortfalls in precipitation relative to plant needs. Annual mean runoff is the surplus water discharged from a location in the form of surface or groundwater flows. This metric is important for water security because it estimates the amount of surplus water for downstream use. Vegetation management and disturbances like wildfire can affect runoff. For example, forest treatments that thin trees in moisture-stressed areas may increase runoff and provide more water availability downstream.

Smoke from wildfires burning in rural areas can extend far distances to impact larger, urban populations as shown here for the San Francisco Bay Area. Photo credit: US Forest Service

Air Quality

Wildfires can have public health impacts that extend far beyond the fire, impacting people and communities hundreds of miles away. Smoke from wildfires can expose people, livestock, crops and wildlife to hazardous air pollutants for weeks, as experienced by the Bay Area during the 2018 wildfire events. Inhalable fine particulate matter (PM2.5) and other pollutants in smoke can exacerbate a range of respiratory and cardiovascular issues and even cause premature death. Black carbon (soot) produced by wildfires may be especially unhealthy; in addition to cardiovascular and respiratory diseases, evidence has linked it to increased risk of cancer, and potentially, birth defects.

Smoke from fire that burns artificial materials, such as buildings and vehicles, can expose downwind populations to elevated levels of toxic metals, such as lead and copper. During the 2018 Camp Fire, which tragically killed 85 people and burned 14,000 residences in Northern California, lead concentrations in the air were observed to be more than 40 times higher than normal at the Point Reyes monitoring station, despite the station being 120 miles away from the fire. These far-reaching impacts may cause unexpected health risks, especially for vulnerable populations, such as children, that have lower tolerance for elevated toxin concentrations.

Recent California wildfires have motivated new research to assess the public impacts of wildfire smoke and how it might disproportionally affect vulnerable populations, such as outdoor workers. One study modeled current and future wildfire smoke emissions and quantified the potential exposure of California agricultural workers to predicted PM2.5 concentrations. They found that agricultural regions of the Central Coast, such as Monterey County, may be especially vulnerable to poor air quality under future climate conditions. There are some measures to protect workers from extremely hazardous conditions, such as requiring employers to provide personal protection equipment (e.g., N-95 respirators) or shifting work to less hazardous areas. However, as they currently stand, these regulations do not go into effect until high levels of pollution are reached, which means that outdoor workers may still be exposed to moderate levels of pollution for significant periods of time.

Indoor air quality is also impacted by wildfire smoke, which can also disproportionately affect disadvantaged communities. Older or poorly-maintained buildings may allow more outside smoke into the living spaces and may not have adequate filtration systems to reduce exposure to the inhabitants. There are at-home approaches that can effectively reduce indoor pollution, such as reducing ventilation (e.g., sealing windows) and filtering air. Air conditioning and associated filtration systems can significantly decrease indoor PM2.5 concentrations. However, many residents of the Central Coast region do not have air conditioning because the cooler coastal climate historically has not required it. Increasing access to public indoor clean air spaces, incentives to retrofit homes and

buildings that are poorly insulated, and personal protective equipment during smoke events may help to protect these vulnerable populations. Proactive work in natural and working lands that reduce wildfire extents, intensity, and duration will be a key element in reducing overall potential exposure into the future.

Prescribed fire has been proposed as a strategy for reducing the risk of uncontrolled and catastrophic wildfires that can inundate communities with wildfire smoke for weeks at a time. Fires that burn at lower intensity over smaller areas emit fewer pollutants than large, high-severity wildfires. Fires that only burn vegetation also do not release the hazardous chemical emissions of fires that burn structures and vehicles. Additionally, prescribed burn organizers and local air districts can collaborate to minimize air quality impacts by planning burns to occur during optimal weather conditions and limit the duration communities may be exposed to smoke. They can also provide advanced public notice of planned burns so that nearby residents can take precautions to reduce smoke exposure and work with public health officials to notify and protect more susceptible individuals. Continued research is needed to further understand the health impacts associated with prescribed fire smoke, especially near populated areas, and how managers can better address and mitigate these impacts in their management of these fires.

Stakeholder Input

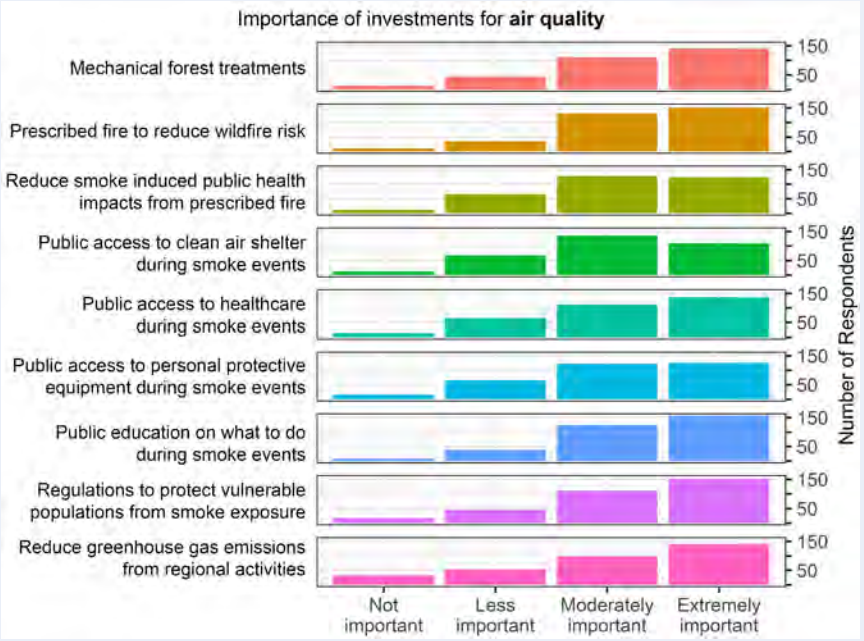


Figure 16. All potential actions for improving air quality received a mean rating of moderately important. Actions that ranked as slightly higher priorities were public education on what to do during smoke events and prescribed fire to reduce wildfire risk. These were closely followed by mechanical forest treatments to reduce wildfire and regulations to protect vulnerable populations from smoke exposure.

Interview findings: Many interviewees raised the topic of air quality as both a challenge for conducting fuel reduction treatments and as a goal for improving management approaches. Similar to other regions, there was a sense that prescribed burning can negatively impact air quality, but there was broad consensus from interviewees that these impacts were significantly less than the smoke impacts that would result from wildfire occurrence. Interviewees noted that communities that have experienced wildfire nearby tend to be more supportive of using prescribed fire for management. In many areas of the region, there is significant public resistance to prescribed burning and preference for prescribed grazing and mechanical treatments. Some groups are using equipment called carbonators to burn biomass from mechanical vegetation treatments on-site, instead of trucking it to distant locations. However, they found that air quality districts did not know how to regulate the new technology. At least one group was able to work with the local air quality board to assess that carbonators do not have significant negative impacts on air quality, resulting in permission to use it with fewer restrictions.

Elkhorn Slough Foundation is conducting a pilot project that uses a carbonator to process invasive eucalyptus wood and convert it into biochar as part of habitat restoration work at Elkhorn Highlands Reserve in Santa Cruz County.
Photo credit: Ken Collins, Elkhorn Slough Foundation

Carbon Storage

Managing natural and working lands to increase sequestration and storage of carbon is considered essential to California's efforts to achieve carbon neutrality. Forest and shrublands comprise approximately 85 percent of California carbon stocks. Wildfire threatens these carbon stocks because when vegetation burns, live pools of carbon can rapidly convert to less stable dead pools, and, as vegetation decays, stored carbon is released into the atmosphere. Regrowth sequesters carbons by turning it into new plant material and is critical to future carbon storage potential.

When ecosystems burn at greater frequency or higher severity over a larger area than they are adapted, carbon stocks become more vulnerable. For example, when seed banks are burned before they have sufficiently matured, vegetation might be unable to reestablish. Reforestation and other restoration efforts might be necessary to assist ecosystem recovery and promote continued carbon sequestration and carbon stability. High-intensity fires can also cause significant tree mortality. Coast redwood forests are generally adapted to fire [see 'Healthy and Resilient Forests'] and are notable for having the highest aboveground carbon density of any ecosystem on earth. When the 2020 Big Basin Fire burned old-growth redwood stands at higher severity than their historic fire regime, live carbon stocks that had been accumulating for centuries were threatened. Most of the ancient redwood trees appear to have survived, and many trees throughout the burned area are resprouting. However, post-fire regrowth of injured trees has been slower than expected, which reduces capacity to sequester carbon. Restoration efforts are monitoring regrowth and considering management actions that can make redwood forests more resilient to future fire and climate change.

Sequestering carbon in Central Coast grasslands may be increasingly important for California carbon goals because carbon in these systems is primarily stored underground in root biomass, making it less vulnerable to wildfire. Native perennial species may store more carbon than other grass species. Management actions such as adding compost have been found to increase soil carbon storage and plant growth, while also having a lower net greenhouse grass emissions than other waste management approaches (e.g., landfilling).

Applying biochar amendments can also add valuable nutrients and moisture retention to the soils of grasslands, stimulating growth to store more carbon. This is in addition to the storage benefits of biochar itself, which is created from plant waste materials and transfers that carbon into much longer term storage into the soils of the grasslands it is added to. Biochar is produced by heating plant biomass at high temperatures in a low oxygen environment to create a special form of charcoal. In addition to providing

a soil amendment, biochar also has other applications because of its ability to absorb chemical contaminants. The Elkhorn Slough Foundation in the Monterey Bay Area is currently piloting a project that uses a mobile kiln to convert removed eucalyptus tree logs into biochar as a way to sequester carbon from their habitat restoration projects. As part of the project, they are also testing the benefits of biochar for increasing the soil health of farmland and filtering agricultural wastewater. A recent study surveying California biochar producers found that the biggest barrier to biochar market success is capital investment for scaling up production, followed by market and demand. Providing producers with revenues from carbon offset credits, increasing awareness of the application potential of biochar, and improving production processes, were identified as key strategies for commercializing biochar.

Stakeholder Input

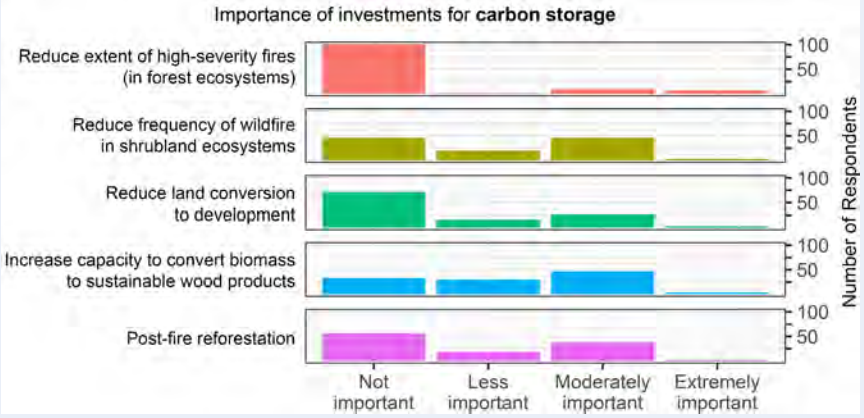


Figure 17. Survey respondents were asked how important potential areas of investment are for achieving large and stable carbon stores in their county or region. Although the mean response for 'Large and stable carbon stores' was still 'moderately important' when participants were asked to rate outcomes, survey respondents rated it as less of a priority than the other values (see Fig. 3). Respondents ranked the actions that might contribute to achieving large and stable carbon stores as being on average 'less important' or 'not important,' though a notable number of respondents did rate these actions as 'moderately important.'

Given that maintaining forest and shrubland carbon stocks are critical to achieving climate change mitigation goals, survey results suggest that investments in this social benefit may need to be driven at the state and regional rather than local levels. These results might also highlight a need for better public communication of how natural lands management for carbon storage and sequestration can be applied to reduce greenhouse gas emissions and mitigate climate change.

Interview findings: Interviewees highlighted that local agencies and land management partners are working on carbon planning and increasing carbon sequestration in soil. Many interviewees mentioned the challenge of dealing with plant biomass after vegetation has been treated. They have generally relied on chipping and pile burning because they would otherwise need to haul it far off-site for the plant waste to be used for power generation or composted. Several groups are exploring biochar production to help address this issue and reduce carbon emissions. Biochar is being produced by burning plant matter removed in vegetation treatments in carbonators. Using a carbonator produces fewer smoke emissions than pile burning, and by only partially burning the material to create biochar, some of the carbon pool is retained. There is some interest from farmers in using biochar, but there is no consensus on which crops can benefit from it. Interviewees also commented on the need to understand whether biochar applications are ecologically suitable at large landscape scales or what the unintended consequences might be.

Current Conditions

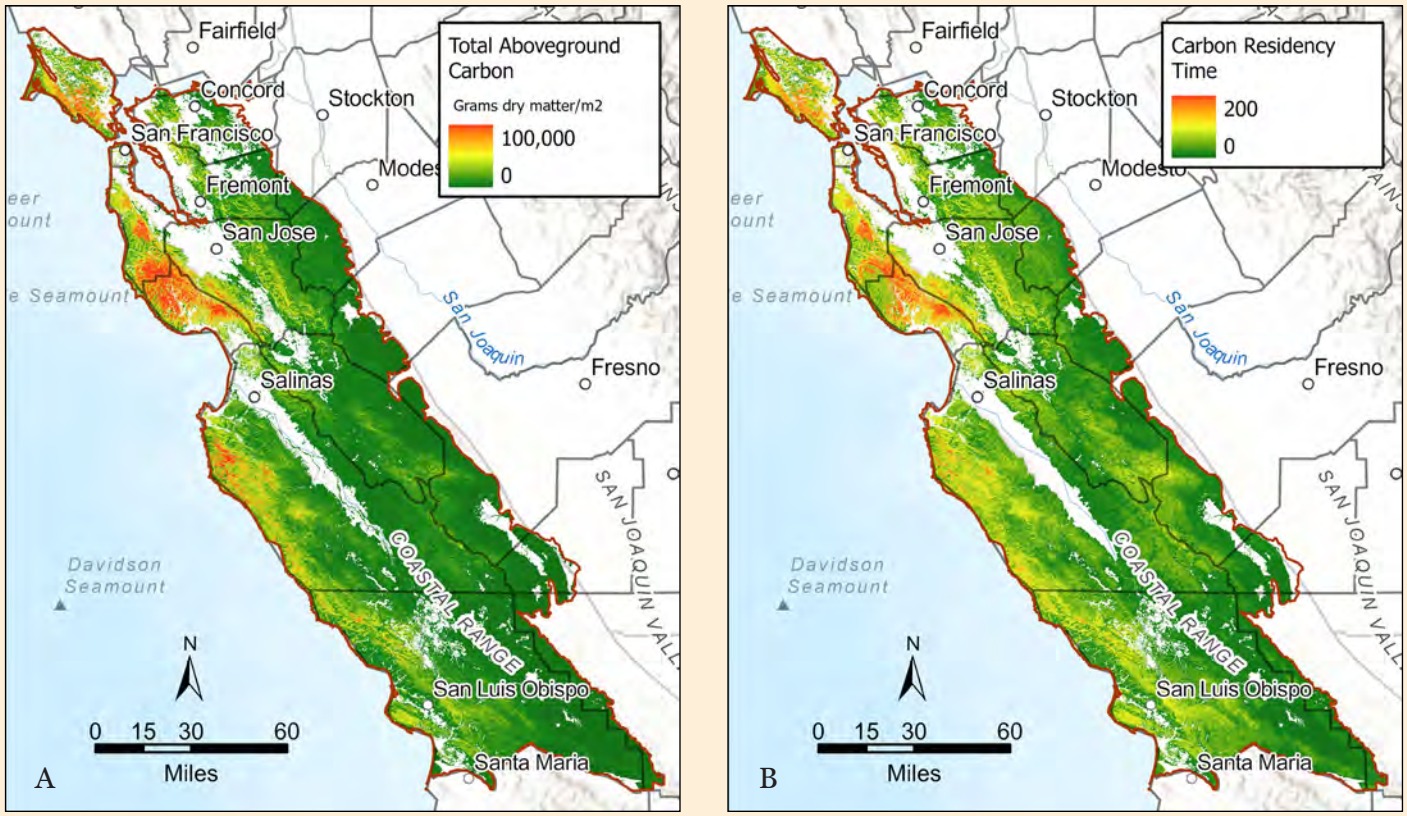


Figure 18. Carbon storage on the landscape can be assessed via total aboveground carbon (A) and carbon residency time (B). The total aboveground carbon is the amount of carbon present in all live and dead trees, shrubs, herbaceous vegetation, and dead material on the ground. Total aboveground carbon is important because preserving carbon stored in natural systems is generally desirable for management goals and, therefore, understanding the magnitude of carbon stored on a landscape may help inform the location and type of treatment activities. Carbon residency time is the average number of years both aboveground live and dead carbon persists. Locations with longer residency times have more stable carbon stores, often in large trees; areas with shorter residency times may have carbon stored in forms such as leaves. The presence of coast redwood forests and other large trees in Santa Cruz and Monterey is reflected in the large total carbon stores and over 200 year average residency time of these counties.

Economically-Robust Communities

Wildfires can have enormous economic impacts for individual homeowners, communities, and the state. The August 2020 CZU Lightning Complex fire, which burned over 86,000 acres and damaged 1,490 structures, provides a recent example of some of these costs. This incident alone cost $68 million in firefighting costs and $2.5 billion in estimated insured losses. In addition to razing more than 900 homes, the fire also critically damaged infrastructure, including roads, septic and storm drainage systems, water distribution systems and other essential public utilities.

Afterward, many residents could not afford to rebuild because permitting processes and complying with updated building codes were time-consuming and more expensive than the damage covered by insurance. Santa Cruz County waived many permitting fees for CZU fire survivors to facilitate recovery, but the average cost for permitting a 1500-square-foot home was still nearly $11,000. Over a year after the fire, less than 10% of property owners who had lost their homes had received permission to begin rebuilding. Many former community members left burned rural areas for the city or moved out of Santa Cruz County entirely. This has resulted in a loss of local businesses and critical workforce. Lack of available housing for workers has made it additionally hard for surviving businesses to recover.

The smoke impacts of wildfire can also have far-reaching impacts for key industries in the region, including agriculture and tourism, which are economically important and susceptible to wildfire.

Even if fields and rangelands are not burned, smoke can impact crops. For example, smoke can taint grapes that are on the vine and can result in total crop loss. The public health hazards of smoke can also make it unsafe for outdoor workers to perform time-sensitive agricultural work. Smoky conditions and road or business closures caused by wildfires can also deter tourists from visiting the region.

The costs of wildfire mitigation activities are also higher in the Central Coast region than many other areas. High costs of living in the San Francisco Bay Area and other cities of the Central Coast where affordable housing is limited require higher wages to sustain a workforce than less expensive areas. Fuel reduction work is also more expensive in areas where there is limited forest product processing capacity. The Central Coast region has less of a remaining timber industry than the Sierra Nevada and North Coast regions. A few timber companies persist in the Santa Cruz Mountains area, and Big Creek Lumber runs the only remaining redwood sawmill on the Central Coast. However, Big Creek Lumber has been strictly doing salvage logging since the CZU Lightning Complex fire, and it is not economical to process any wood besides redwood in the region. There is nowhere to take the Douglas fir wood that burned or biomass from other vegetation treatments.

Local and regional efforts are developing alternative solutions to deal with the biomass from fuel reduction work that will reduce the costs and public health impacts of these projects. For example, regional parks and open space districts are using technology such as carbonators and curtain burners to burn biomass on site with very little resulting smoke, rather than trucking it to faraway facilities. Growing the market for biochar production may provide an additional way to offset the costs of vegetation management treatments while simultaneously storing carbon back into soil [see 'Carbon Storage'].

Land managers are also considering ways to apply prescribed grazing for wildfire hazard reduction and ecological goals. Livestock grazing is not compatible with all habitats, and there are concerns that overgrazing has historically impacted native ecosystems. However, prescribed, or targeted, grazing entails using a specific type of livestock at a determined season, duration, and intensity to accomplish management goals. Researchers and land managers are working to understand how prescribed grazing can be strategically applied to achieve multiple co-benefits, such as restoring native habitat for biodiversity and reducing fuel loads. Expanding grazing operations for fuel reduction would require additional support for necessary infrastructure, like road maintenance, fencing, and water for the animals.

Stakeholder Input

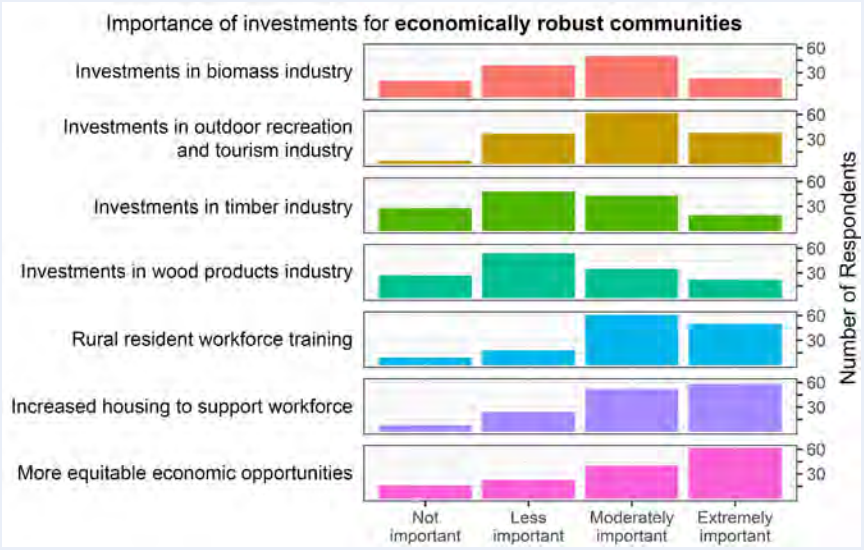


Figure 19. Stakeholders considered increased housing to support workforce, rural resident workforce training, and more equitable economic opportunities to be on average moderately important for achieving economically robust communities. Investments in timber industry and wood products industry were considered to be the least important of potential areas of investment.

Interview findings: Many interviewees described workforce retention and development as a key challenge for increasing wildfire resilience. There is limited skilled workforce for land management work because the high cost of living and lack of affordable housing on the Central Coast makes it hard to retain and attract people to work in the region when they could make the same salary somewhere less expensive. Interviewees noted that the costs of doing work in the Central Coast are also much higher than other parts of the state because of the lack of capacity to process removed biomass, including salvaged trees, and working close to the built environment increases project costs such as traffic control. Many organizations are using responsibly-managed grazing to promote native habitat restoration while reducing fuels, including in steep areas that mechanical treatments cannot access. However, it is difficult to fund conservation grazing and regional capacity is currently limited.

Current Conditions

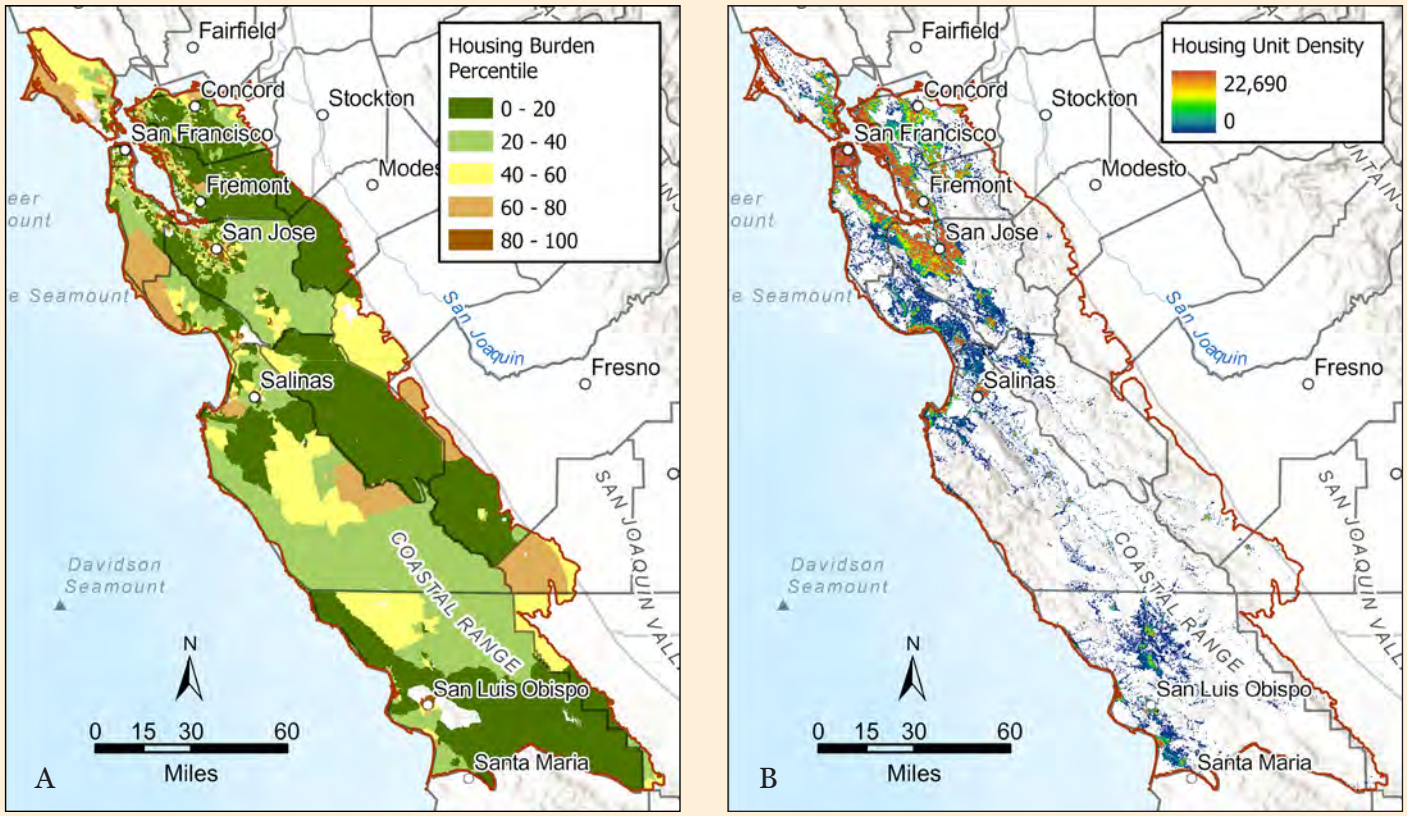


Figure 20. Housing burden (A) reflects the percent of households in a census tract that are both low income and pay greater than 50% of their income to housing costs. In the Central Coast region, 60 - 80% of households experience this burden in southern San Mateo County and western Santa Cruz County; 80-100% of households in the Oakland and San Jose areas experience this burden. Housing unit density (B) in this region is extremely concentrated in the Bay Area and in coastal cities such as Santa Cruz and Monterey. However, there are large swathes of the region with very low, or even nonexistent, housing. Together, these metrics illustrate a critical issue for the Central Coast region; lack of affordable housing is frequently identified as a major barrier to increasing and sustaining workforce development for wildfire resilience projects (see Stakeholder Input section).

Concluding Recommendations from Interviews

When interviewing experts who work on Central Coast land management related to wildfire resilience, we asked participants if they had recommendations for increasing community and ecological resilience to wildfire. In addition to the findings already shared pertaining to specific pillars of resilience, some key big picture themes emerged from interviews. We conclude by highlighting a few of those recommendations.

1) Increase public awareness of the need for proactive management to reduce wildfire hazard. Interviewees observed that there is a frequent misconception that the Central Coast region is not vulnerable to wildfire. While the region does not burn as frequently as other areas of California, these areas can occasionally burn really severely and with the potential to be very devastating to densely-populated communities. This means that actions that mitigate risk, such as vegetation management to reduce fuel loads and hardening buildings to reduce the risk of ignition, will be increasingly important for protecting communities and conserving the rich biological resources of the region.

2) Support reliable, longer-term funding to sustain work. Nearly half of interviewees flagged funding as a key issue, especially for more rural counties without a large tax base to fund public work. There is a need for capacity building funding to develop longer-lasting programs, as well as maintenance funding for implemented projects to be effective. Consistent and secure funding can enable organizations to be less reactive to grant cycles and instead develop longer-term strategies and partnerships.

3) Address regulatory barriers to increase the pace and scale of ecologically-beneficial management. Regulatory barriers were the most frequently cited challenge to increasing resilience. Some interviewees felt that regulatory processes, such as the California Environmental Quality Act and Coastal Act, that were designed to regulate large, environmentally harmful projects like highway development were too onerous for small restoration projects like prescribed burning. Interviewees advocated for streamlining regulatory processes so that more environmentally-beneficial work could be accomplished and pointed to the state's 'Cutting Green Tape' initiative as vital to these efforts.

4) Continue research to understand past, current, and future resilience of native ecosystems. There is still a lot that needs to be understood about natural disturbance regimes in this region which has been so formatively influenced by human activity from Indigenous stewardship to modern development. Emerging threats like climate change, novel pathogens, and exotic species are continuing to drive significant change, and it is not possible to set the clock back to historic conditions. Land managers and researchers must strive to understand what 'resilience' means for this region, and what actions should be prioritized to ensure that the multitude of ecosystem services that the Central Coast provides human and natural communities can persist.

PC: C. Andreozzi

List of Interview Participants

Stakeholder input was gathered during 32 individual, semi-structured interviews that focused on the key issues related to ecosystem and community resilience in the Central Coast region, and the barriers, possible solutions, and recommendations for addressing these issues. Interviewees have extensive knowledge of and experience in the ecological, social and cultural aspects of land management in the Central Coast region.

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David Cowman, Forest Ecologist, San Mateo Resource Conservation District

Anne Crealock, Planning and Program Manager, Marin Wildfire Prevention Authority

Dash Dunkell, Stewardship Director, Elkhorn Slough Foundation

Timothy Federal, Forest Health and Fire Resiliency Program Manager, San Mateo Resource Conservation District

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Tom Gandesbery, Project Lead, State Coastal Conservancy

Wes Gray, Natural Resource Manager, California State Parks

Grey Hayes, Education and Research Programs Manager, Swanton Pacific Ranch

Khari Helae, Assistant Fire Chief, East Bay Regional Parks

Karen Holl, Professor, University of California, Santa Cruz

Shaun Horne, Watershed Resources Manager, Marin Municipal Water District

Taj Katuna, Fire Stewardship Ecologist, Point Blue Conservation Science

Royce Larsen, Area Natural Resources Advisor, UC Cooperative Extension

Lisa Lurie, Executive Director, Santa Cruz Resource Conservation District

Janet McCrary Webb, President, Big Creek Lumber Co.

Cheryl Miller, Executive Director, Diablo Fire Safe Council

Joanna Nelson, Director of Science and Conservation Planning, Save the Redwoods League

Edgar Orre, Unit Forester - Division Chief, CAL FIRE

Devii Rao, Livestock and Natural Resources Advisor, UC Cooperative Extension

Barb Satink Wolfson, Fire Advisor, UC Cooperative Extension

Coty Sifuentes-Winter, Senior Resource Management Specialist, Midpeninsula Region Open Space Authority

Mary Small, Deputy Executive Officer, State Coastal Conservancy

Jamie Tuitele-Lewis, Fire Fuel Mitigation Program and Forest Health Coordinator, Monterey Resource Conservation District

Kostoula Vallianos, Grant and Project Manager, State Coastal Conservancy

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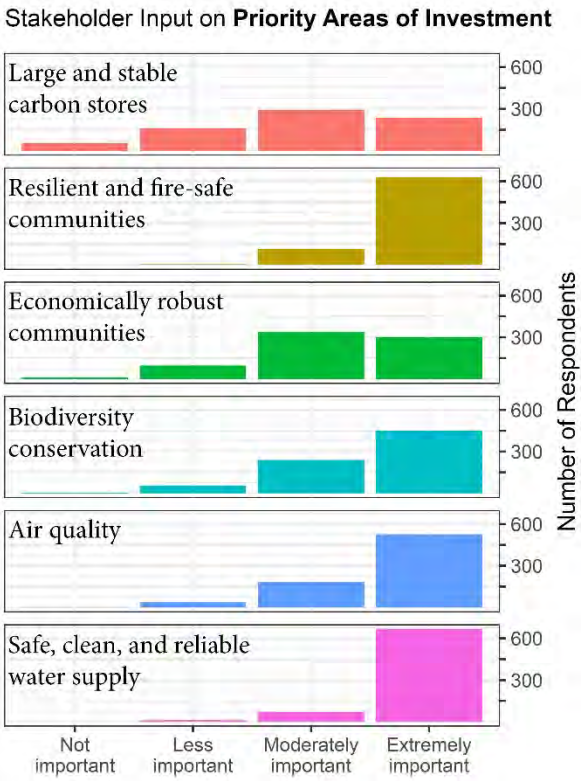
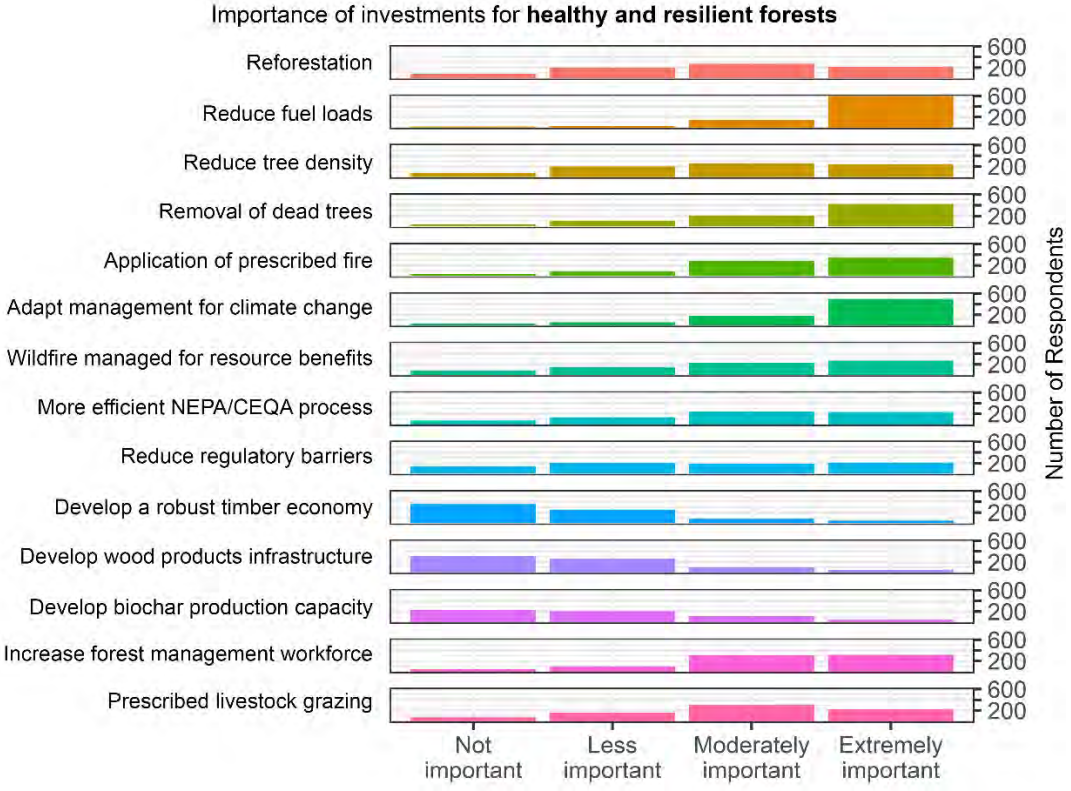
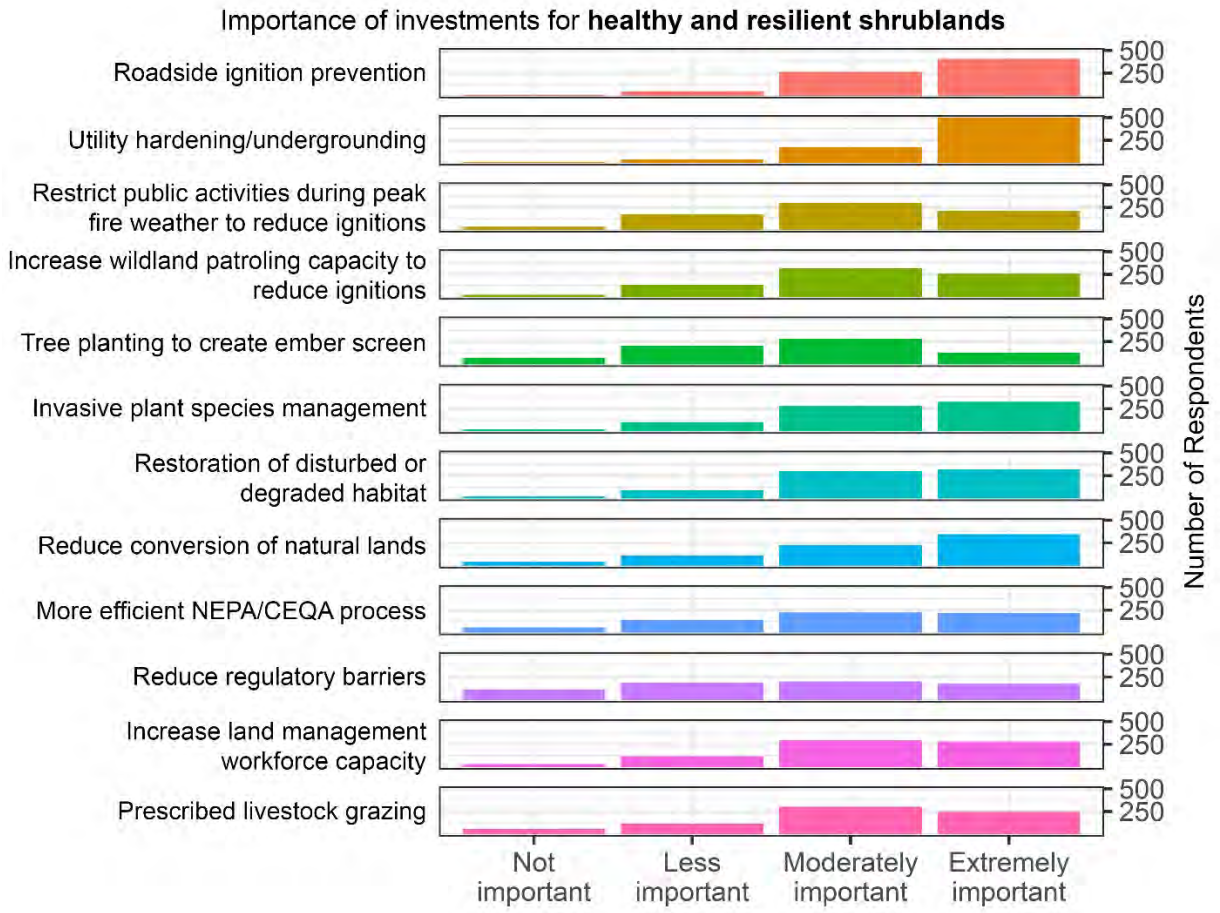
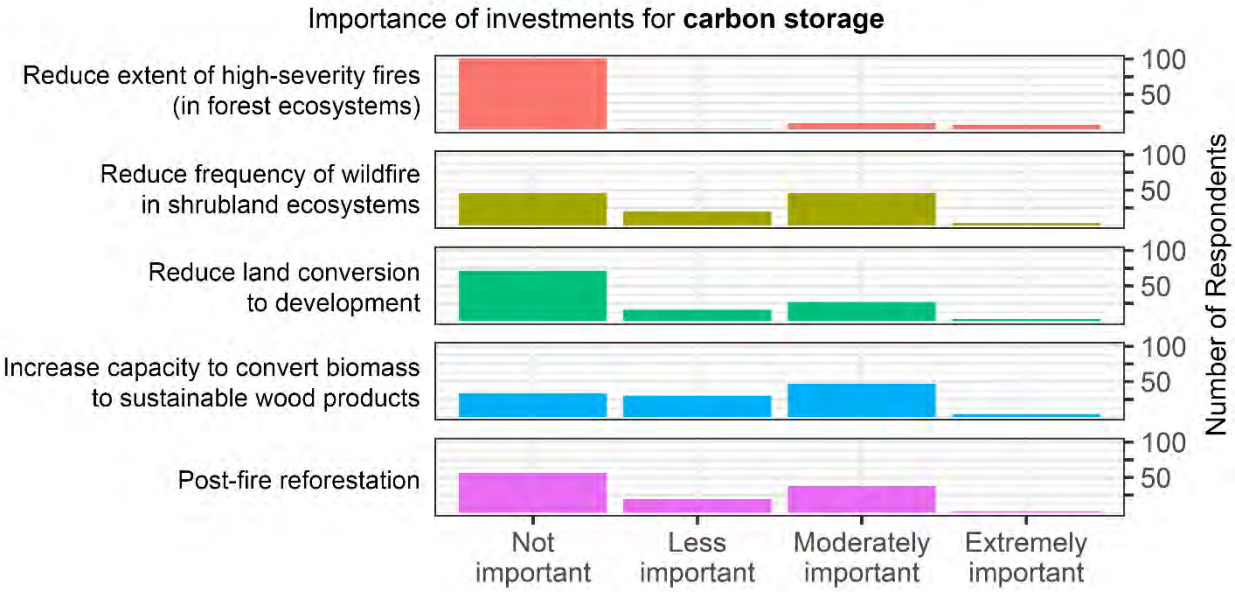
Central Coast Survey Results:

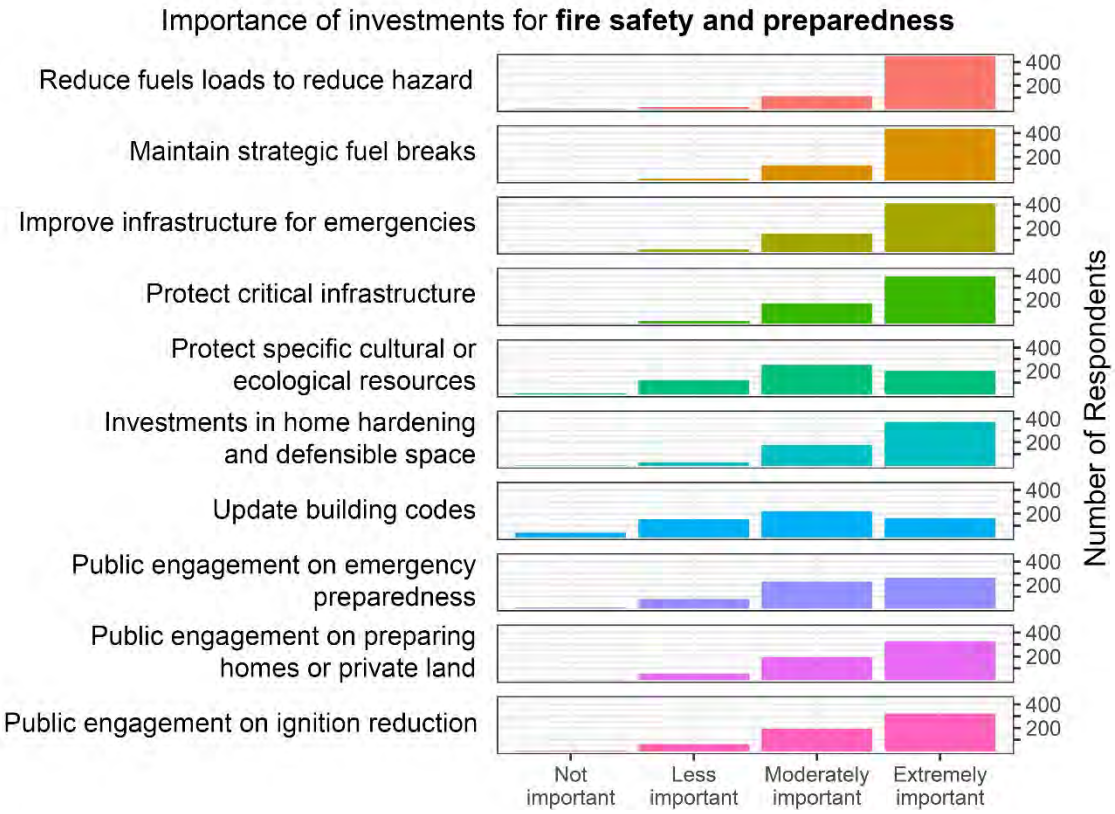
All Respondents

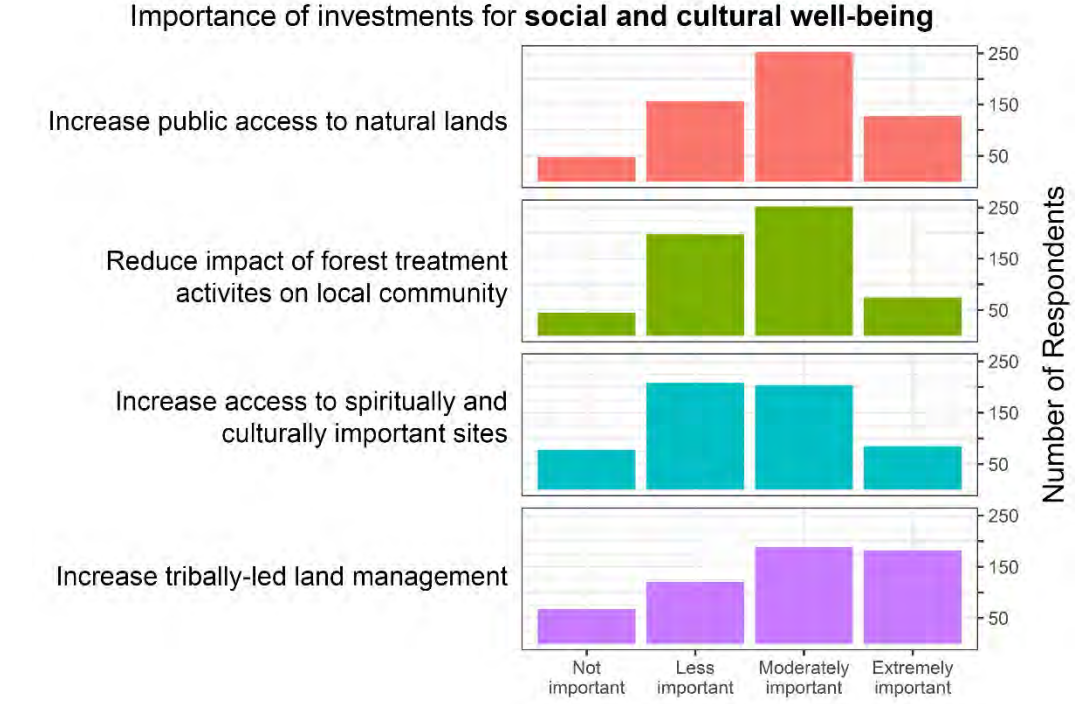


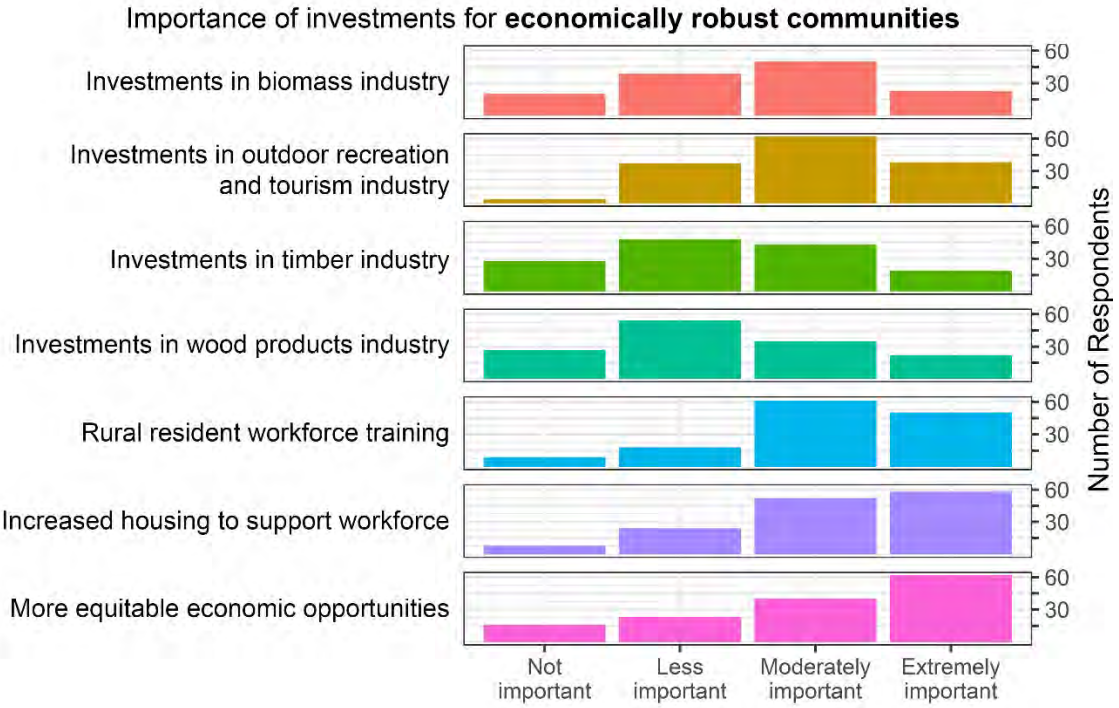


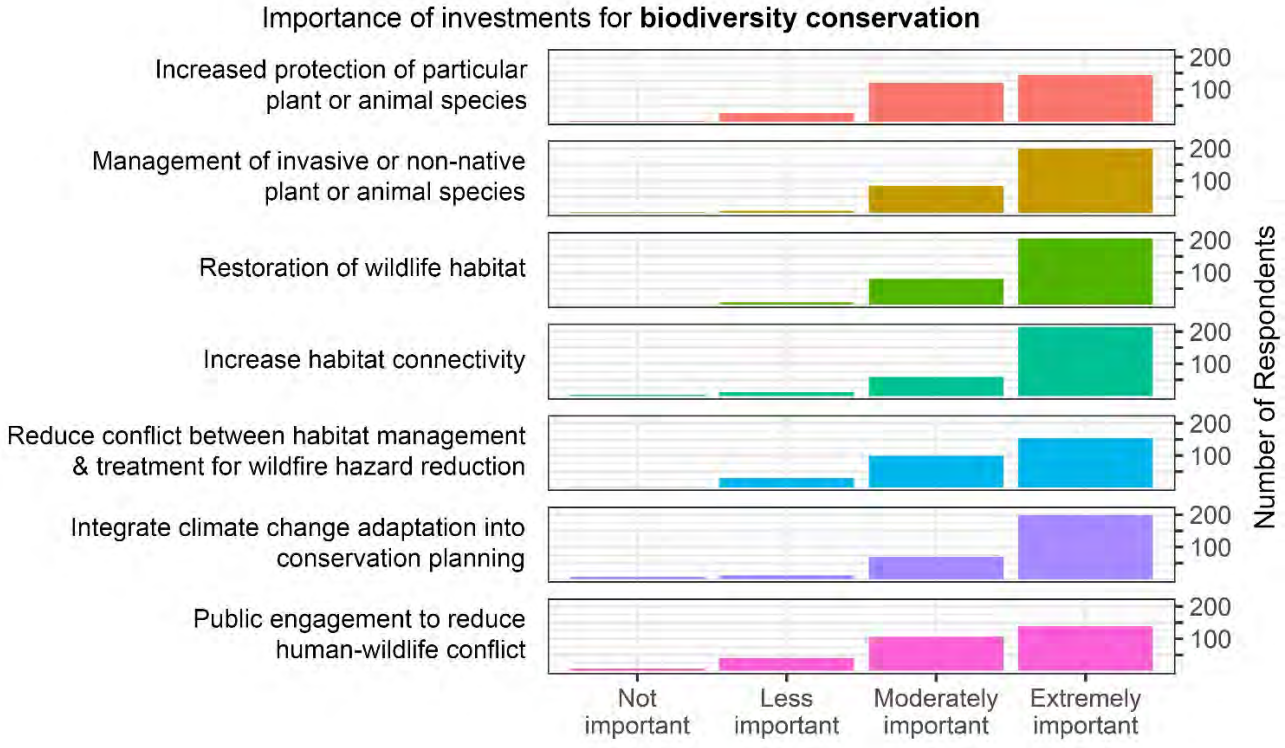

Importance of investments for **healthy and resilient shrublands**
Roadside ignition prevention
Utility hardening/undergrounding
Restrict public activities during peak fire weather to reduce ignitions
Increase wildland patroling capacity to reduce ignitions
Tree planting to create ember screen
Invasive plant species management
Restoration of disturbed or degraded habitat
Reduce conversion of natural lands
More efficient NEPA/CEQA process
Reduce regulatory barriers
Increase land management workforce capacity
Prescribed livestock grazing
500
250
Number of Respondents
Not important
Less important
Moderately important
Extremely important

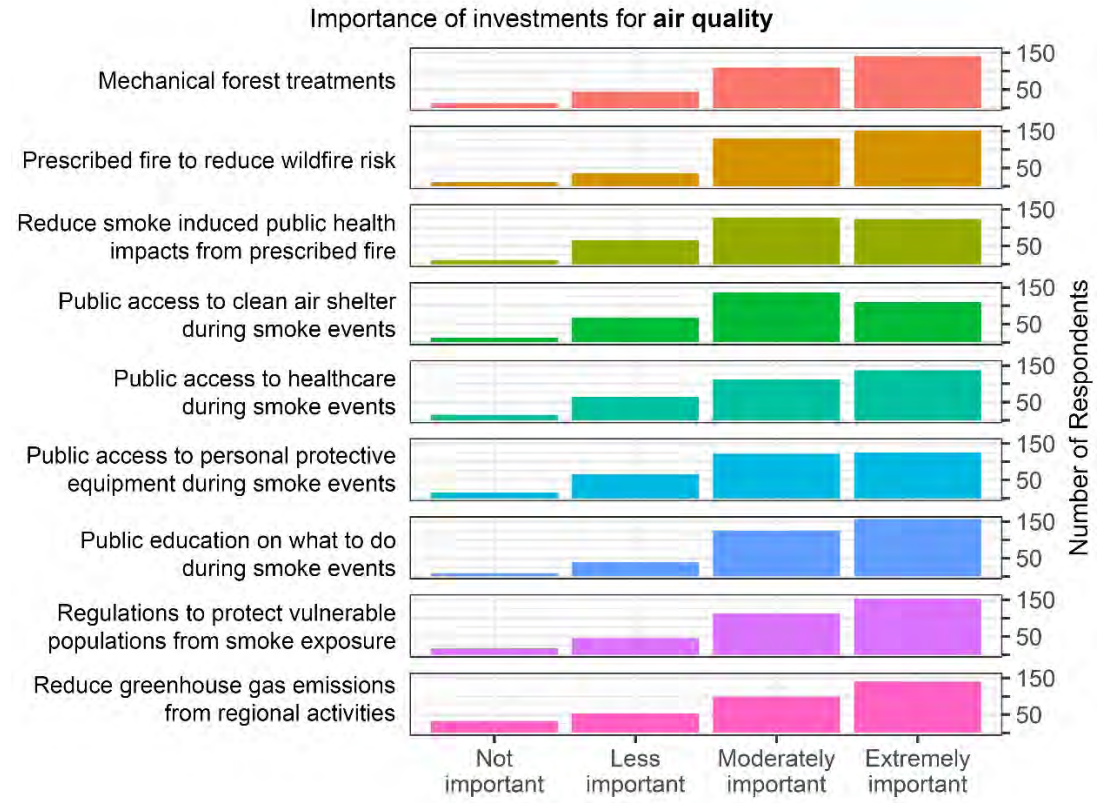

Importance of investments for **carbon storage**
Reduce extent of high-severity fires (in forest ecosystems)
Reduce frequency of wildfire in shrubland ecosystems
Reduce land conversion to development
Increase capacity to convert biomass to sustainable wood products
Post-fire reforestation
100
50
Number of Respondents
Not important
Less important
Moderately important
Extremely important

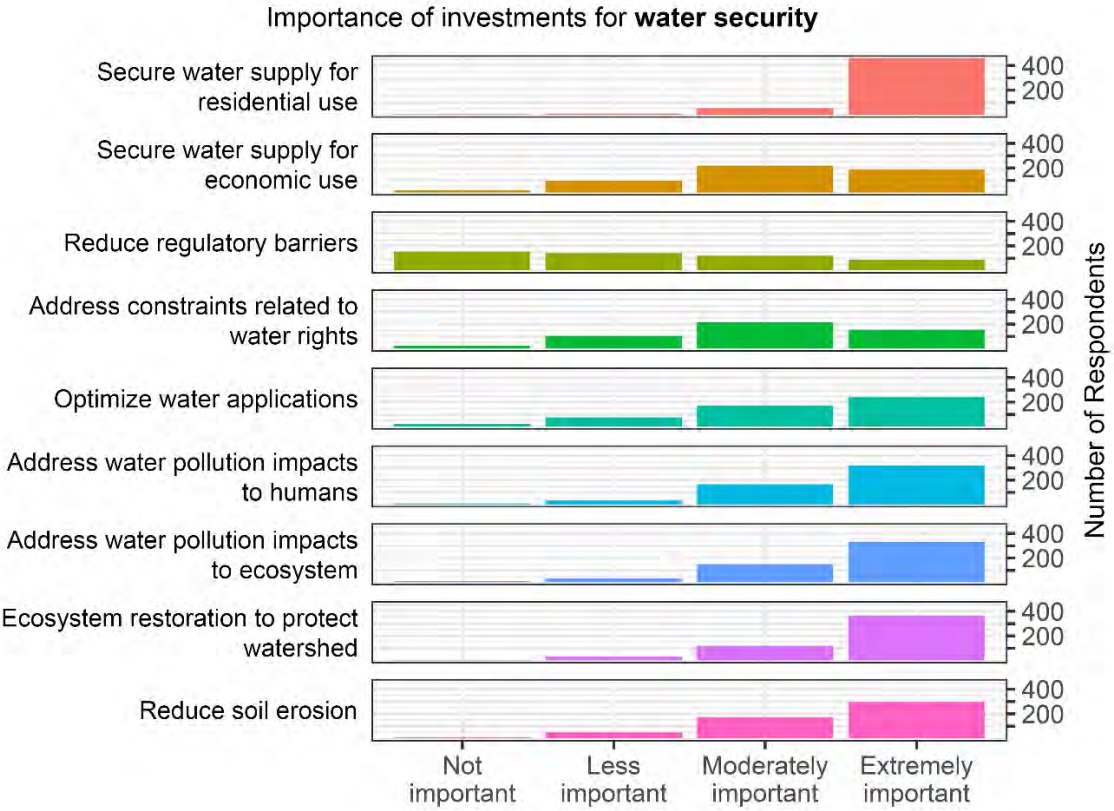

Importance of investments for **fire safety and preparedness**
Reduce fuels loads to reduce hazard
Maintain strategic fuel breaks
Improve infrastructure for emergencies
Protect critical infrastructure
Protect specific cultural or ecological resources
Investments in home hardening and defensible space
Update building codes
Public engagement on emergency preparedness
Public engagement on preparing homes or private land
Public engagement on ignition reduction
400
200
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **social and cultural well-being**
Increase public access to natural lands
Reduce impact of forest treatment activites on local community
Increase access to spiritually and culturally important sites
Increase tribally-led land management
250
150
50
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **economically robust communities**
Investments in biomass industry
Investments in outdoor recreation and tourism industry
Investments in timber industry
Investments in wood products industry
Rural resident workforce training
Increased housing to support workforce
More equitable economic opportunities
60
30
Number of Respondents
Not important
Less important
Moderately important
Extremely important

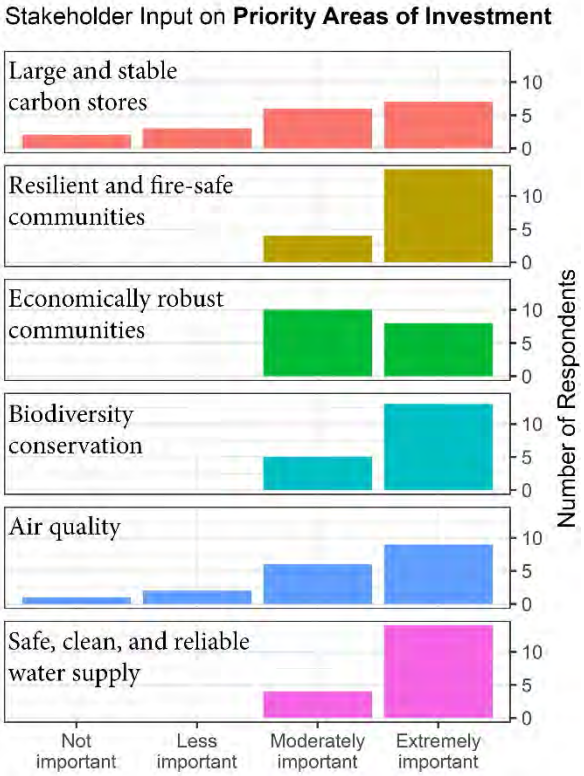

Importance of investments for **biodiversity conservation**
Increased protection of particular plant or animal species
Management of invasive or non-native plant or animal species
Restoration of wildlife habitat
Increase habitat connectivity
Reduce conflict between habitat management & treatment for wildfire hazard reduction
Integrate climate change adaptation into conservation planning
Public engagement to reduce human-wildlife conflict
200
100
Number of Respondents
Not important
Less important
Moderately important
Extremely important

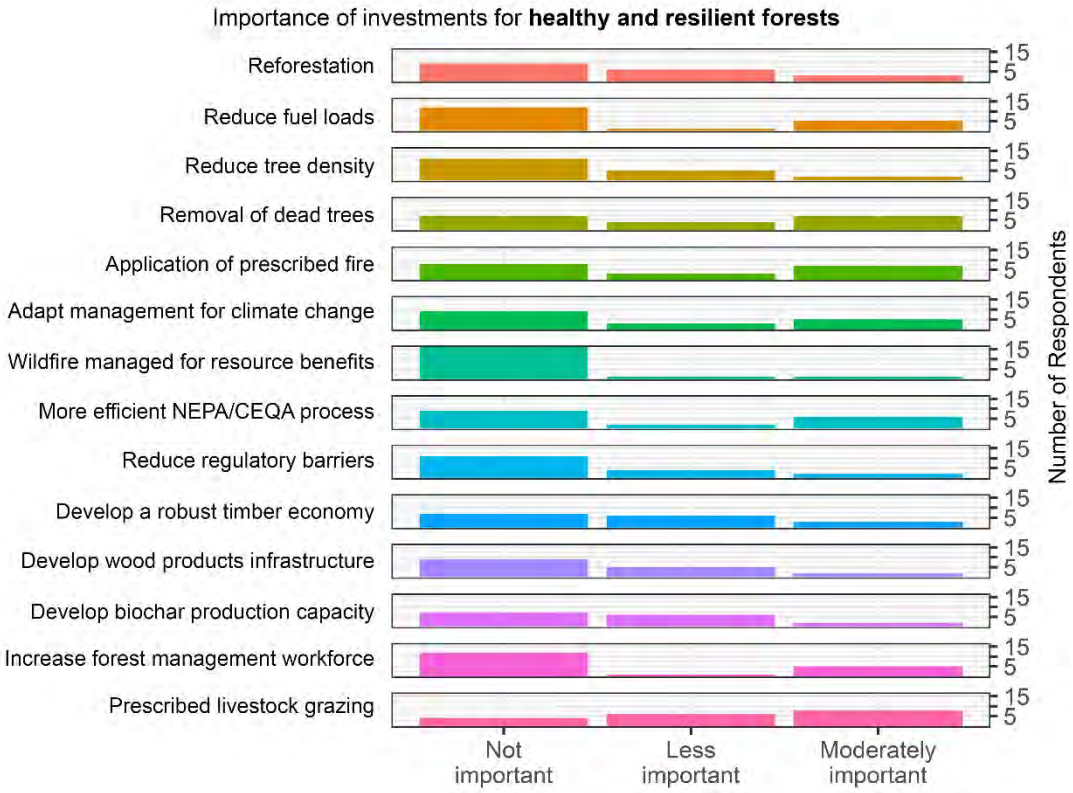

Importance of investments for **air quality**
Mechanical forest treatments
Prescribed fire to reduce wildfire risk
Reduce smoke induced public health impacts from prescribed fire
Public access to clean air shelter during smoke events
Public access to healthcare during smoke events
Public access to personal protective equipment during smoke events
Public education on what to do during smoke events
Regulations to protect vulnerable populations from smoke exposure
Reduce greenhouse gas emissions from regional activities
150
50
Number of Respondents
Not important
Less important
Moderately important
Extremely important

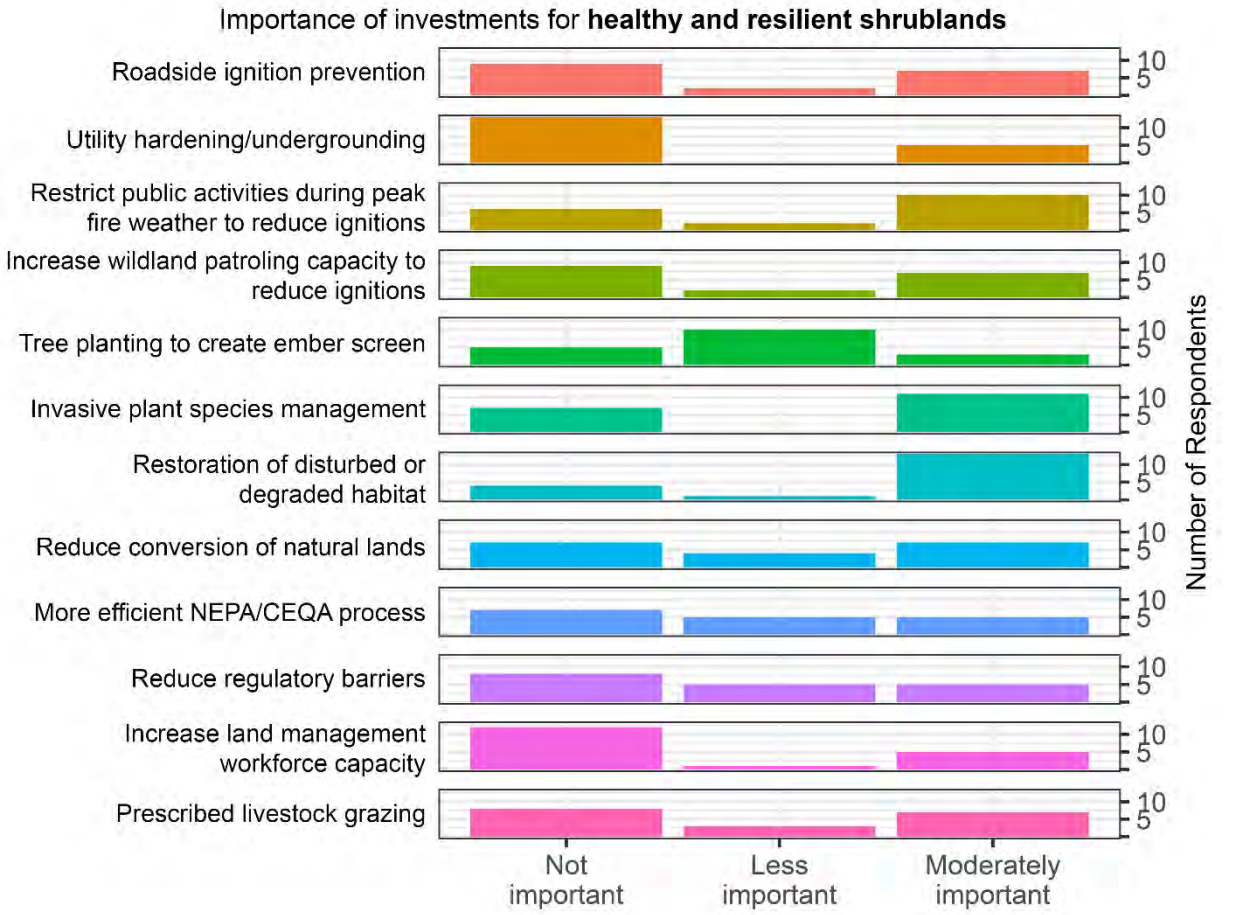

Importance of investments for **water security**
Secure water supply for residential use
Secure water supply for economic use
Reduce regulatory barriers
Address constraints related to water rights
Optimize water applications
Address water pollution impacts to humans
Address water pollution impacts to ecosystem
Ecosystem restoration to protect watershed
Reduce soil erosion
400
200
Number of Respondents
Not important
Less important
Moderately important
Extremely important

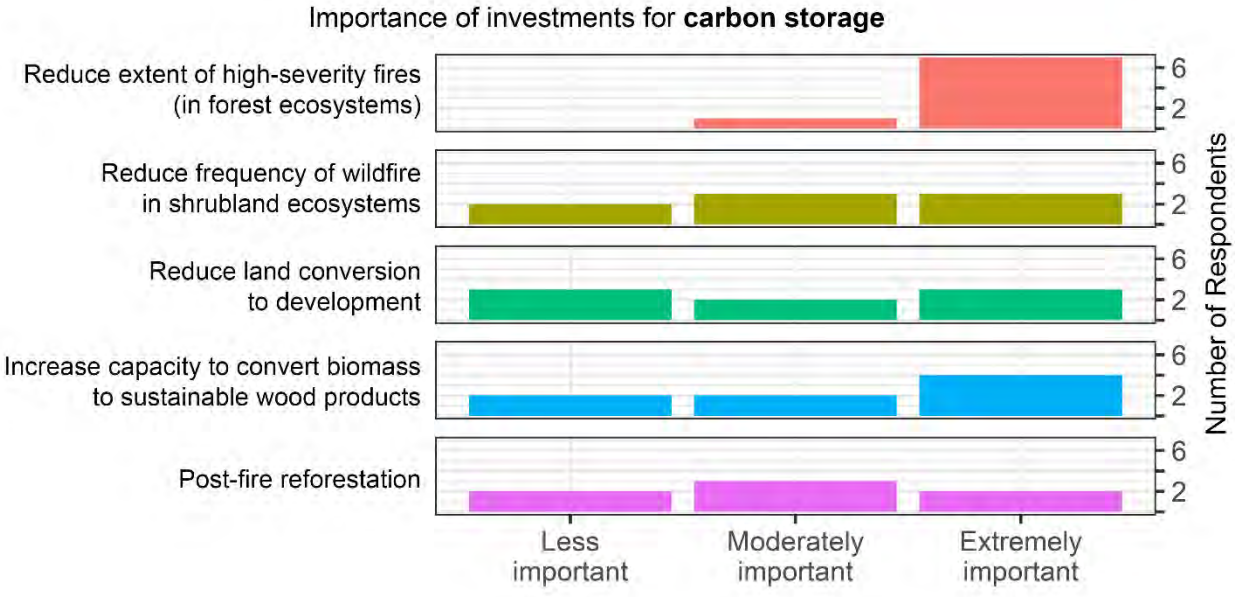
Central Coast Survey Results:

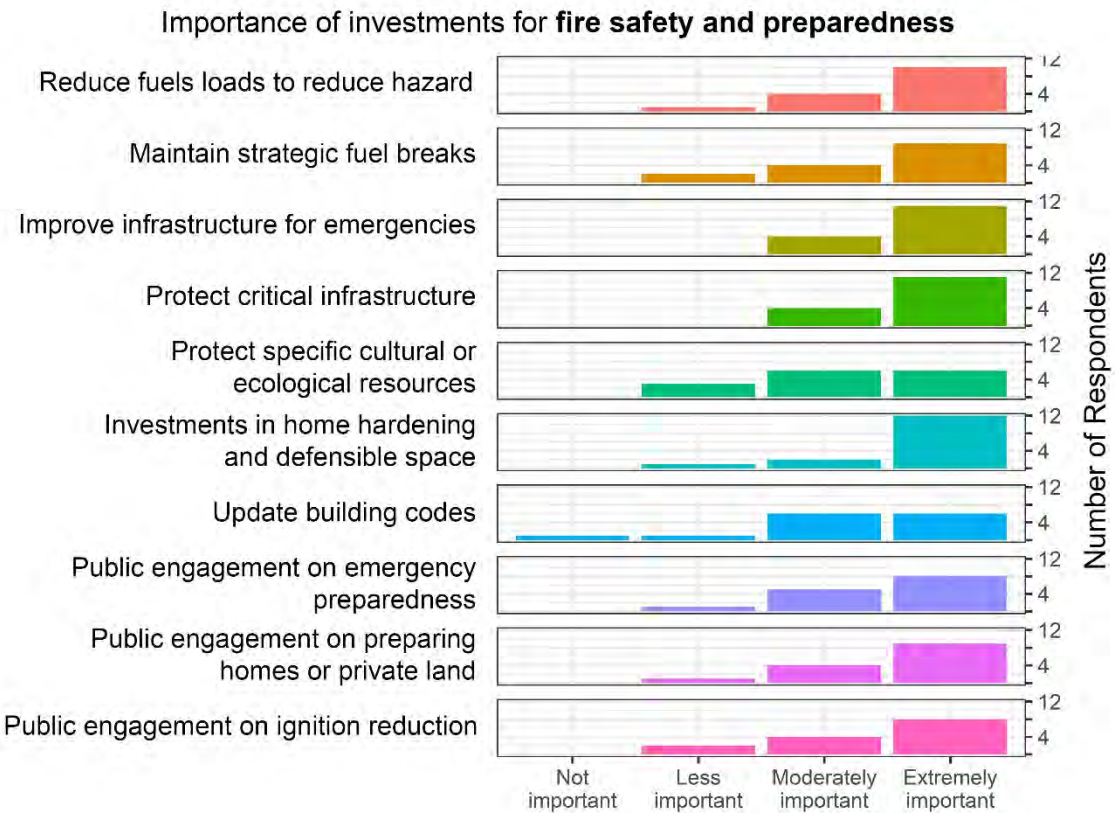
Entire Region

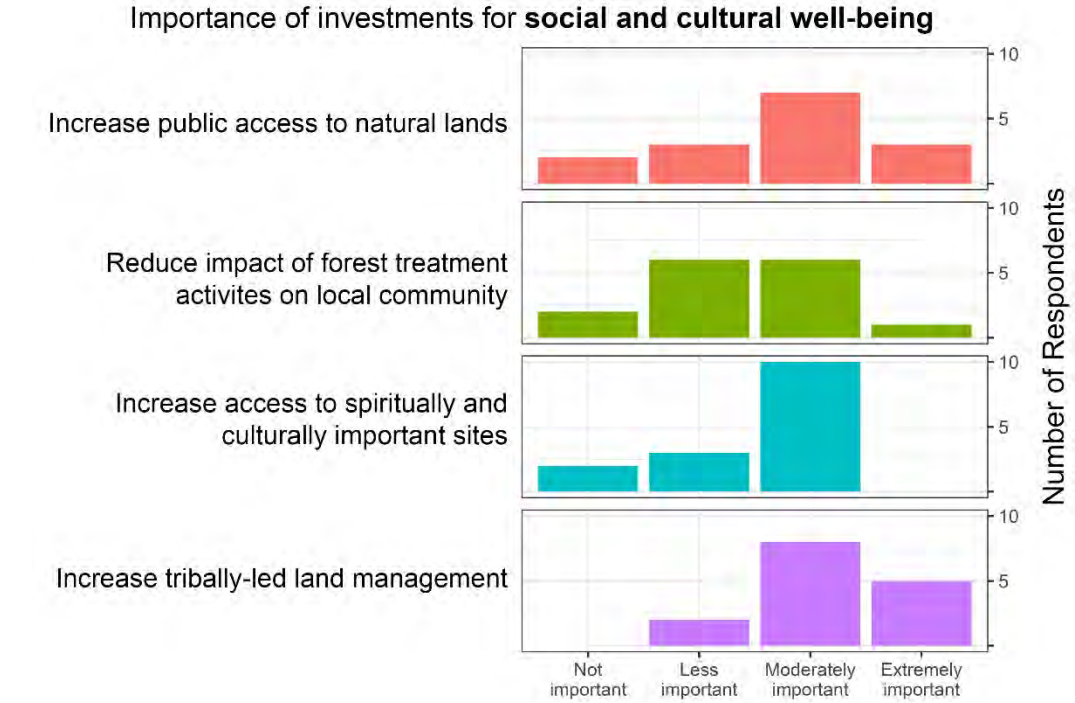


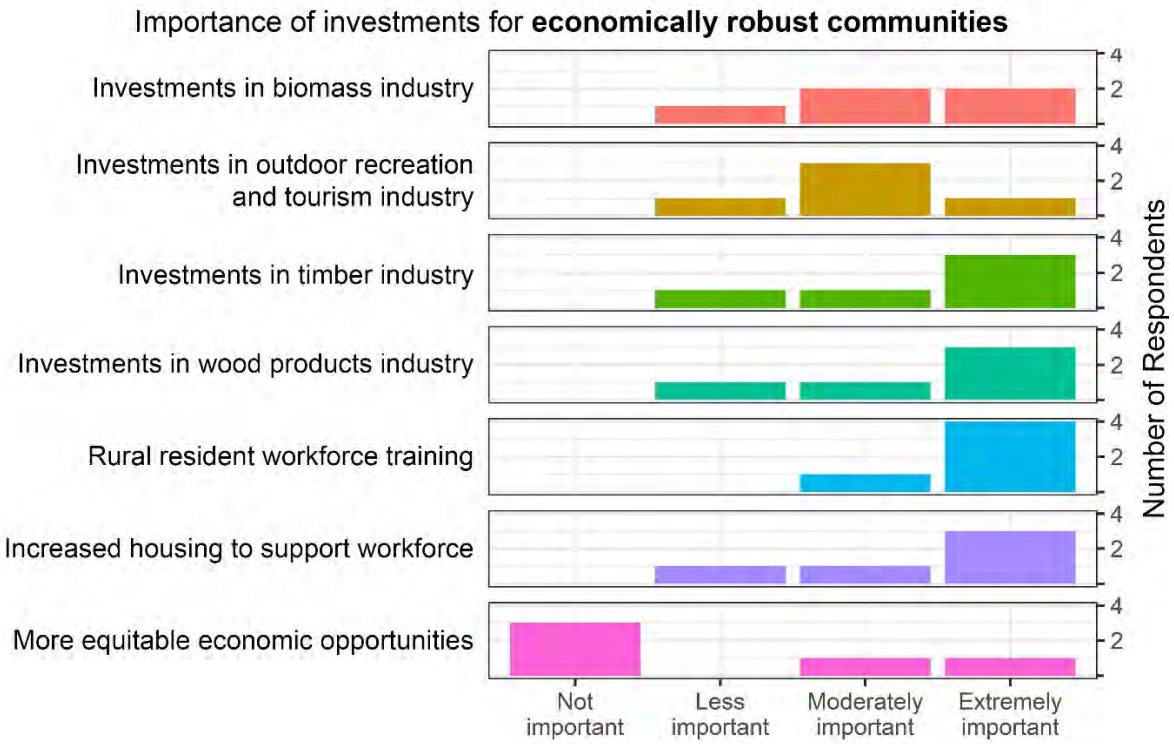


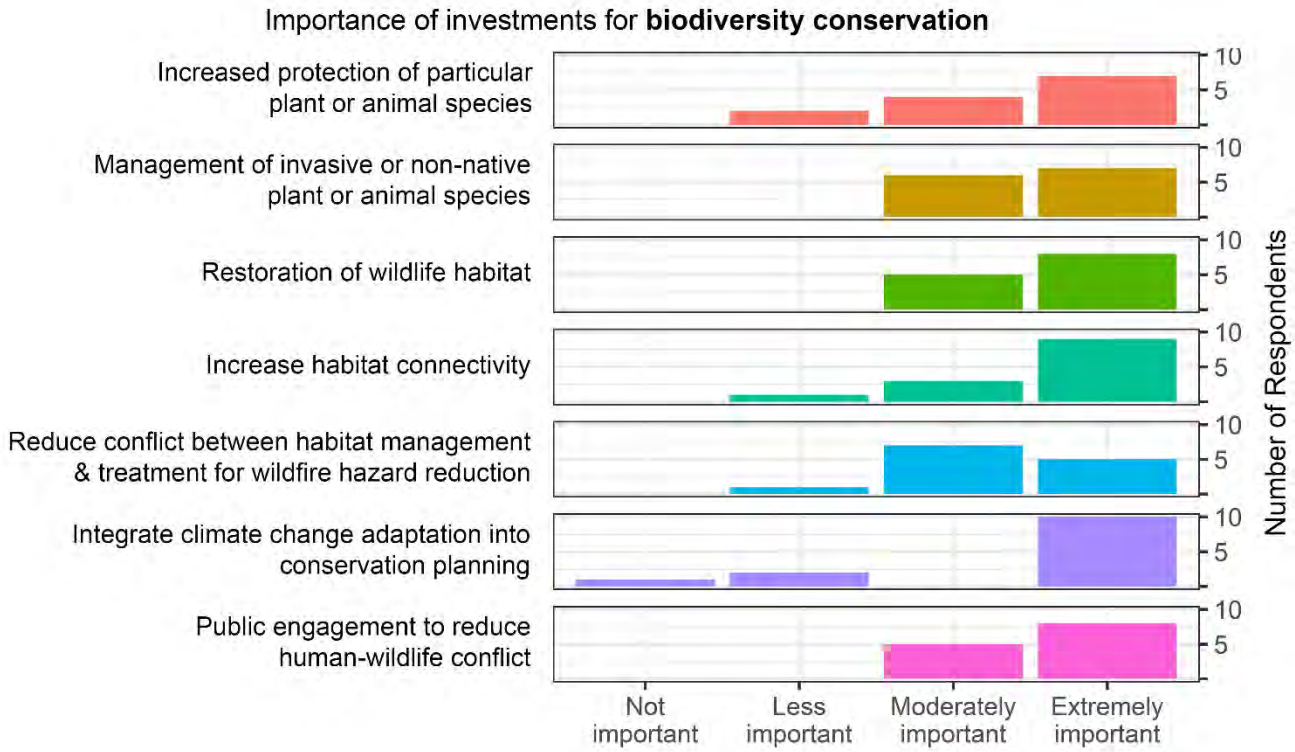

Importance of investments for **healthy and resilient shrublands**
Roadside ignition prevention
Utility hardening/undergrounding
Restrict public activities during peak fire weather to reduce ignitions
Increase wildland patroling capacity to reduce ignitions
Tree planting to create ember screen
Invasive plant species management
Restoration of disturbed or degraded habitat
Reduce conversion of natural lands
More efficient NEPA/CEQA process
Reduce regulatory barriers
Increase land management workforce capacity
Prescribed livestock grazing
10
5
Number of Respondents
Not important
Less important
Moderately important

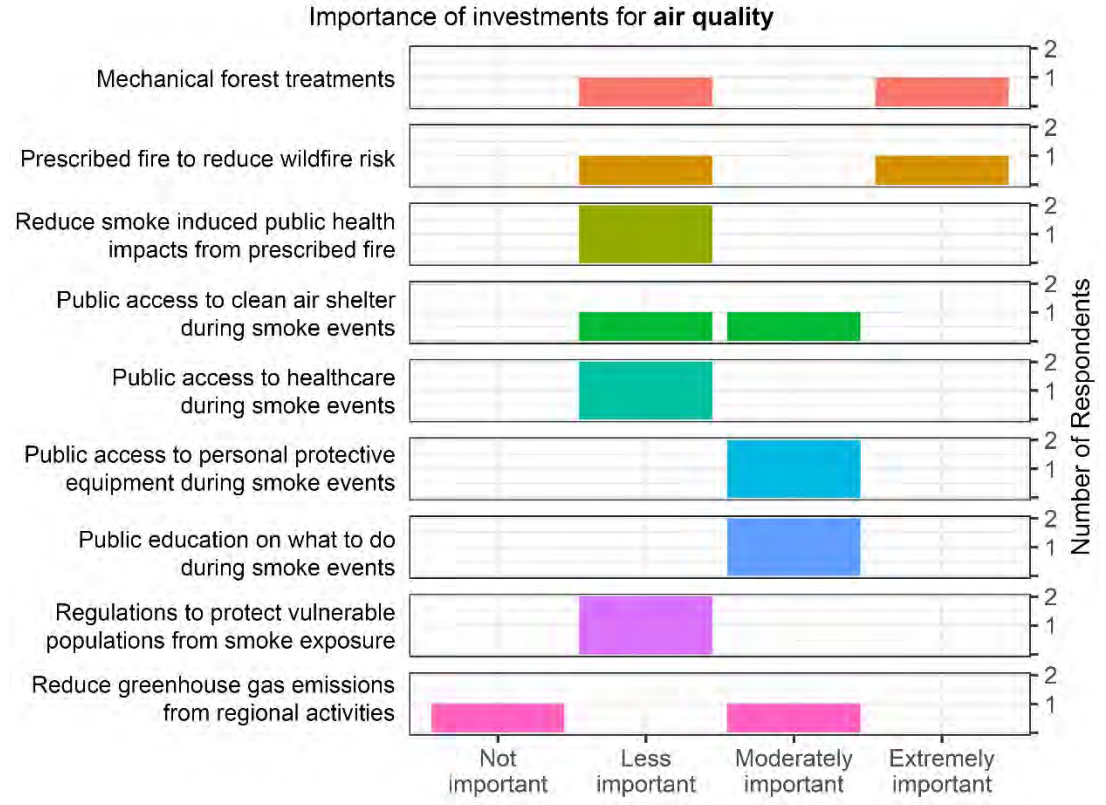

Importance of investments for **carbon storage**
Reduce extent of high-severity fires (in forest ecosystems)
Reduce frequency of wildfire in shrubland ecosystems
Reduce land conversion to development
Increase capacity to convert biomass to sustainable wood products
Post-fire reforestation
6
2
Number of Respondents
Less important
Moderately important
Extremely important

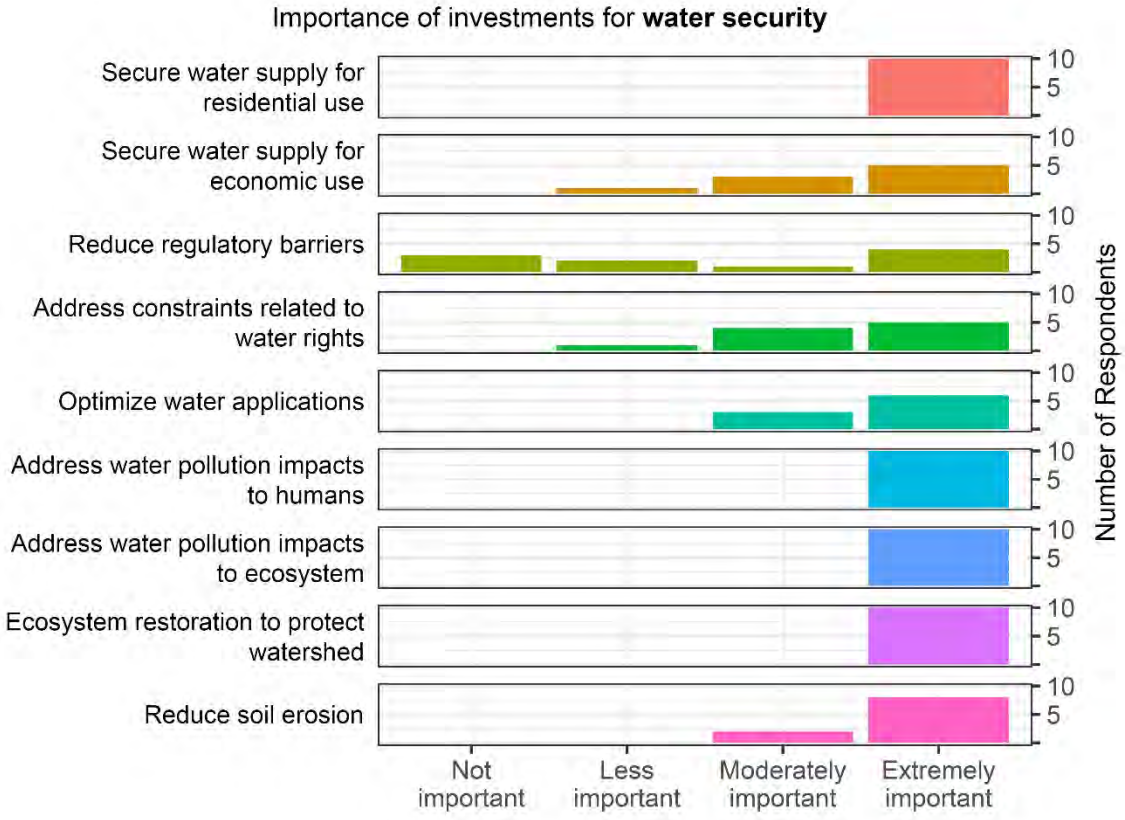

Importance of investments for **fire safety and preparedness**
Reduce fuels loads to reduce hazard
Maintain strategic fuel breaks
Improve infrastructure for emergencies
Protect critical infrastructure
Protect specific cultural or ecological resources
Investments in home hardening and defensible space
Update building codes
Public engagement on emergency preparedness
Public engagement on preparing homes or private land
Public engagement on ignition reduction
12
4
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **social and cultural well-being**
Increase public access to natural lands
Reduce impact of forest treatment activites on local community
Increase access to spiritually and culturally important sites
Increase tribally-led land management
10
5
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **economically robust communities**
Investments in biomass industry
Investments in outdoor recreation and tourism industry
Investments in timber industry
Investments in wood products industry
Rural resident workforce training
Increased housing to support workforce
More equitable economic opportunities
Number of Respondents
Not important
Less important
Moderately important
Extremely important

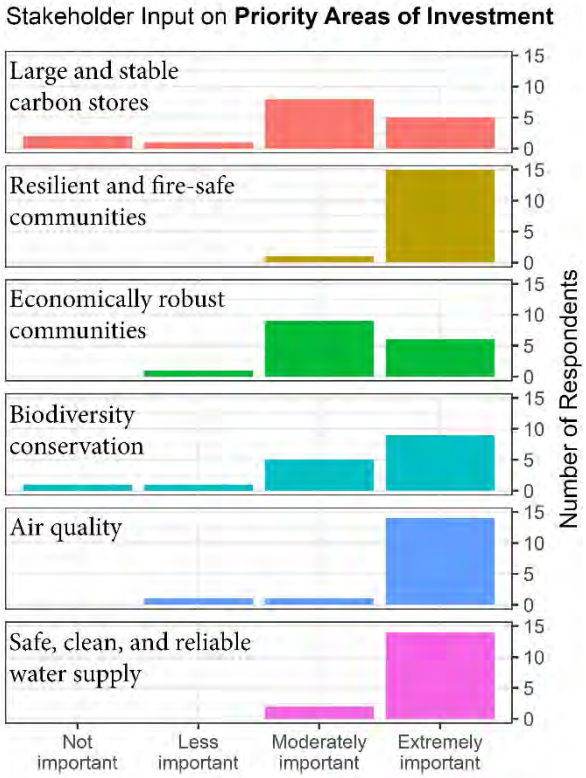

Importance of investments for **biodiversity conservation**
Increased protection of particular plant or animal species
Management of invasive or non-native plant or animal species
Restoration of wildlife habitat
Increase habitat connectivity
Reduce conflict between habitat management & treatment for wildfire hazard reduction
Integrate climate change adaptation into conservation planning
Public engagement to reduce human-wildlife conflict
Number of Respondents
Not important
Less important
Moderately important
Extremely important

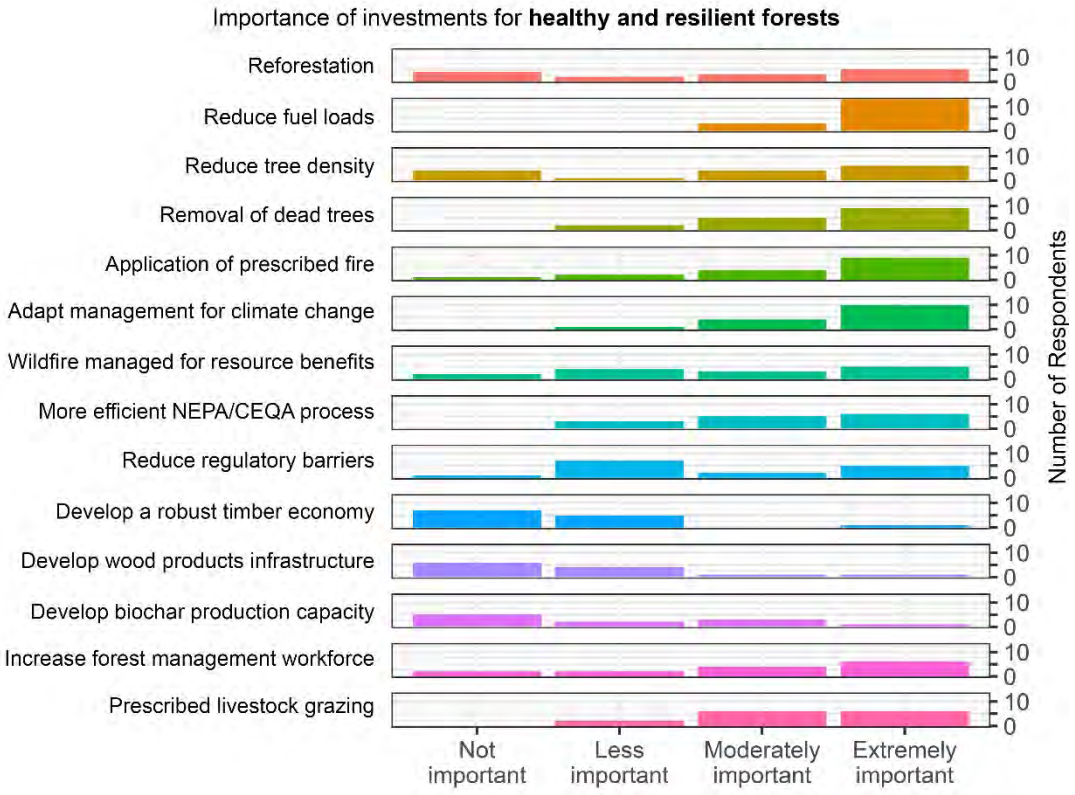

Importance of investments for **air quality**
Mechanical forest treatments
Prescribed fire to reduce wildfire risk
Reduce smoke induced public health impacts from prescribed fire
Public access to clean air shelter during smoke events
Public access to healthcare during smoke events
Public access to personal protective equipment during smoke events
Public education on what to do during smoke events
Regulations to protect vulnerable populations from smoke exposure
Reduce greenhouse gas emissions from regional activities
2
1
Number of Respondents
Not important
Less important
Moderately important
Extremely important

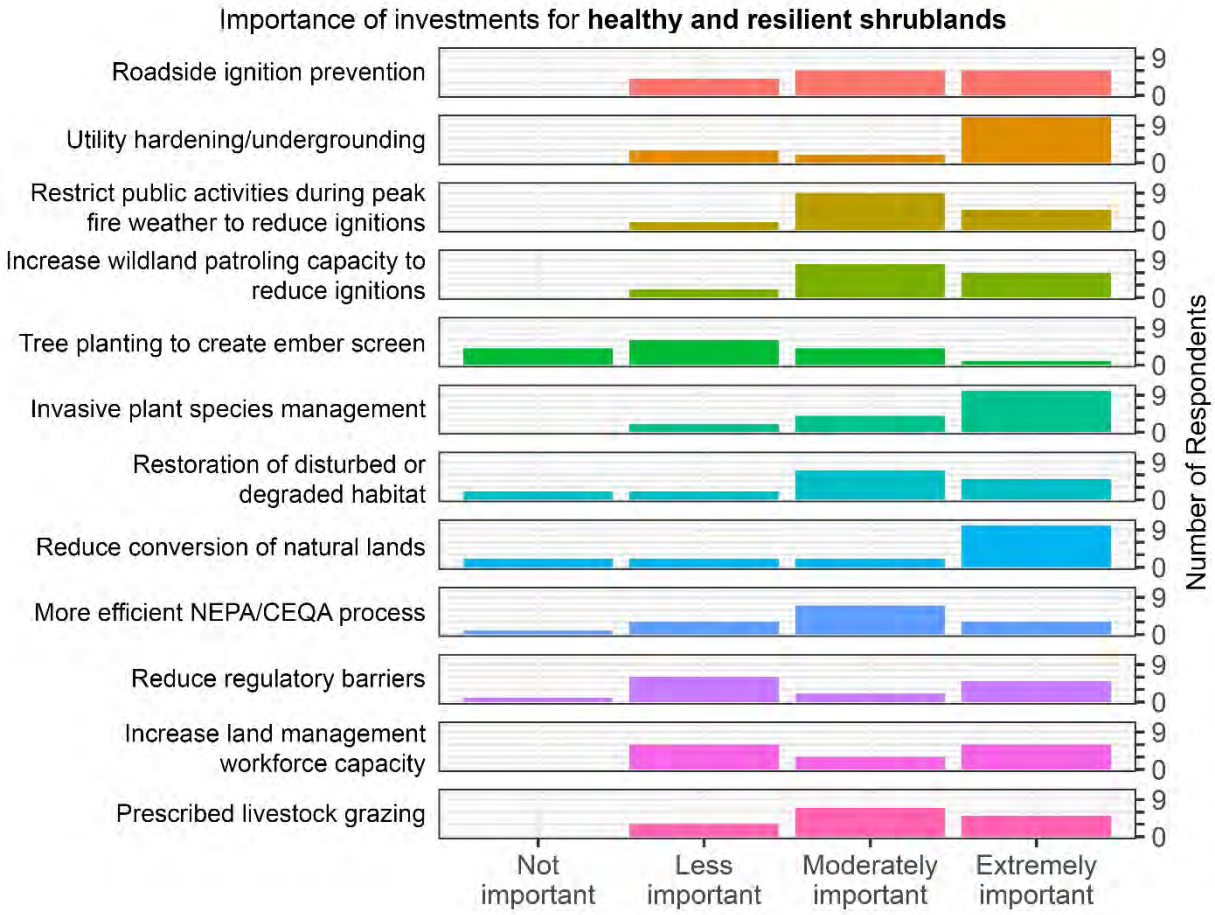

Importance of investments for **water security**
Secure water supply for residential use
Secure water supply for economic use
Reduce regulatory barriers
Address constraints related to water rights
Optimize water applications
Address water pollution impacts to humans
Address water pollution impacts to ecosystem
Ecosystem restoration to protect watershed
Reduce soil erosion
10
5
Number of Respondents
Not important
Less important
Moderately important
Extremely important

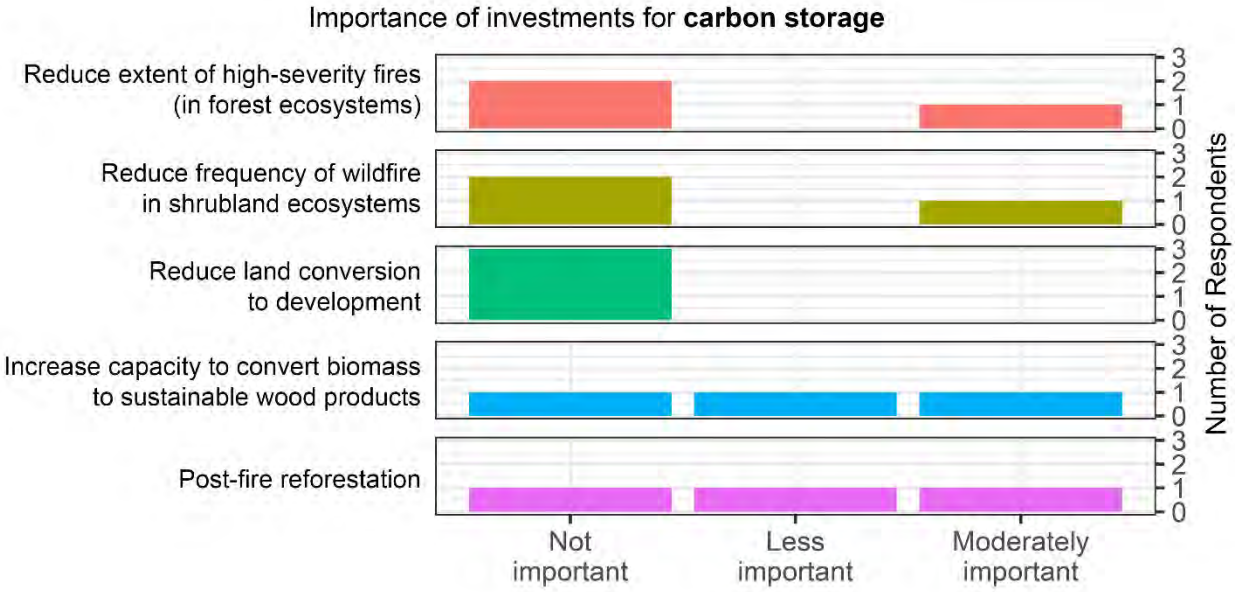
Central Coast Survey Results:

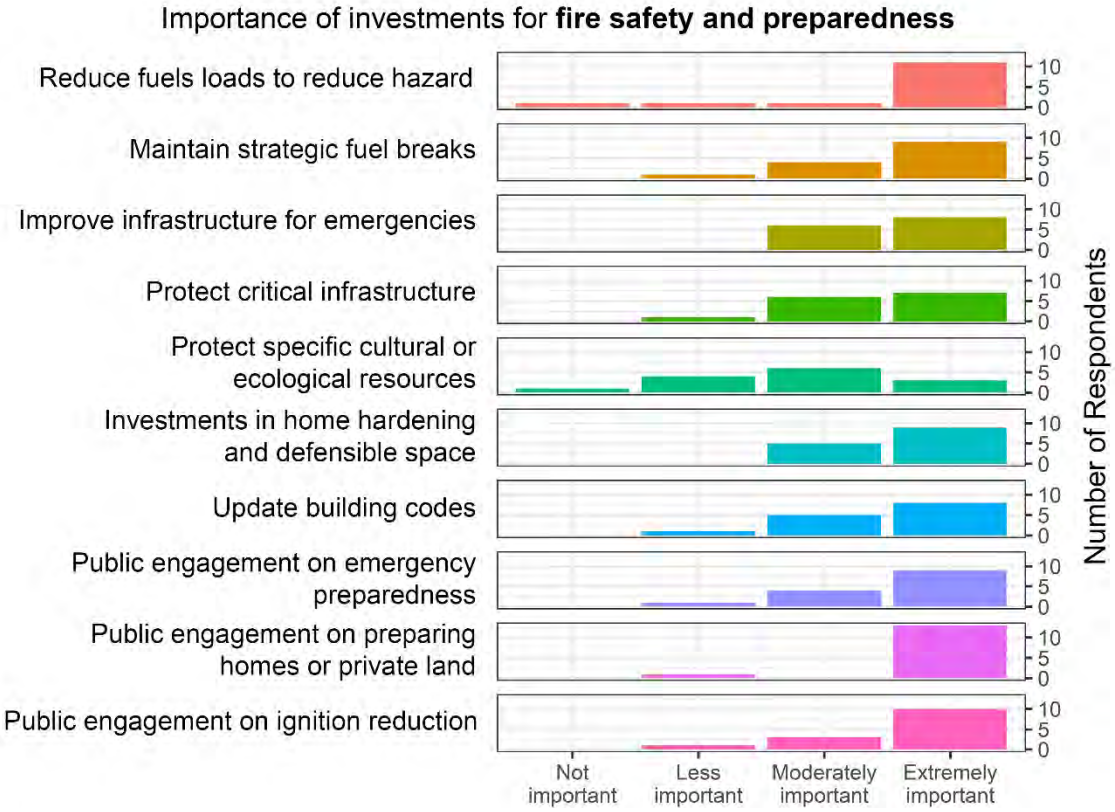
Alameda County

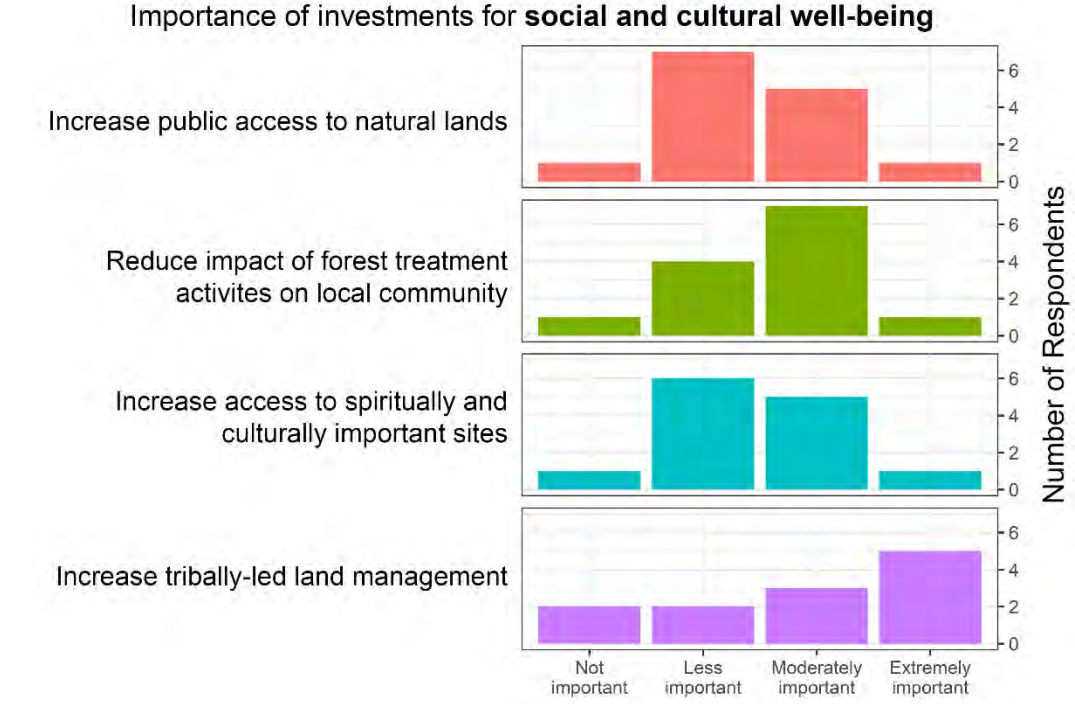


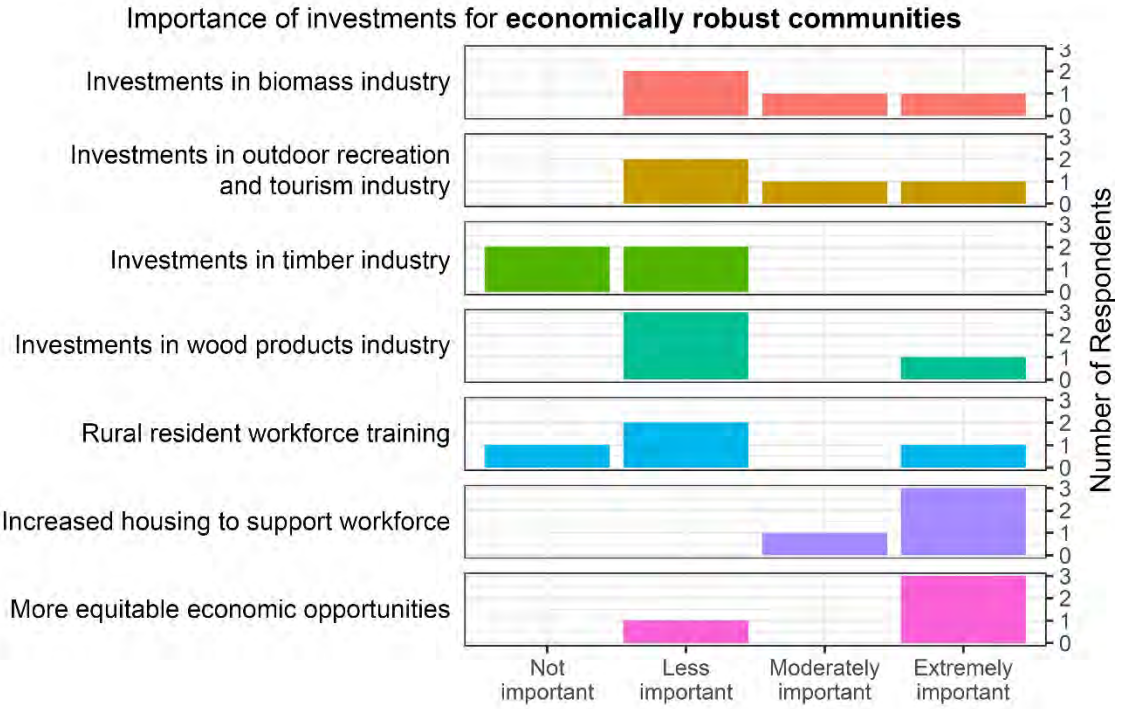


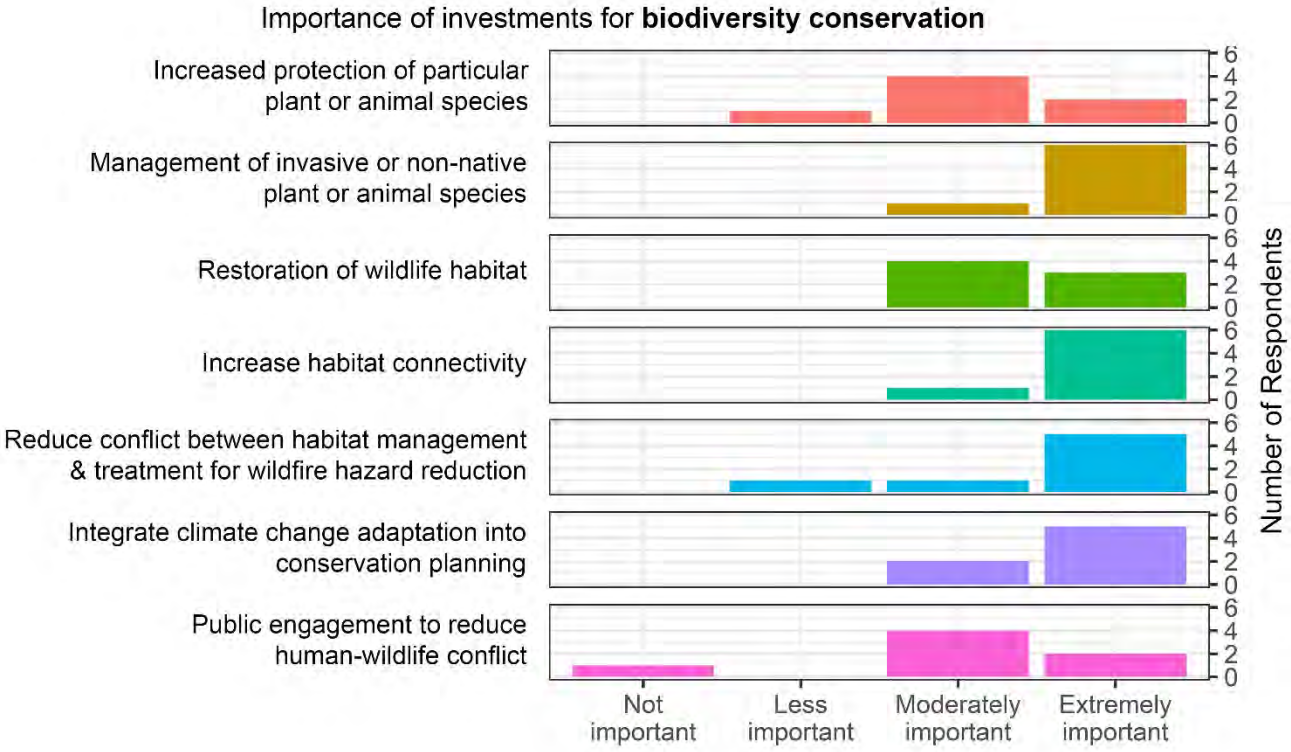

Importance of investments for **healthy and resilient shrublands**
Roadside ignition prevention
Utility hardening/undergrounding
Restrict public activities during peak fire weather to reduce ignitions
Increase wildland patroling capacity to reduce ignitions
Tree planting to create ember screen
Invasive plant species management
Restoration of disturbed or degraded habitat
Reduce conversion of natural lands
More efficient NEPA/CEQA process
Reduce regulatory barriers
Increase land management workforce capacity
Prescribed livestock grazing
0
9
Number of Respondents
Not important
Less important
Moderately important
Extremely important

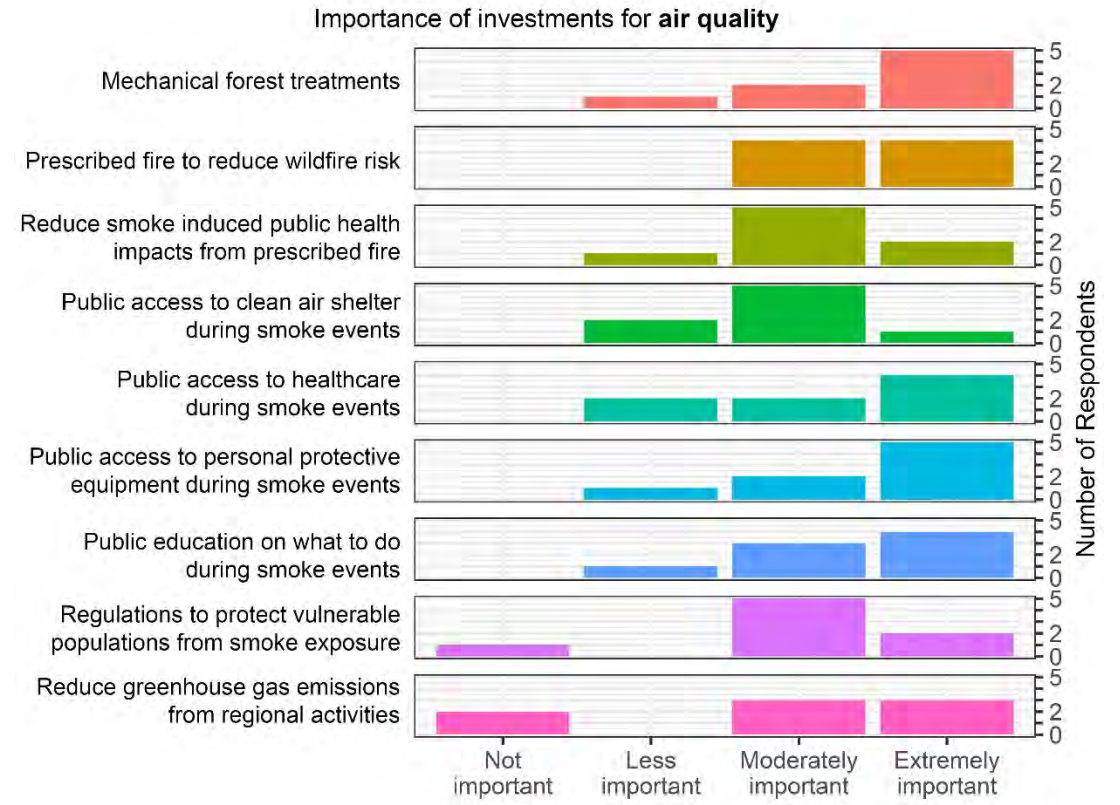

Importance of investments for **carbon storage**
Reduce extent of high-severity fires (in forest ecosystems)
Reduce frequency of wildfire in shrubland ecosystems
Reduce land conversion to development
Increase capacity to convert biomass to sustainable wood products
Post-fire reforestation
0
1
2
3
Number of Respondents
Not important
Less important
Moderately important

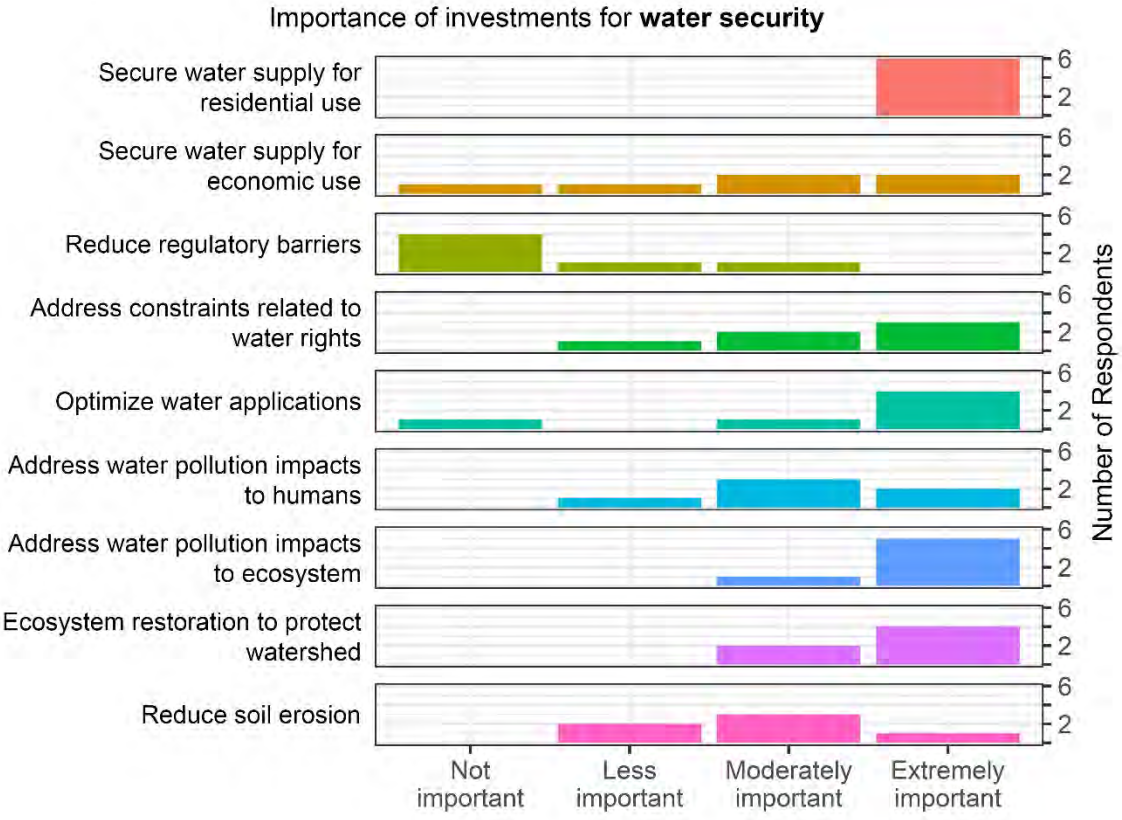

Importance of investments for **fire safety and preparedness**
Reduce fuels loads to reduce hazard
Maintain strategic fuel breaks
Improve infrastructure for emergencies
Protect critical infrastructure
Protect specific cultural or ecological resources
Investments in home hardening and defensible space
Update building codes
Public engagement on emergency preparedness
Public engagement on preparing homes or private land
Public engagement on ignition reduction
Number of Respondents
0
5
10
Not important
Less important
Moderately important
Extremely important


Importance of investments for **social and cultural well-being**
Increase public access to natural lands
Reduce impact of forest treatment activites on local community
Increase access to spiritually and culturally important sites
Increase tribally-led land management
Number of Respondents
0
2
4
6
Not important
Less important
Moderately important
Extremely important


Importance of investments for **economically robust communities**
Investments in biomass industry
Investments in outdoor recreation and tourism industry
Investments in timber industry
Investments in wood products industry
Rural resident workforce training
Increased housing to support workforce
More equitable economic opportunities
Number of Respondents
0
1
2
3
Not important
Less important
Moderately important
Extremely important

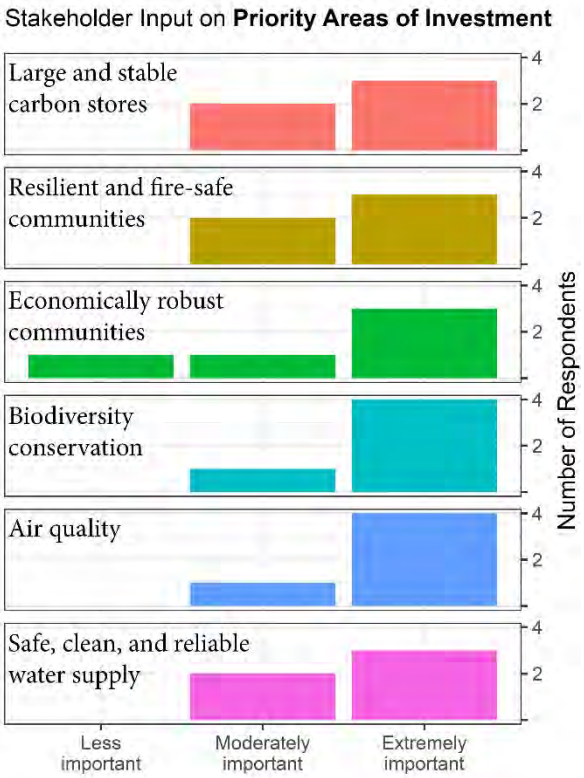

Importance of investments for **biodiversity conservation**
Increased protection of particular plant or animal species
Management of invasive or non-native plant or animal species
Restoration of wildlife habitat
Increase habitat connectivity
Reduce conflict between habitat management & treatment for wildfire hazard reduction
Integrate climate change adaptation into conservation planning
Public engagement to reduce human-wildlife conflict
Number of Respondents
0
2
4
6
Not important
Less important
Moderately important
Extremely important

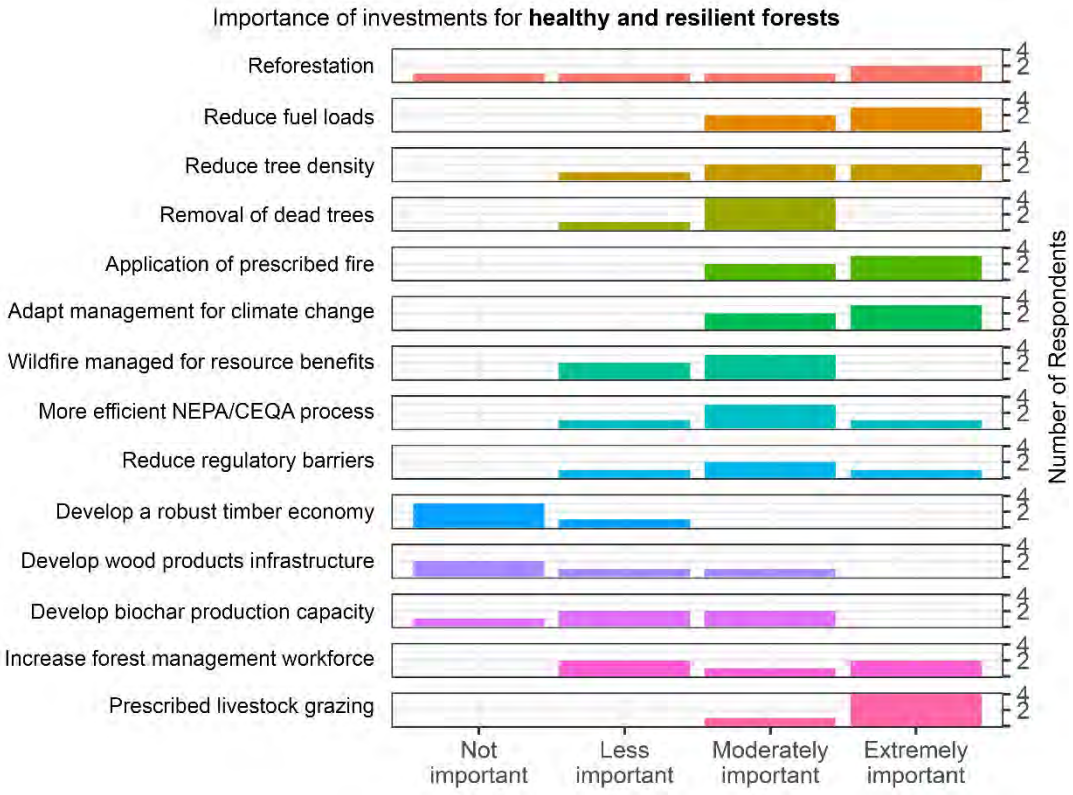

Importance of investments for **air quality**
Mechanical forest treatments
Prescribed fire to reduce wildfire risk
Reduce smoke induced public health impacts from prescribed fire
Public access to clean air shelter during smoke events
Public access to healthcare during smoke events
Public access to personal protective equipment during smoke events
Public education on what to do during smoke events
Regulations to protect vulnerable populations from smoke exposure
Reduce greenhouse gas emissions from regional activities
Number of Respondents
0
2
5
Not important
Less important
Moderately important
Extremely important

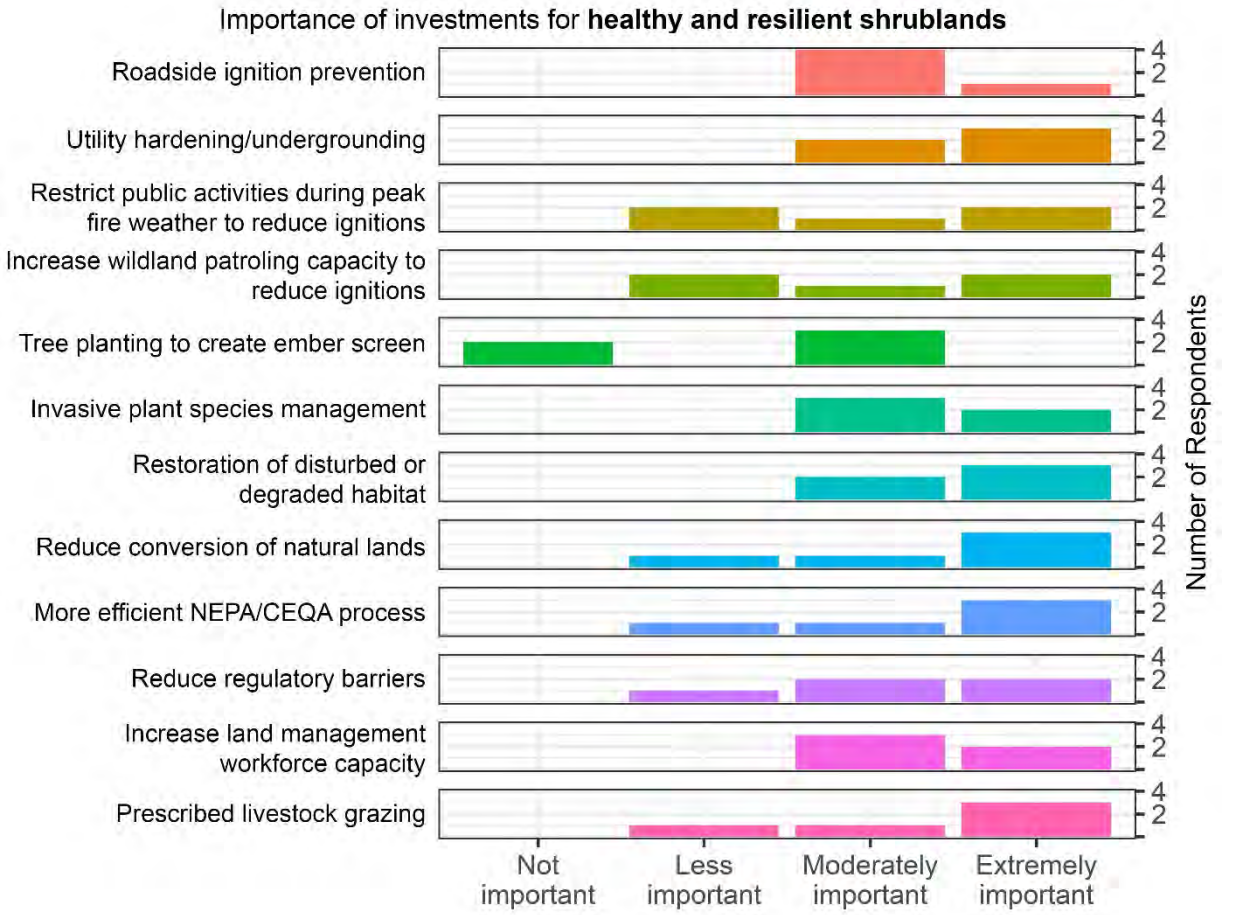

Importance of investments for **water security**
Secure water supply for residential use
Secure water supply for economic use
Reduce regulatory barriers
Address constraints related to water rights
Optimize water applications
Address water pollution impacts to humans
Address water pollution impacts to ecosystem
Ecosystem restoration to protect watershed
Reduce soil erosion
Number of Respondents
2
6
Not important
Less important
Moderately important
Extremely important

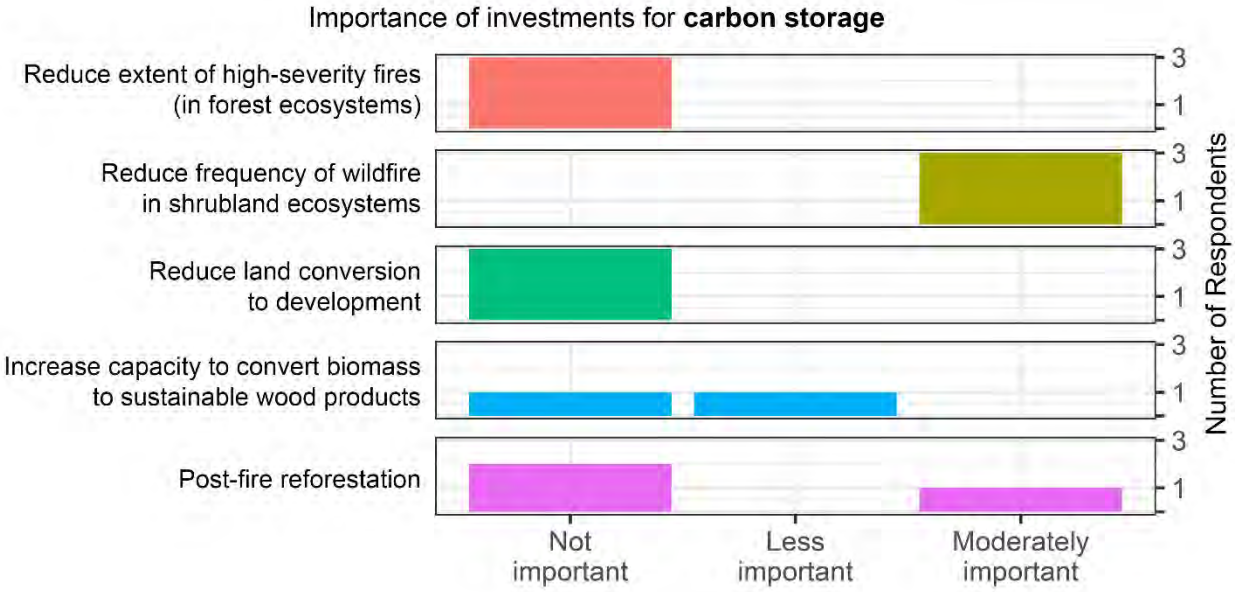
Central Coast Survey Results:

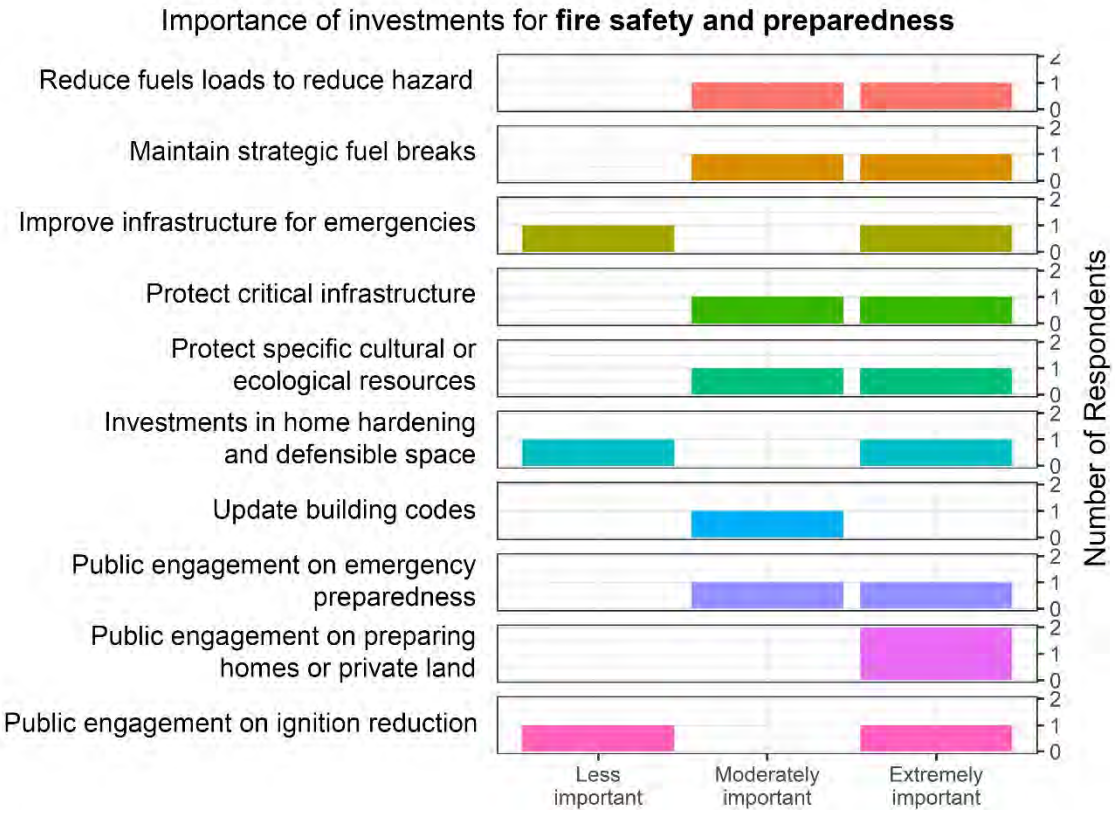
Contra Costa County

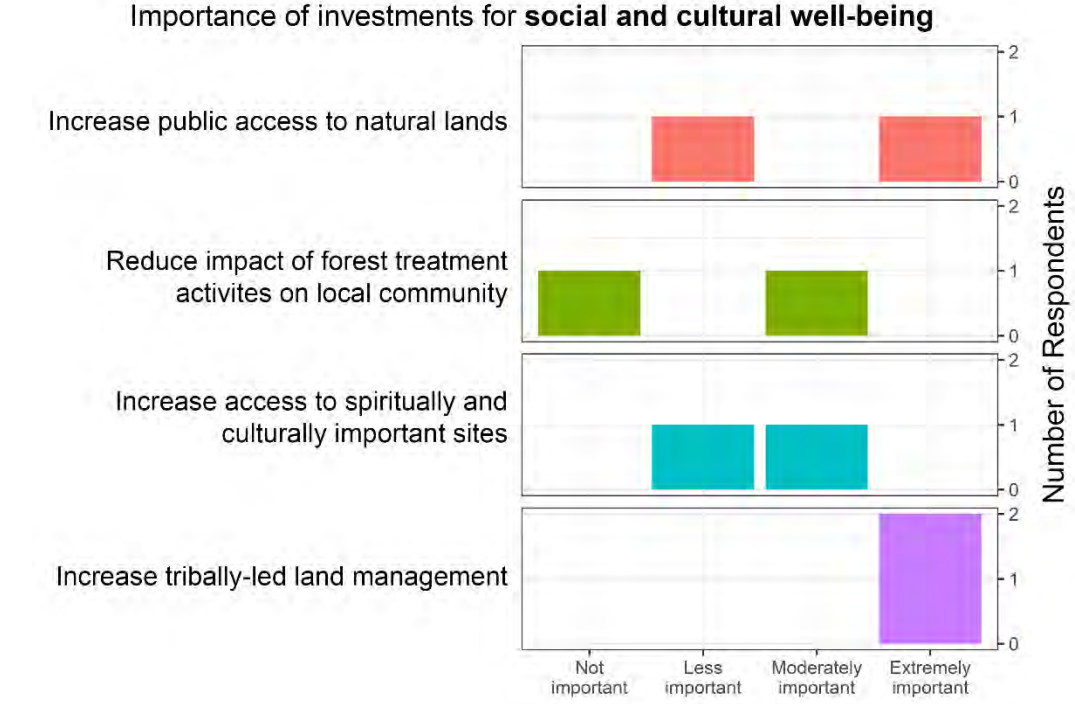




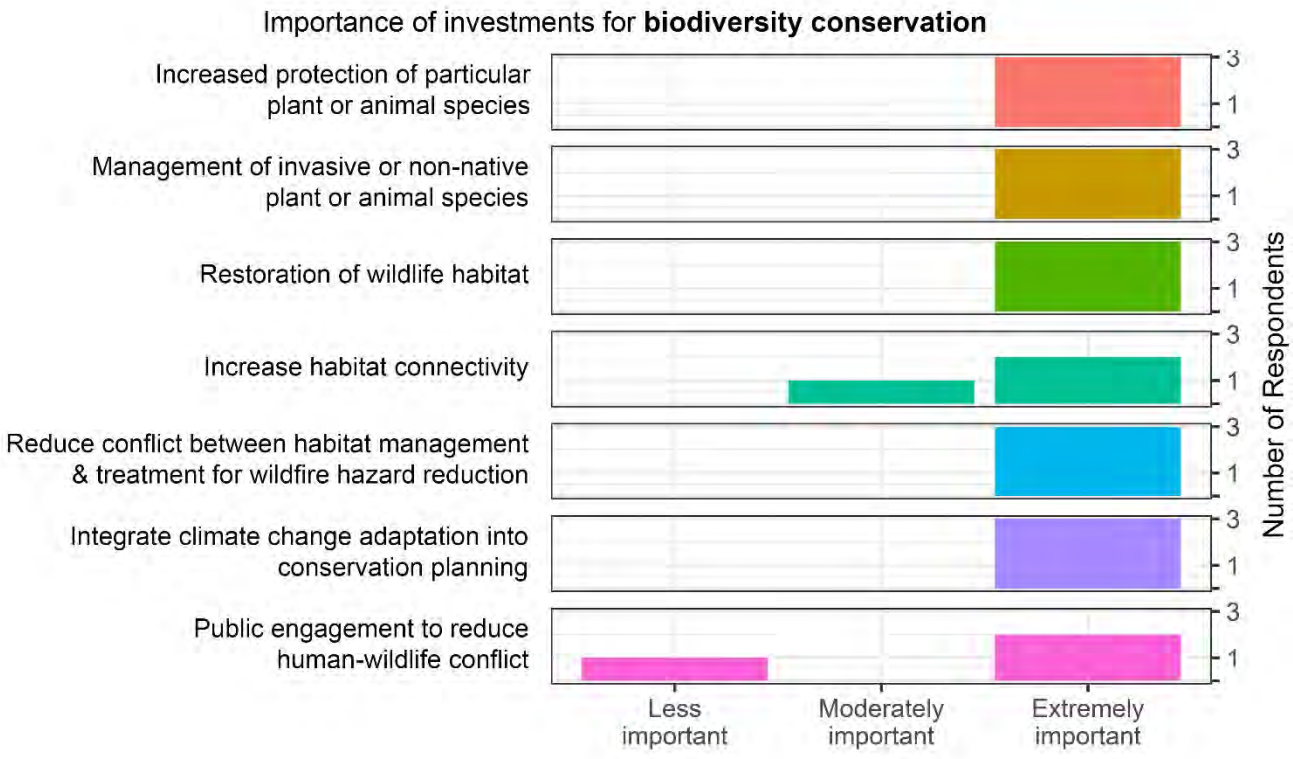

Importance of investments for **healthy and resilient shrublands**
Roadside ignition prevention
Utility hardening/undergrounding
Restrict public activities during peak fire weather to reduce ignitions
Increase wildland patroling capacity to reduce ignitions
Tree planting to create ember screen
Invasive plant species management
Restoration of disturbed or degraded habitat
Reduce conversion of natural lands
More efficient NEPA/CEQA process
Reduce regulatory barriers
Increase land management workforce capacity
Prescribed livestock grazing
4
2
Number of Respondents
Not important
Less important
Moderately important
Extremely important

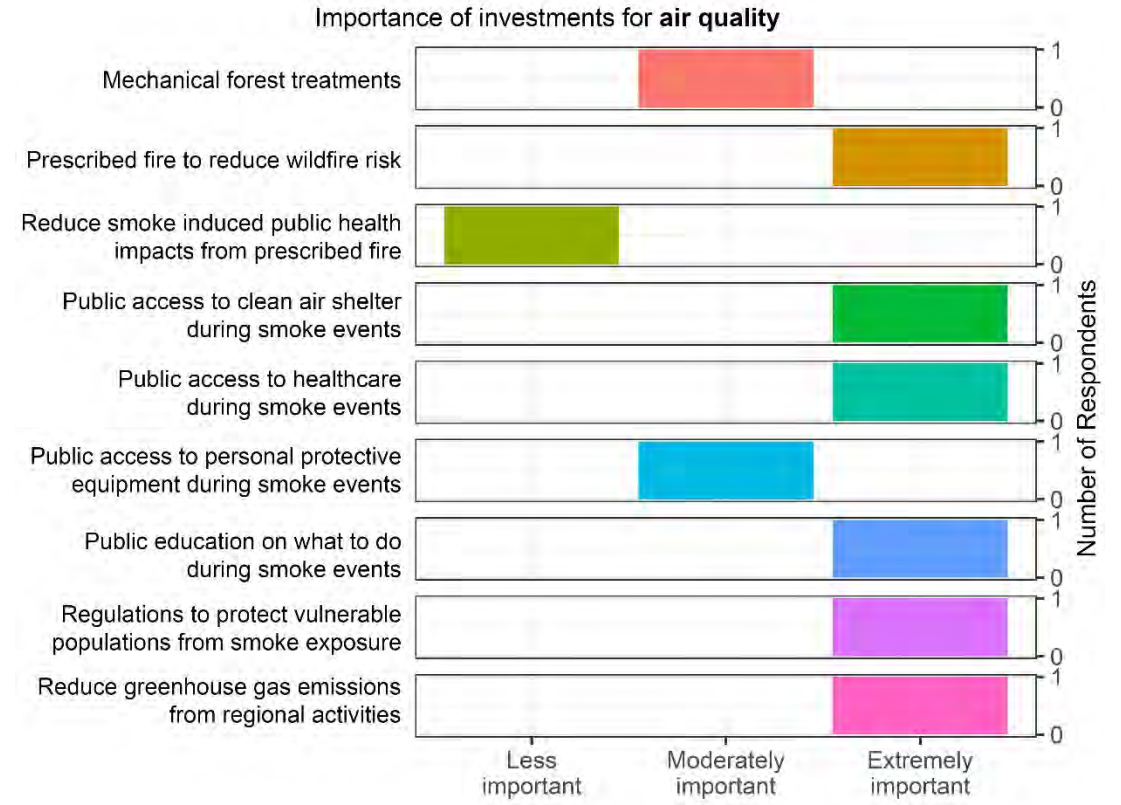

Importance of investments for **carbon storage**
Reduce extent of high-severity fires (in forest ecosystems)
Reduce frequency of wildfire in shrubland ecosystems
Reduce land conversion to development
Increase capacity to convert biomass to sustainable wood products
Post-fire reforestation
3
1
Number of Respondents
Not important
Less important
Moderately important

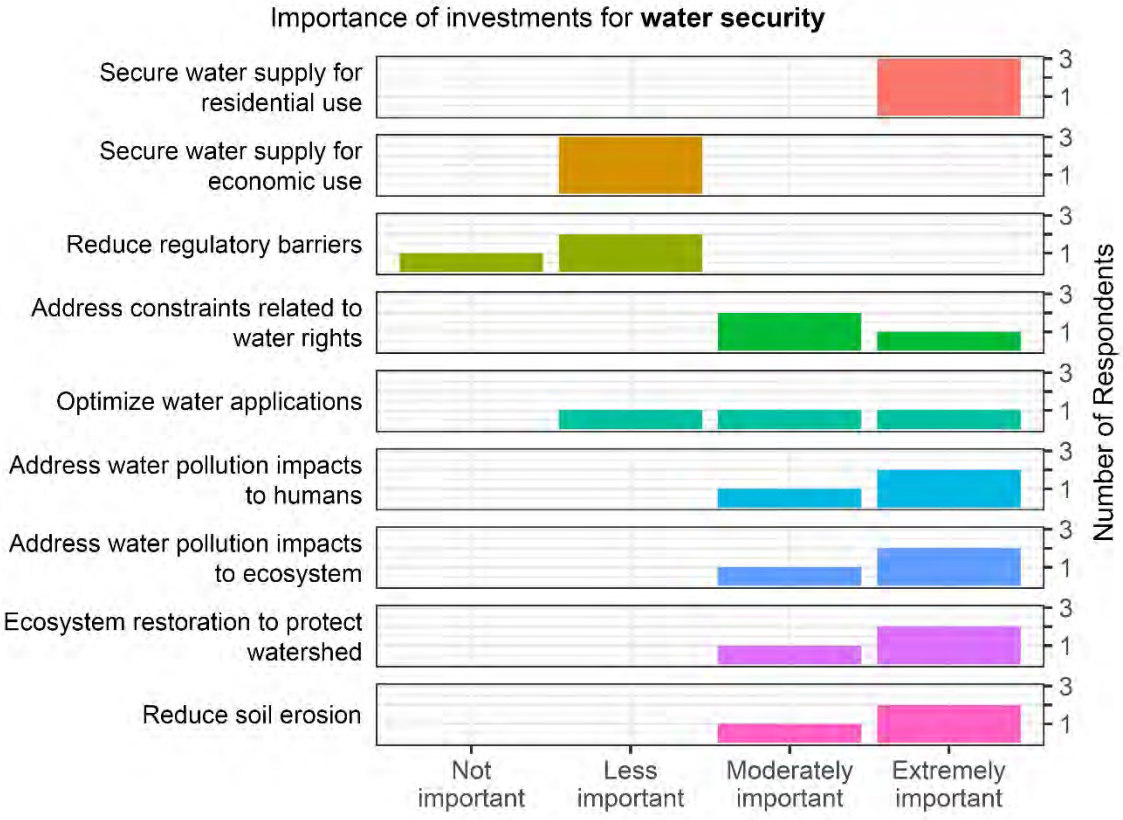

Importance of investments for **fire safety and preparedness**
Reduce fuels loads to reduce hazard
Maintain strategic fuel breaks
Improve infrastructure for emergencies
Protect critical infrastructure
Protect specific cultural or ecological resources
Investments in home hardening and defensible space
Update building codes
Public engagement on emergency preparedness
Public engagement on preparing homes or private land
Public engagement on ignition reduction
Number of Respondents
0
1
2
Less important
Moderately important
Extremely important


Importance of investments for **social and cultural well-being**
Increase public access to natural lands
Reduce impact of forest treatment activites on local community
Increase access to spiritually and culturally important sites
Increase tribally-led land management
Number of Respondents
0
1
2
Not important
Less important
Moderately important
Extremely important

Please note: no survey participants responded to "Economically robust communities" category for this county.

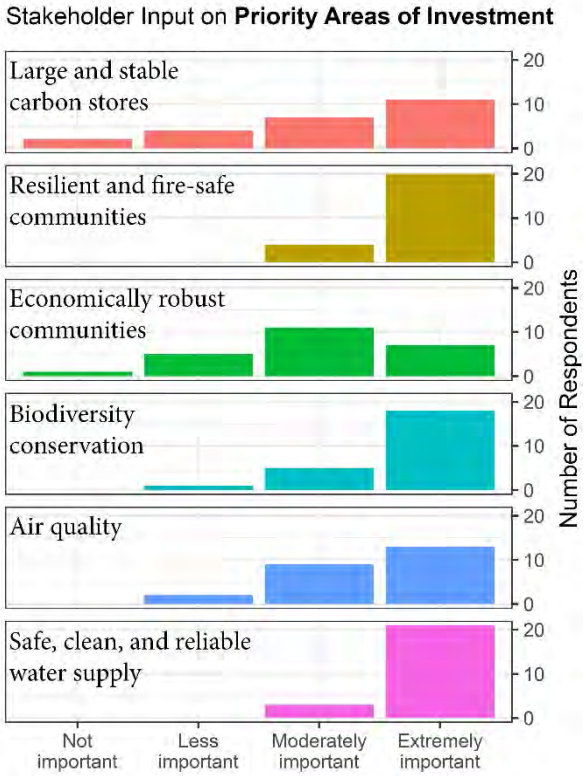


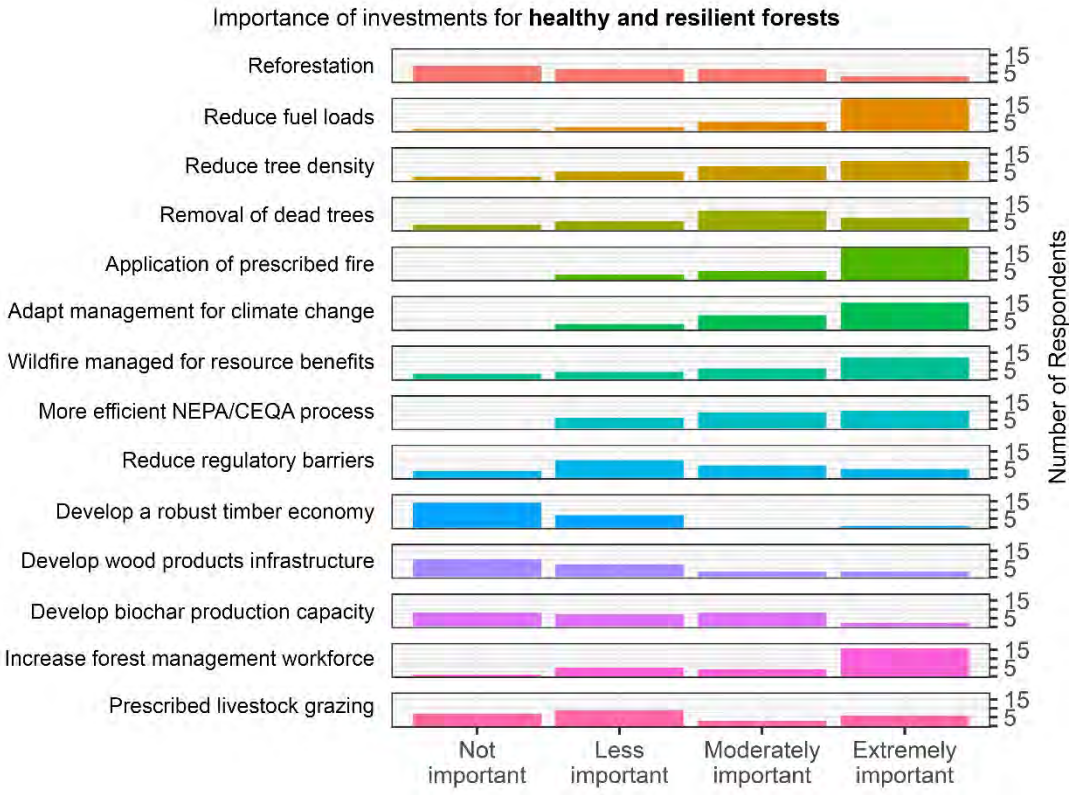

Importance of investments for **air quality**
Mechanical forest treatments
Prescribed fire to reduce wildfire risk
Reduce smoke induced public health impacts from prescribed fire
Public access to clean air shelter during smoke events
Public access to healthcare during smoke events
Public access to personal protective equipment during smoke events
Public education on what to do during smoke events
Regulations to protect vulnerable populations from smoke exposure
Reduce greenhouse gas emissions from regional activities
Number of Respondents
0
1
Less important
Moderately important
Extremely important

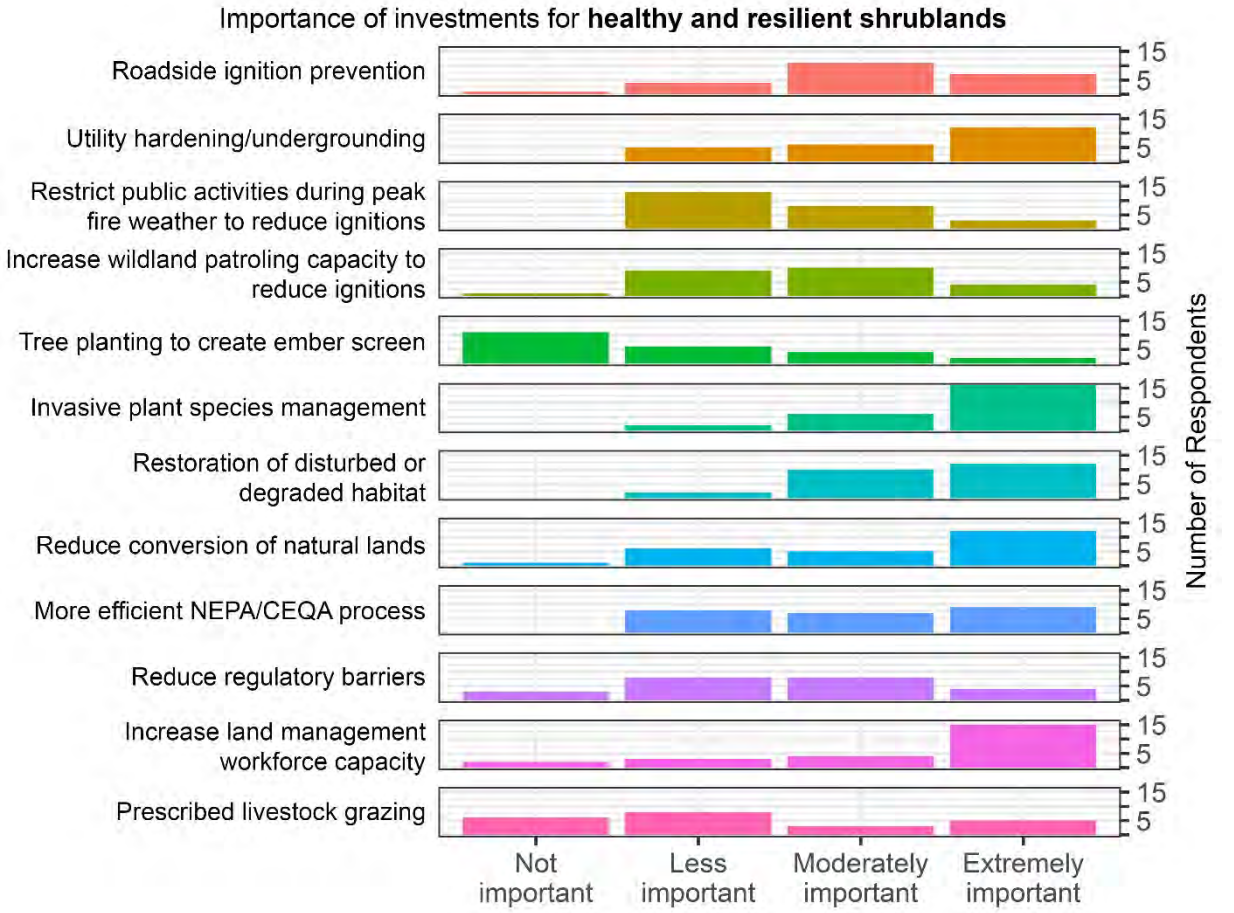

Importance of investments for **water security**
Secure water supply for residential use
Secure water supply for economic use
Reduce regulatory barriers
Address constraints related to water rights
Optimize water applications
Address water pollution impacts to humans
Address water pollution impacts to ecosystem
Ecosystem restoration to protect watershed
Reduce soil erosion
Number of Respondents
1
3
Not important
Less important
Moderately important
Extremely important

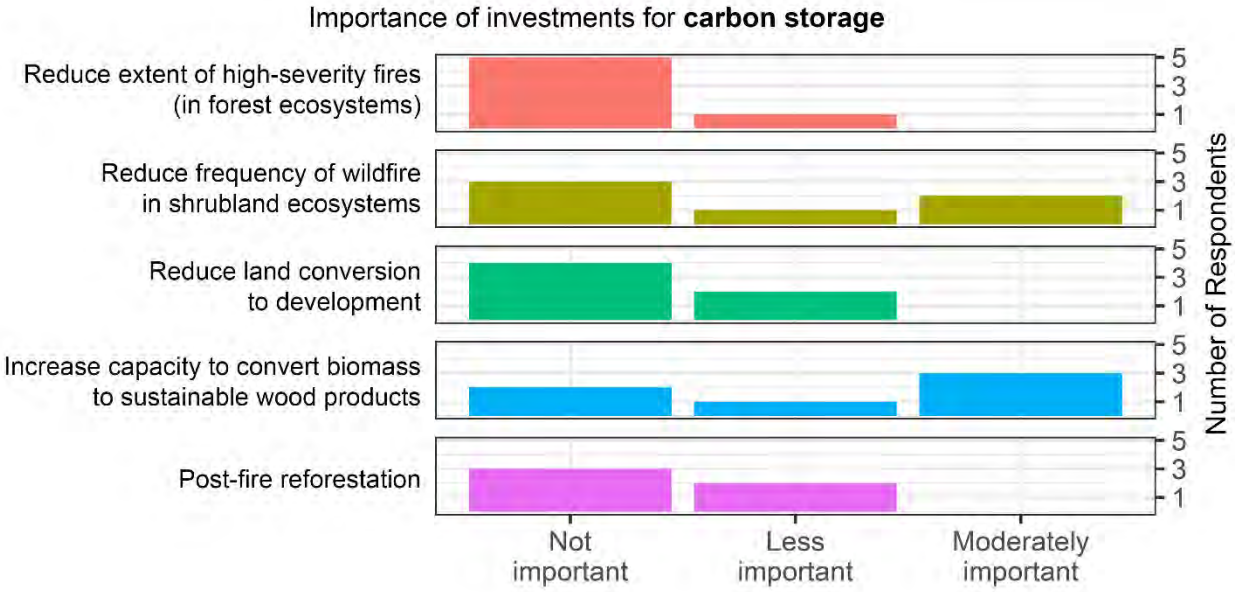
Central Coast Survey Results:

Marin County

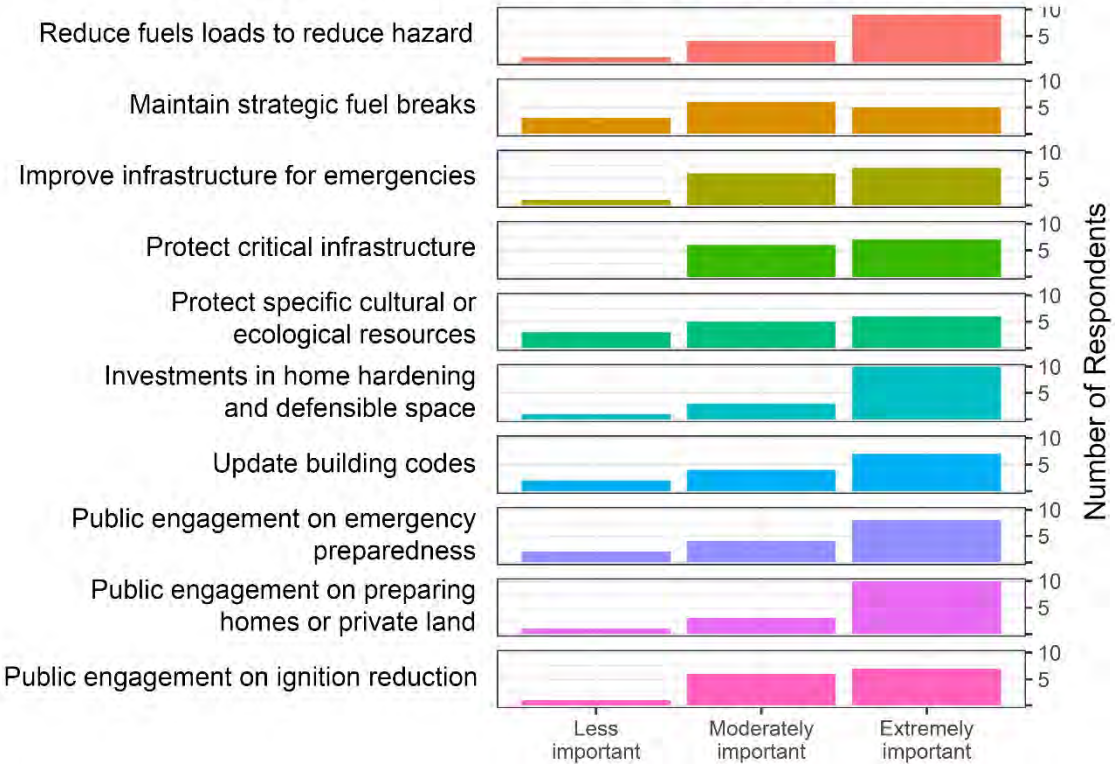




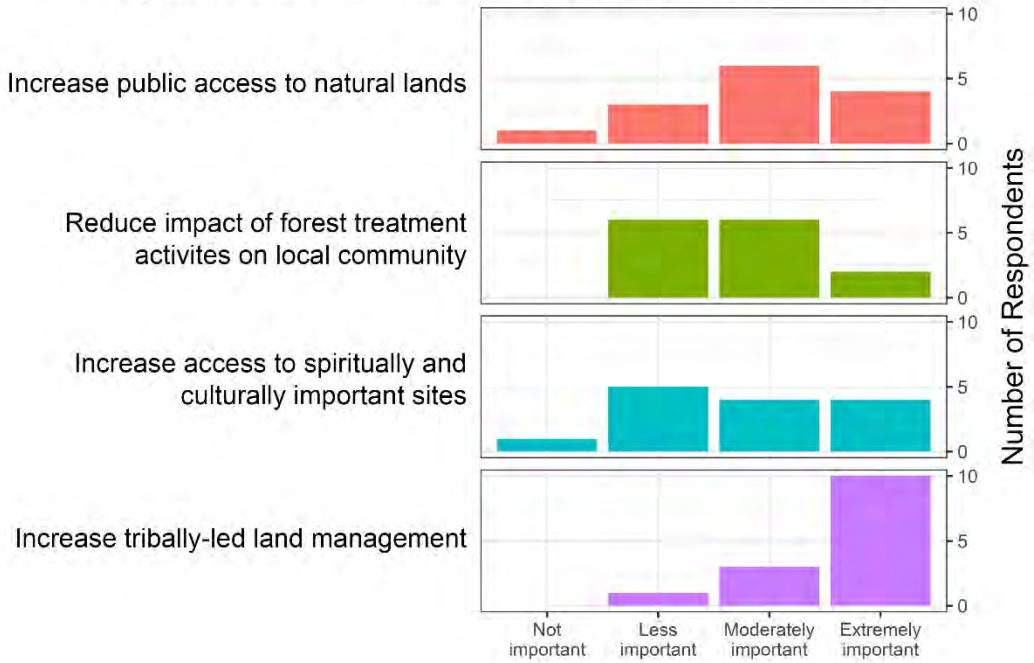

Importance of investments for **healthy and resilient shrublands**
Roadside ignition prevention
Utility hardening/undergrounding
Restrict public activities during peak fire weather to reduce ignitions
Increase wildland patroling capacity to reduce ignitions
Tree planting to create ember screen
Invasive plant species management
Restoration of disturbed or degraded habitat
Reduce conversion of natural lands
More efficient NEPA/CEQA process
Reduce regulatory barriers
Increase land management workforce capacity
Prescribed livestock grazing
15
5
Number of Respondents
Not important
Less important
Moderately important
Extremely important

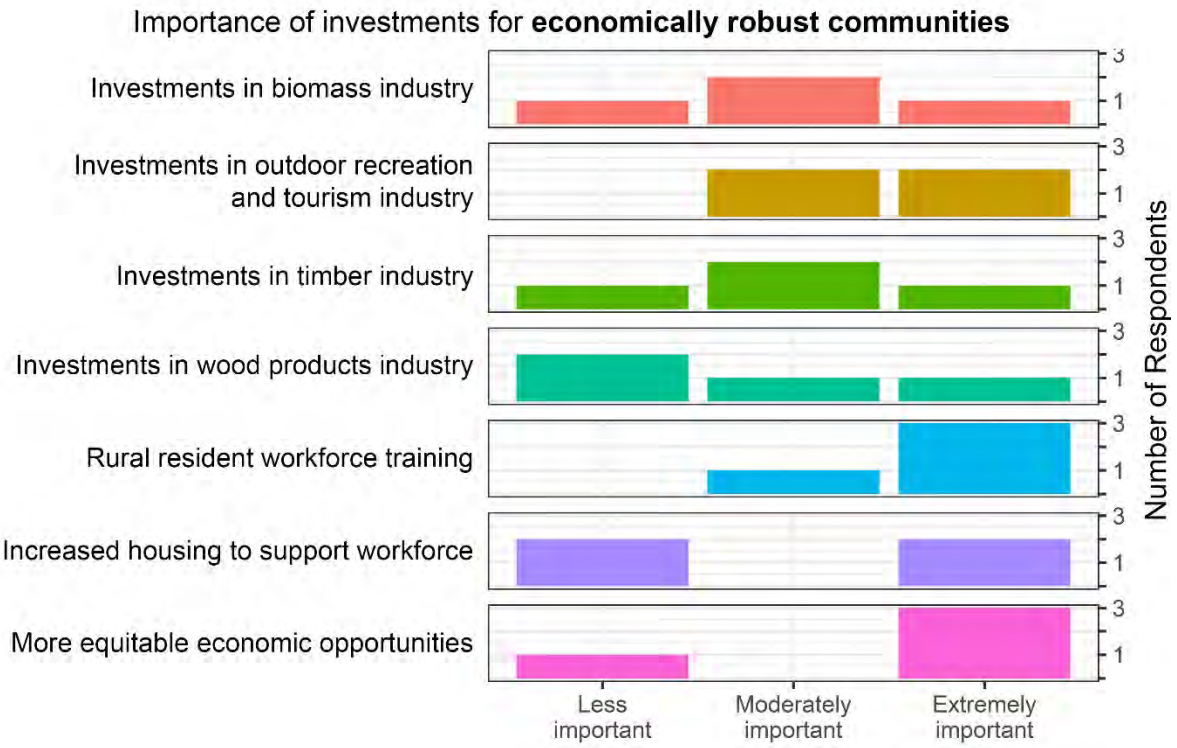

Importance of investments for **carbon storage**
Reduce extent of high-severity fires (in forest ecosystems)
Reduce frequency of wildfire in shrubland ecosystems
Reduce land conversion to development
Increase capacity to convert biomass to sustainable wood products
Post-fire reforestation
5
3
1
Number of Respondents
Not important
Less important
Moderately important

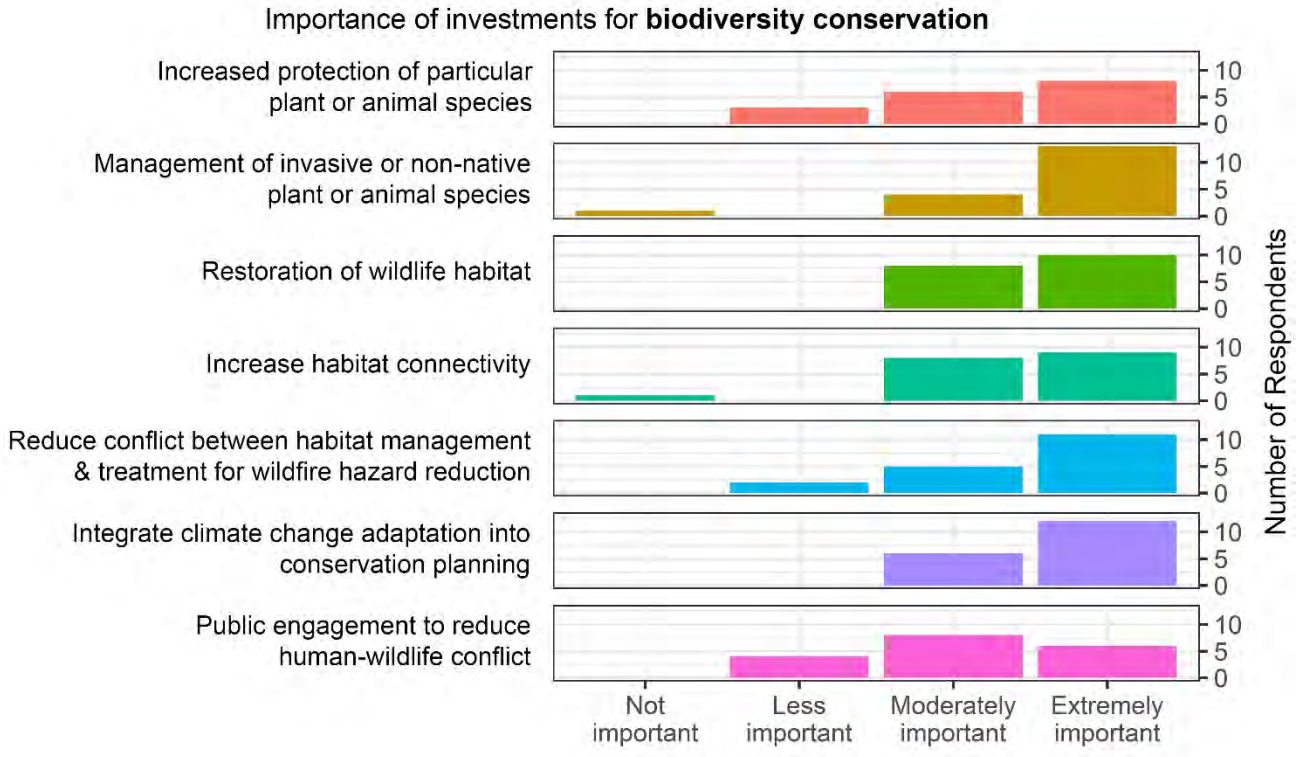
Importance of investments for **fire safety and preparedness**

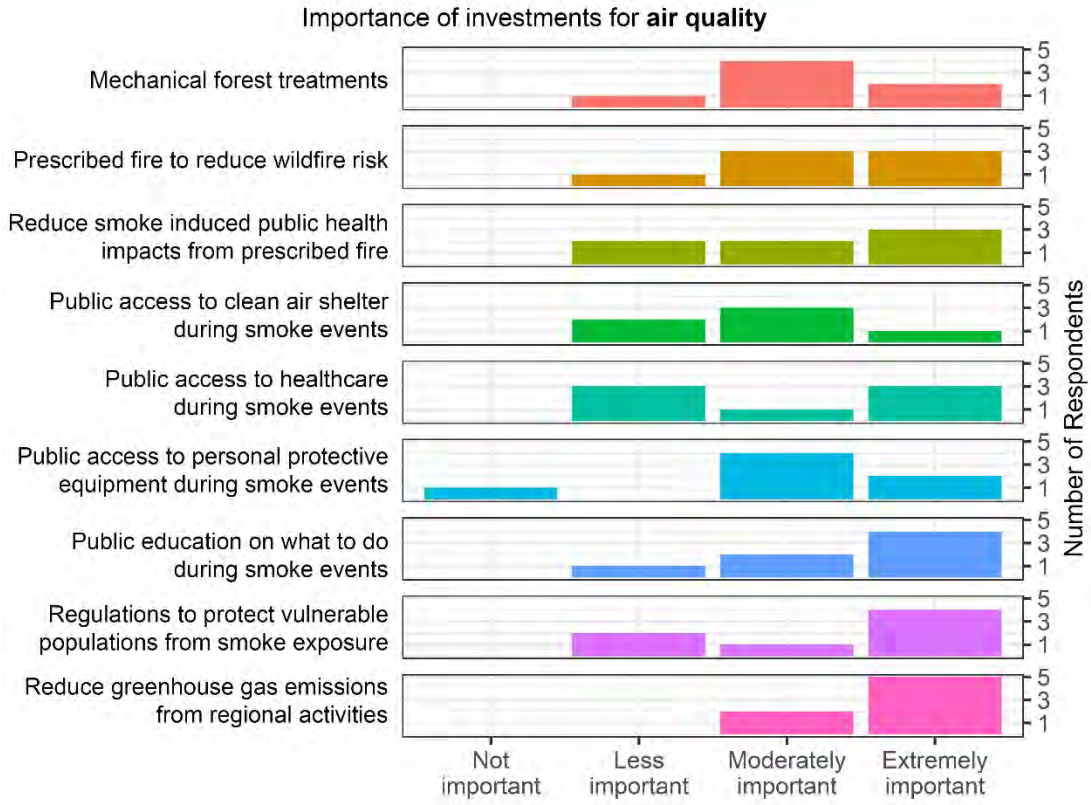


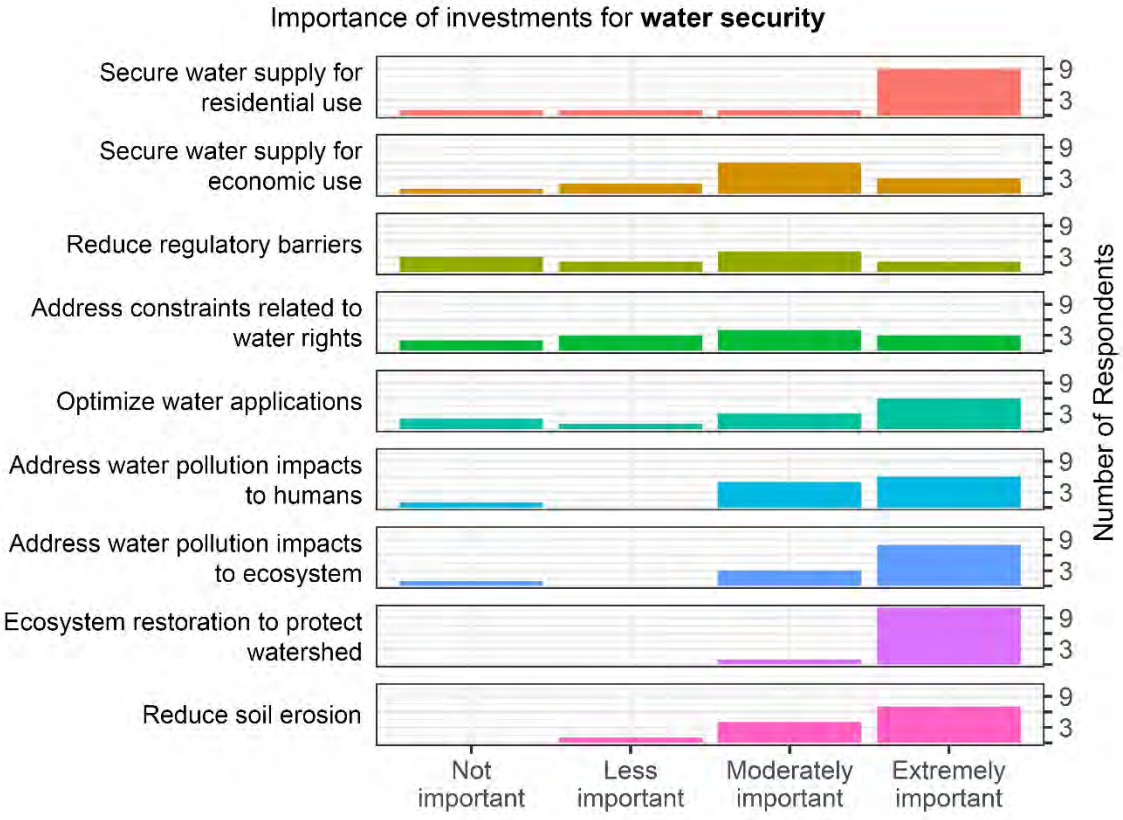
Importance of investments for **social and cultural well-being**




Importance of investments for **economically robust communities**
Investments in biomass industry
Investments in outdoor recreation and tourism industry
Investments in timber industry
Investments in wood products industry
Rural resident workforce training
Increased housing to support workforce
More equitable economic opportunities
3
1
Number of Respondents
Less important
Moderately important
Extremely important

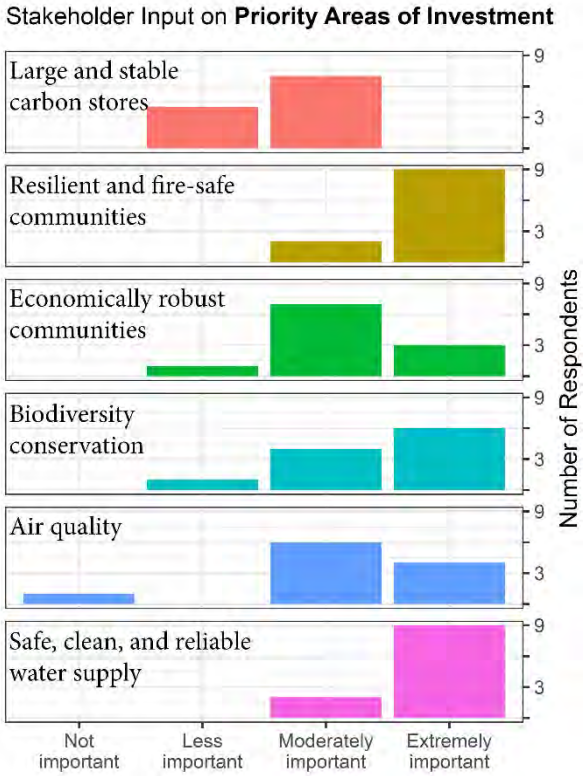

Importance of investments for **biodiversity conservation**
Increased protection of particular plant or animal species
Management of invasive or non-native plant or animal species
Restoration of wildlife habitat
Increase habitat connectivity
Reduce conflict between habitat management & treatment for wildfire hazard reduction
Integrate climate change adaptation into conservation planning
Public engagement to reduce human-wildlife conflict
10
5
0
Number of Respondents
Not important
Less important
Moderately important
Extremely important

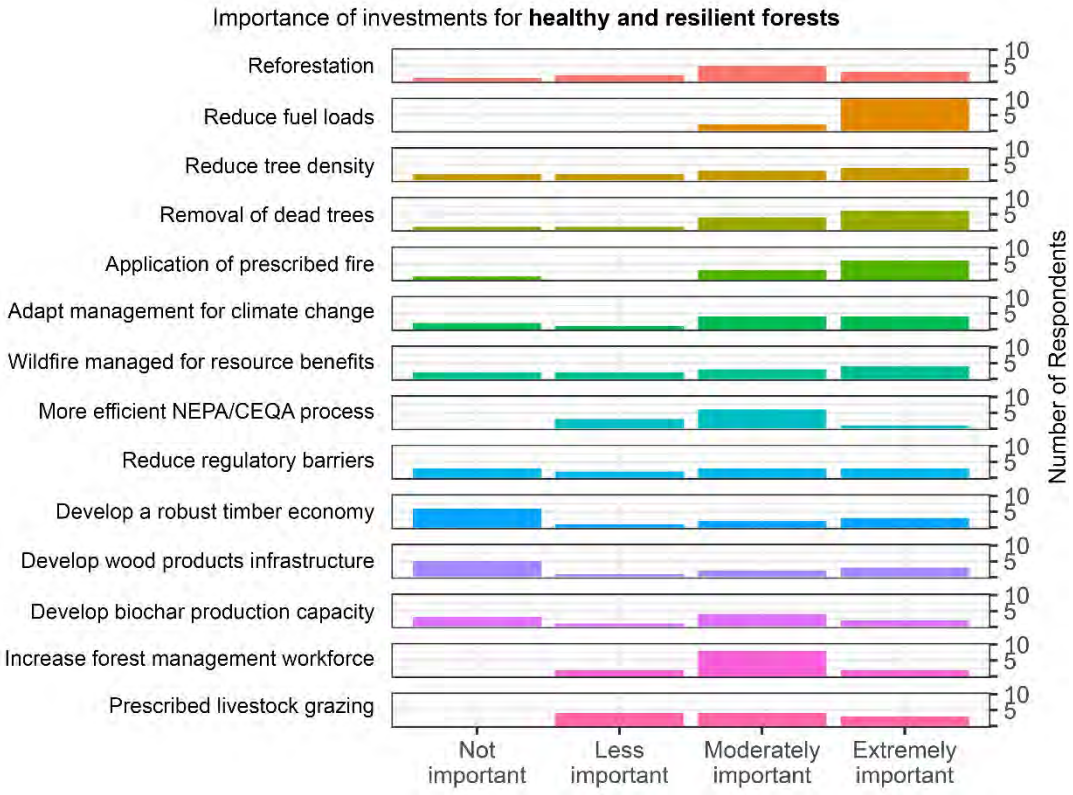

Importance of investments for **air quality**
Mechanical forest treatments
Prescribed fire to reduce wildfire risk
Reduce smoke induced public health impacts from prescribed fire
Public access to clean air shelter during smoke events
Public access to healthcare during smoke events
Public access to personal protective equipment during smoke events
Public education on what to do during smoke events
Regulations to protect vulnerable populations from smoke exposure
Reduce greenhouse gas emissions from regional activities
5
3
1
Number of Respondents
Not important
Less important
Moderately important
Extremely important

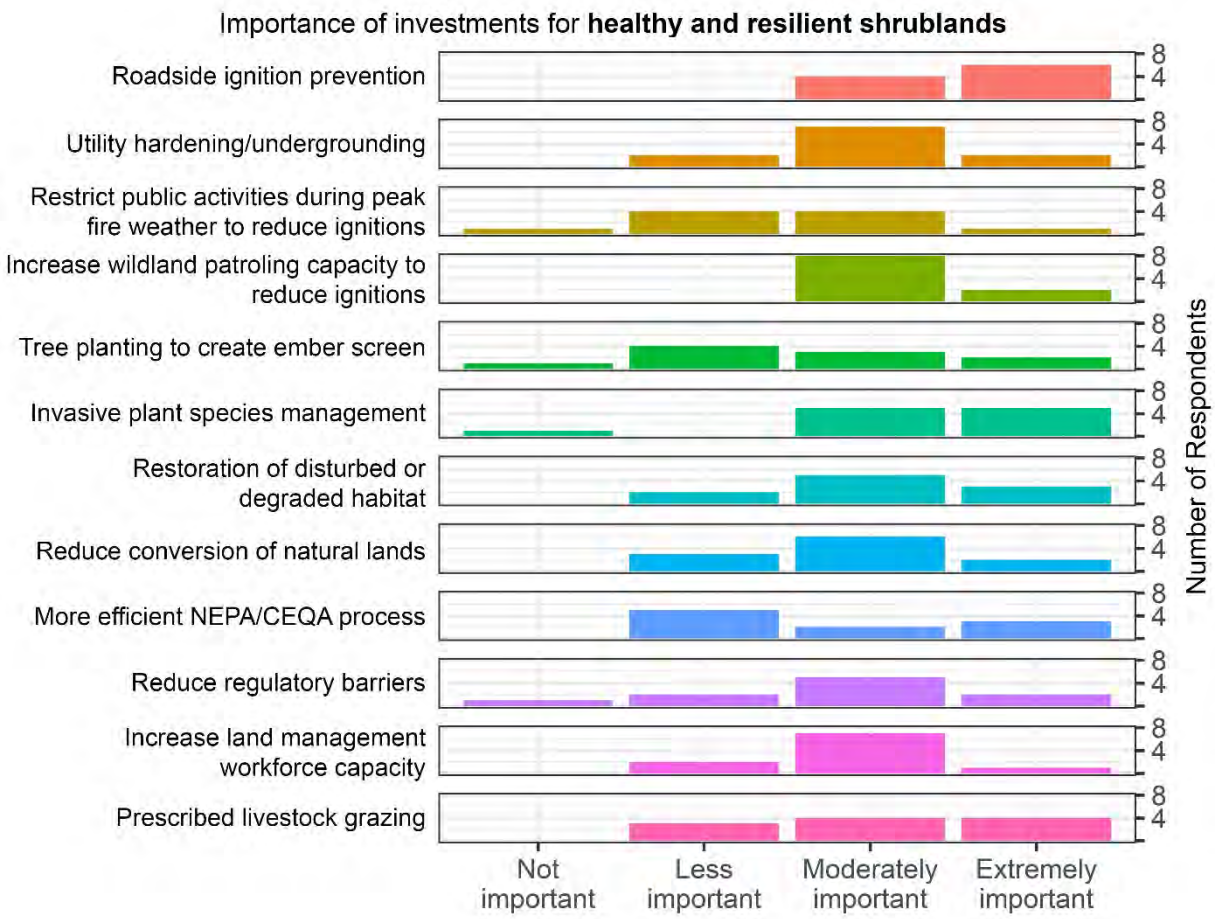

Importance of investments for **water security**
Secure water supply for residential use
Secure water supply for economic use
Reduce regulatory barriers
Address constraints related to water rights
Optimize water applications
Address water pollution impacts to humans
Address water pollution impacts to ecosystem
Ecosystem restoration to protect watershed
Reduce soil erosion
9
3
Number of Respondents
Not important
Less important
Moderately important
Extremely important

Central Coast Survey Results:

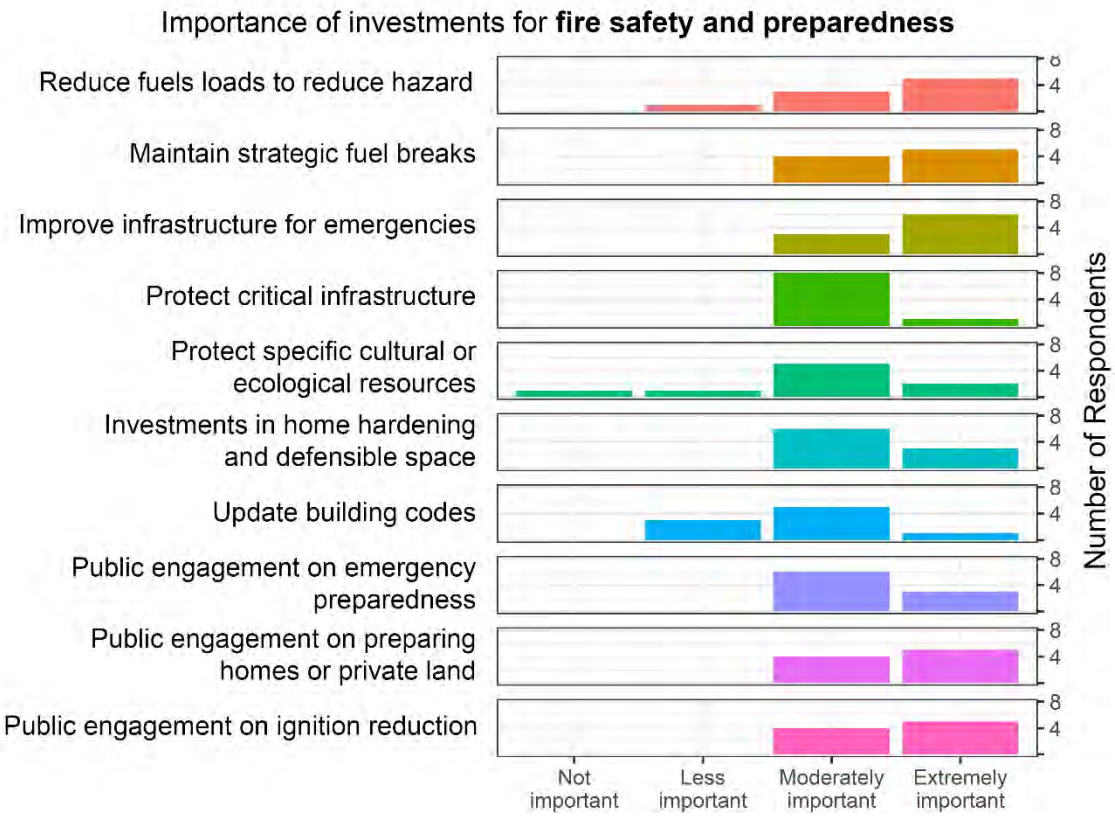
Monterey County

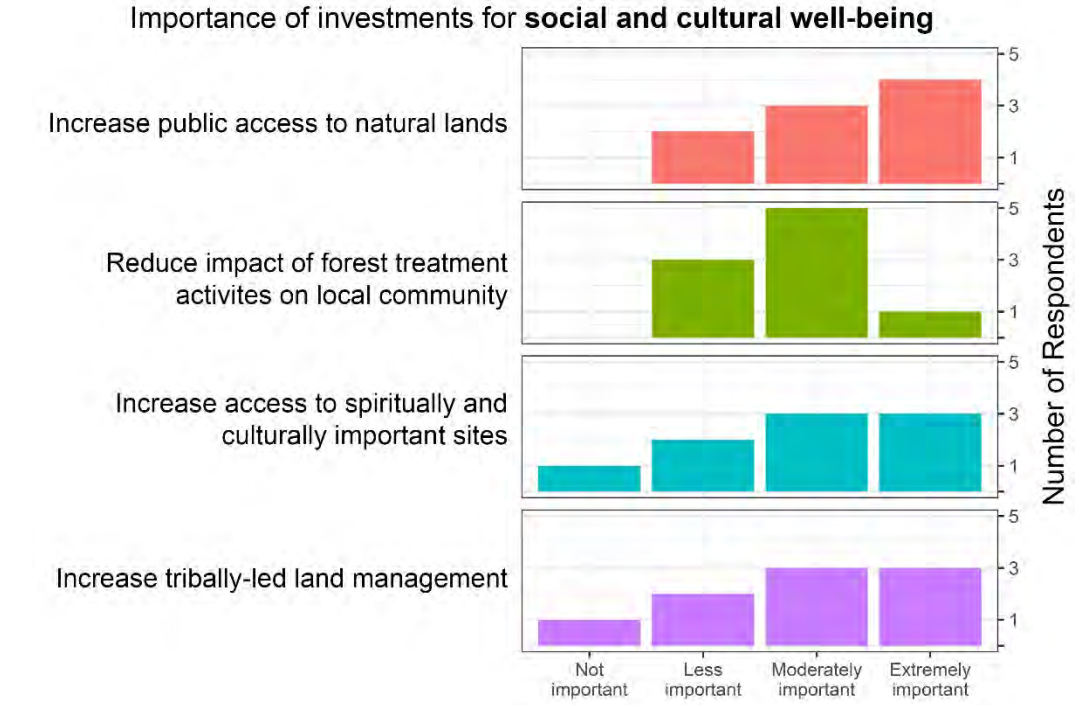


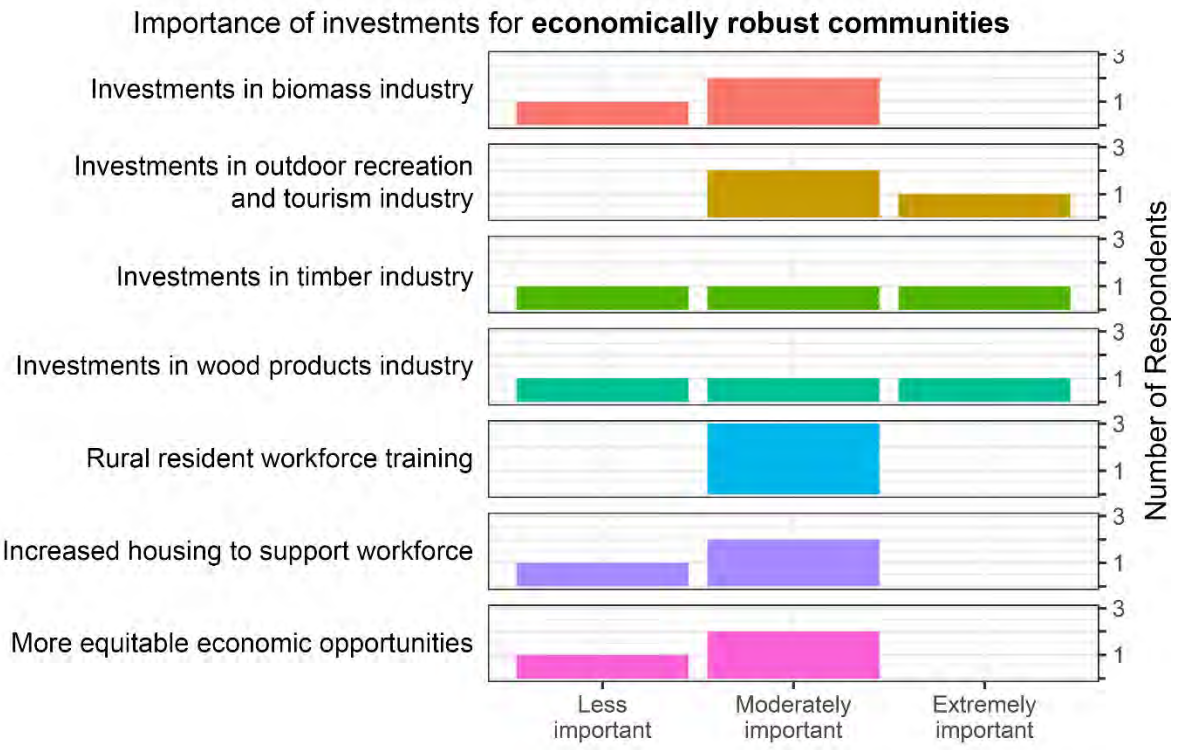


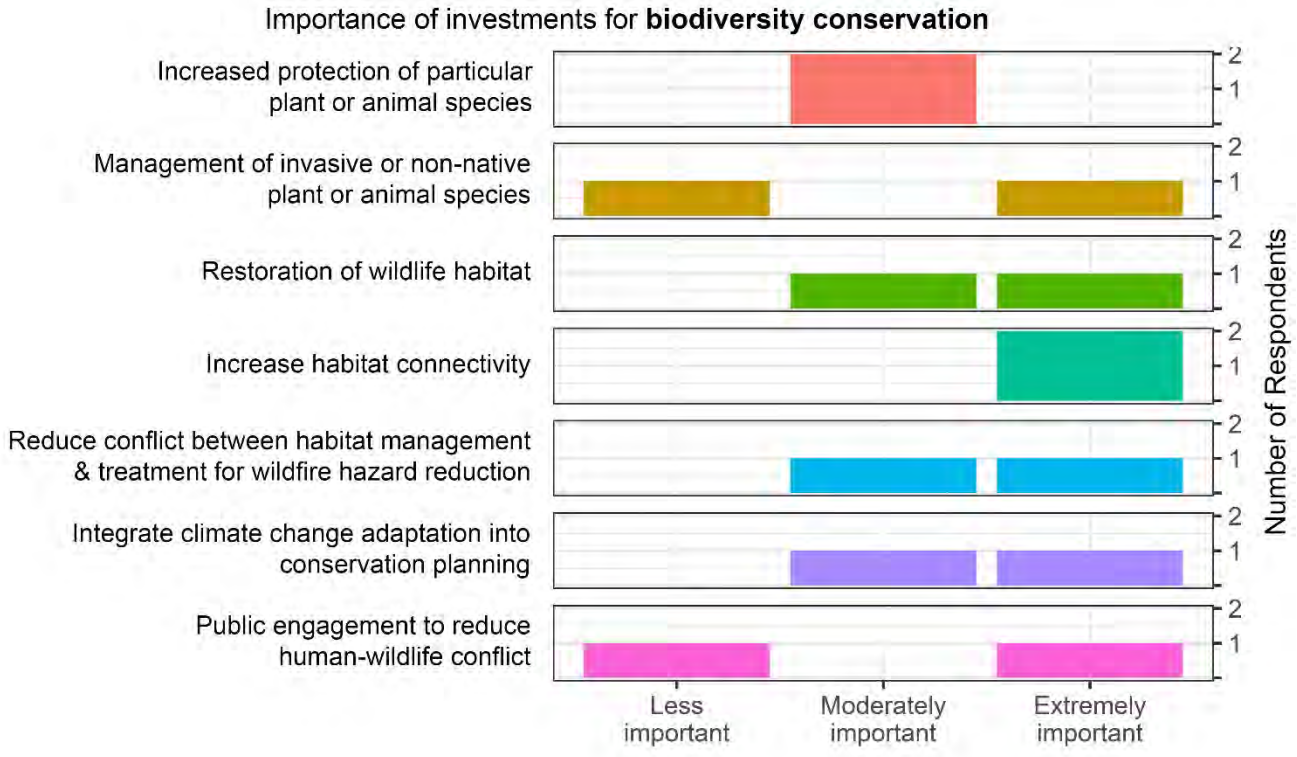


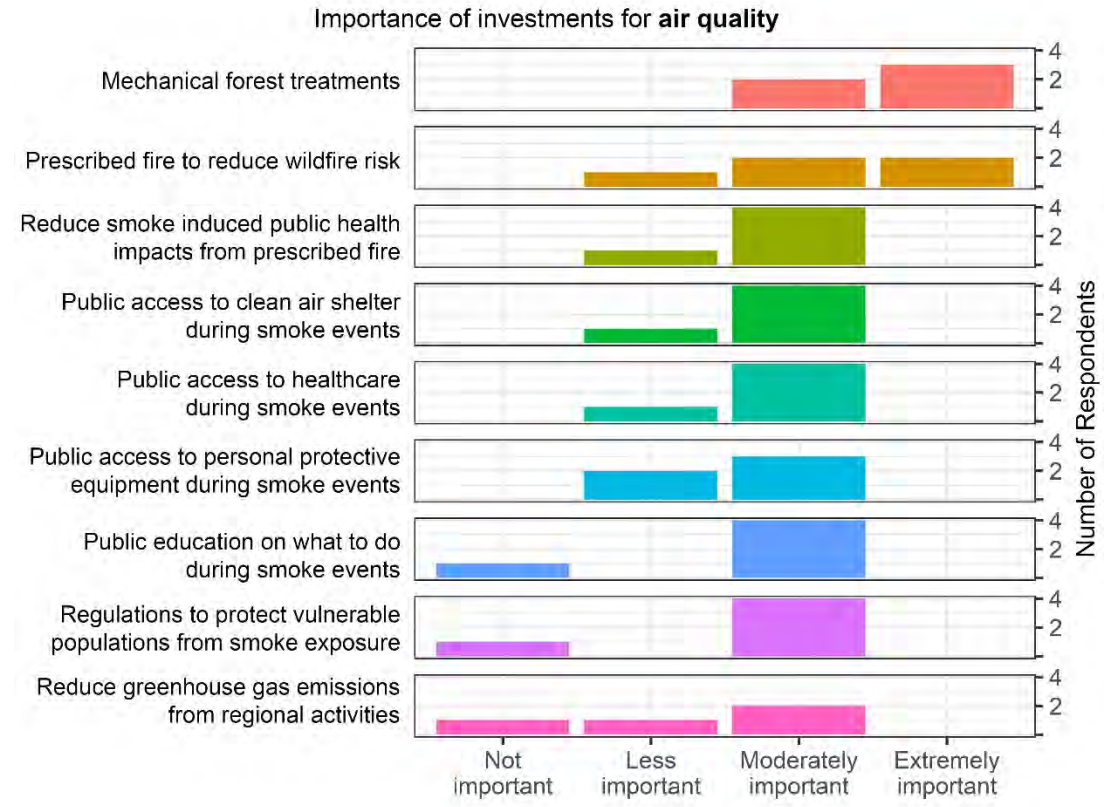
Please note: no survey participants responded to "Large and stable carbon stores" category for this county.

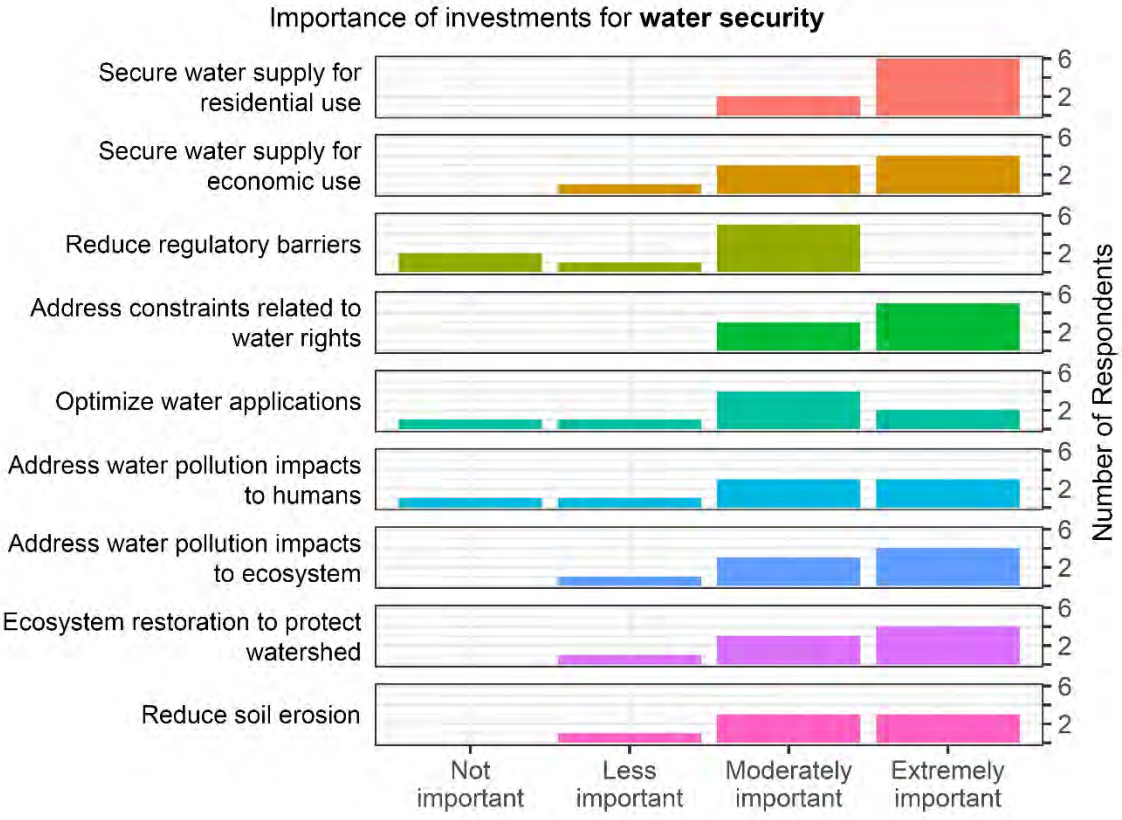

Importance of investments for **fire safety and preparedness**
Reduce fuels loads to reduce hazard
Maintain strategic fuel breaks
Improve infrastructure for emergencies
Protect critical infrastructure
Protect specific cultural or ecological resources
Investments in home hardening and defensible space
Update building codes
Public engagement on emergency preparedness
Public engagement on preparing homes or private land
Public engagement on ignition reduction
Number of Respondents
8
4
Not important
Less important
Moderately important
Extremely important


Importance of investments for **social and cultural well-being**
Increase public access to natural lands
Reduce impact of forest treatment activites on local community
Increase access to spiritually and culturally important sites
Increase tribally-led land management
Number of Respondents
5
3
1
Not important
Less important
Moderately important
Extremely important


Importance of investments for **economically robust communities**
Investments in biomass industry
Investments in outdoor recreation and tourism industry
Investments in timber industry
Investments in wood products industry
Rural resident workforce training
Increased housing to support workforce
More equitable economic opportunities
3
1
Number of Respondents
Less important
Moderately important
Extremely important

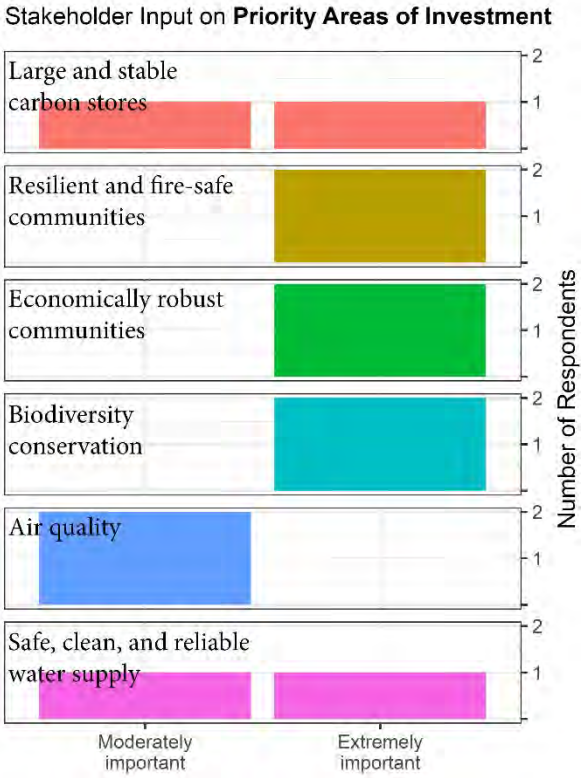

Importance of investments for **biodiversity conservation**
Increased protection of particular plant or animal species
Management of invasive or non-native plant or animal species
Restoration of wildlife habitat
Increase habitat connectivity
Reduce conflict between habitat management & treatment for wildfire hazard reduction
Integrate climate change adaptation into conservation planning
Public engagement to reduce human-wildlife conflict
2
1
Number of Respondents
Less important
Moderately important
Extremely important

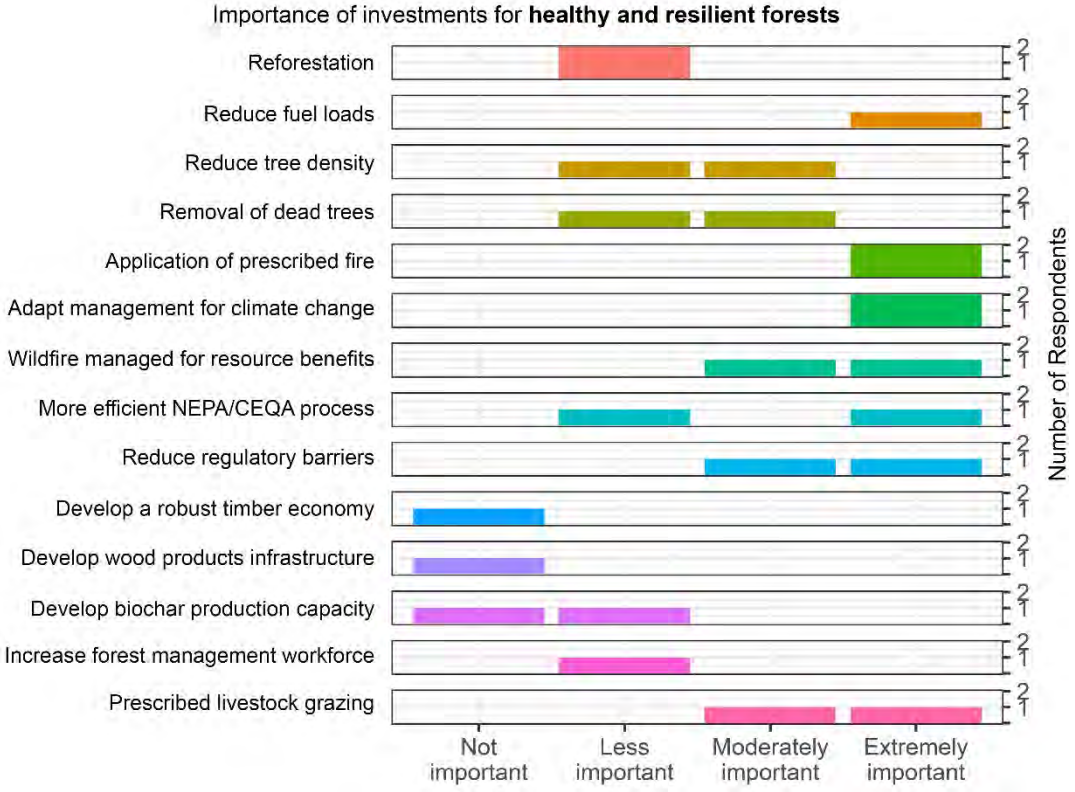

Importance of investments for **air quality**
Mechanical forest treatments
Prescribed fire to reduce wildfire risk
Reduce smoke induced public health impacts from prescribed fire
Public access to clean air shelter during smoke events
Public access to healthcare during smoke events
Public access to personal protective equipment during smoke events
Public education on what to do during smoke events
Regulations to protect vulnerable populations from smoke exposure
Reduce greenhouse gas emissions from regional activities
Number of Respondents
4
2
Not important
Less important
Moderately important
Extremely important

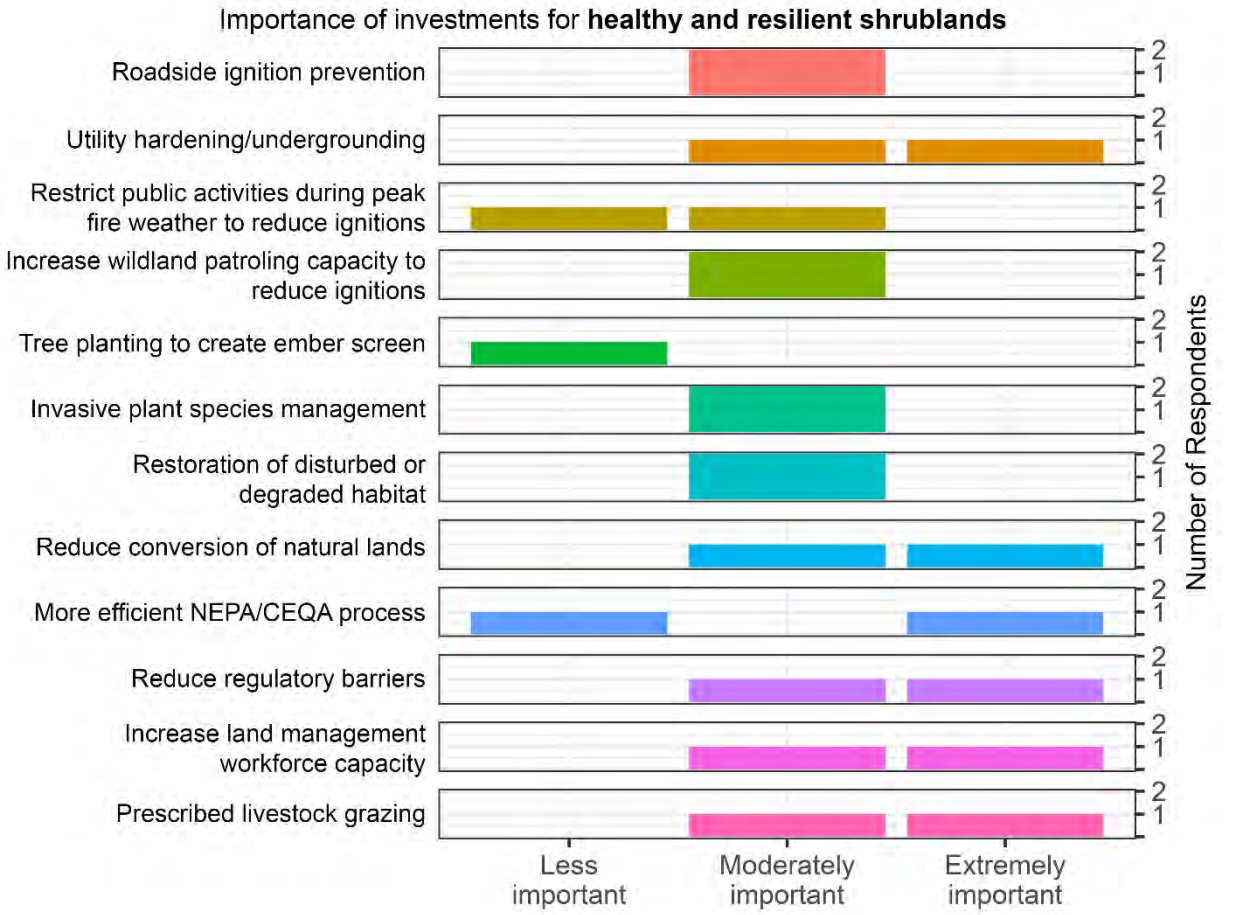

Importance of investments for **water security**
Secure water supply for residential use
Secure water supply for economic use
Reduce regulatory barriers
Address constraints related to water rights
Optimize water applications
Address water pollution impacts to humans
Address water pollution impacts to ecosystem
Ecosystem restoration to protect watershed
Reduce soil erosion
Number of Respondents
6
2
Not important
Less important
Moderately important
Extremely important

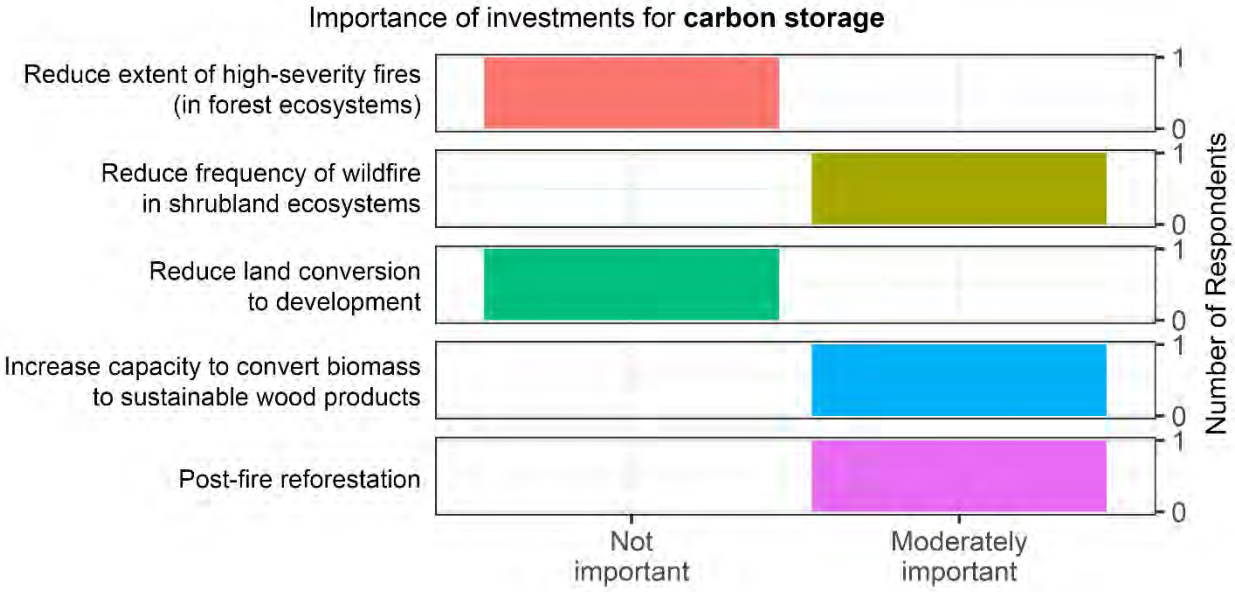
Central Coast Survey Results:

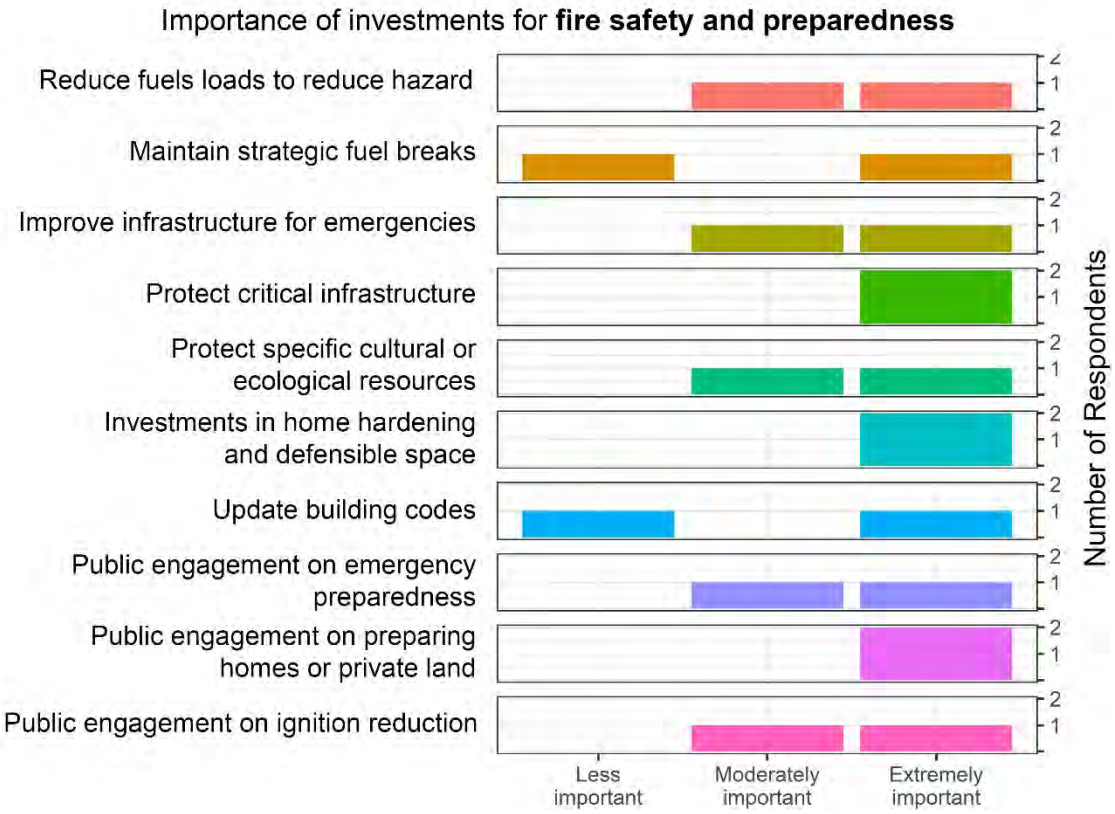
San Benito County

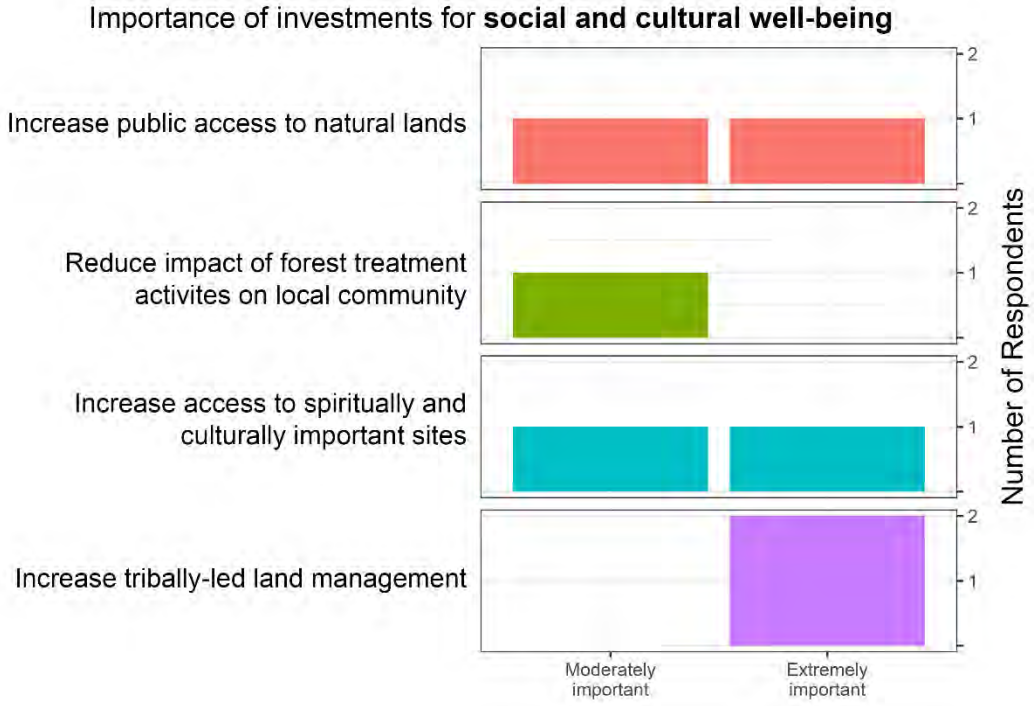


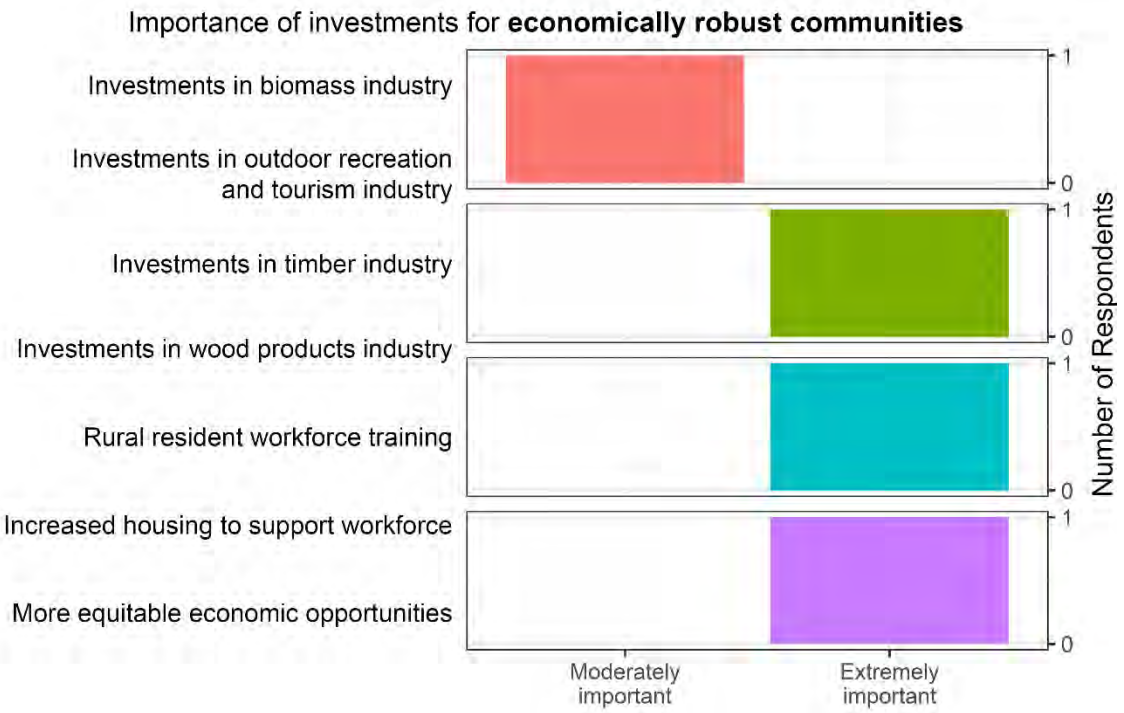


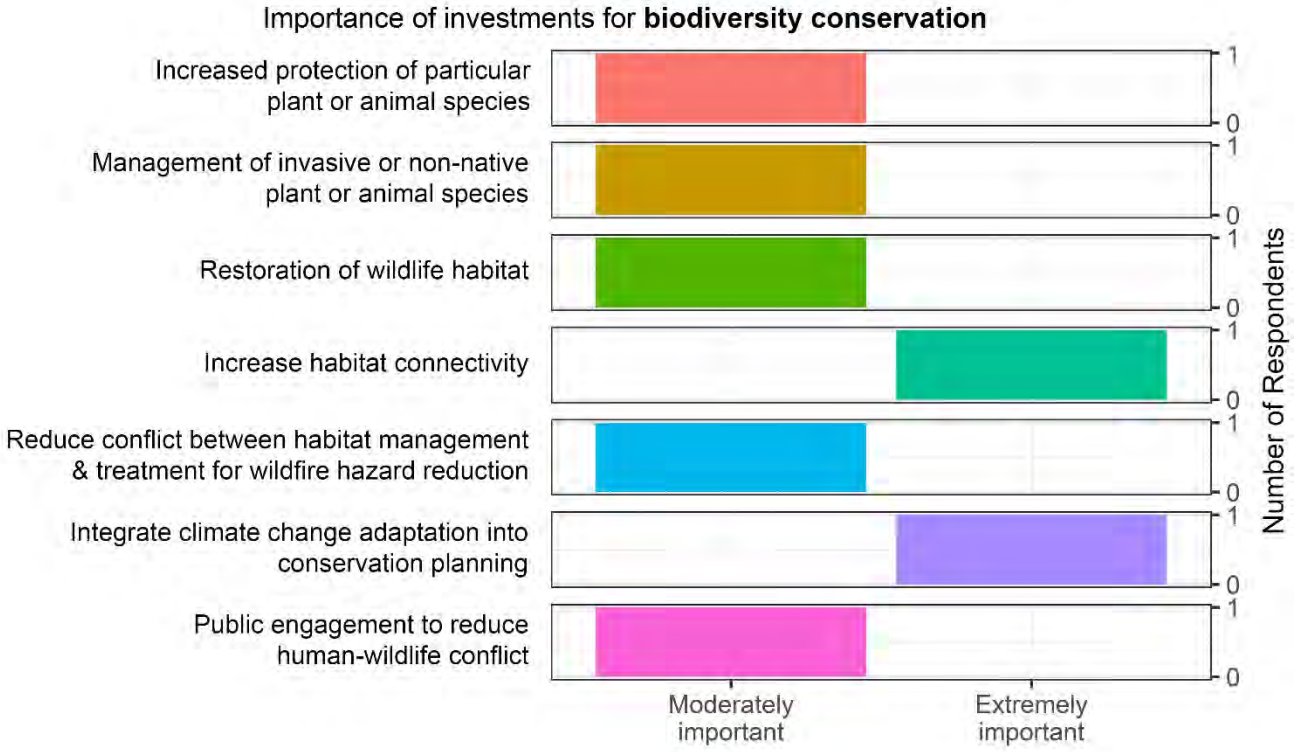

Importance of investments for **healthy and resilient shrublands**
Roadside ignition prevention
Utility hardening/undergrounding
Restrict public activities during peak fire weather to reduce ignitions
Increase wildland patroling capacity to reduce ignitions
Tree planting to create ember screen
Invasive plant species management
Restoration of disturbed or degraded habitat
Reduce conversion of natural lands
More efficient NEPA/CEQA process
Reduce regulatory barriers
Increase land management workforce capacity
Prescribed livestock grazing
2
1
Number of Respondents
Less important
Moderately important
Extremely important


Importance of investments for **carbon storage**
Reduce extent of high-severity fires (in forest ecosystems)
Reduce frequency of wildfire in shrubland ecosystems
Reduce land conversion to development
Increase capacity to convert biomass to sustainable wood products
Post-fire reforestation
1
0
Number of Respondents
Not important
Moderately important


Importance of investments for **fire safety and preparedness**
Reduce fuels loads to reduce hazard
Maintain strategic fuel breaks
Improve infrastructure for emergencies
Protect critical infrastructure
Protect specific cultural or ecological resources
Investments in home hardening and defensible space
Update building codes
Public engagement on emergency preparedness
Public engagement on preparing homes or private land
Public engagement on ignition reduction
Number of Respondents
2
1
Less important
Moderately important
Extremely important


Importance of investments for **social and cultural well-being**
Increase public access to natural lands
Reduce impact of forest treatment activites on local community
Increase access to spiritually and culturally important sites
Increase tribally-led land management
Number of Respondents
2
1
Moderately important
Extremely important


Importance of investments for **economically robust communities**
Investments in biomass industry
Investments in outdoor recreation and tourism industry
Investments in timber industry
Investments in wood products industry
Rural resident workforce training
Increased housing to support workforce
More equitable economic opportunities
Moderately important
Extremely important
Number of Respondents
0
1

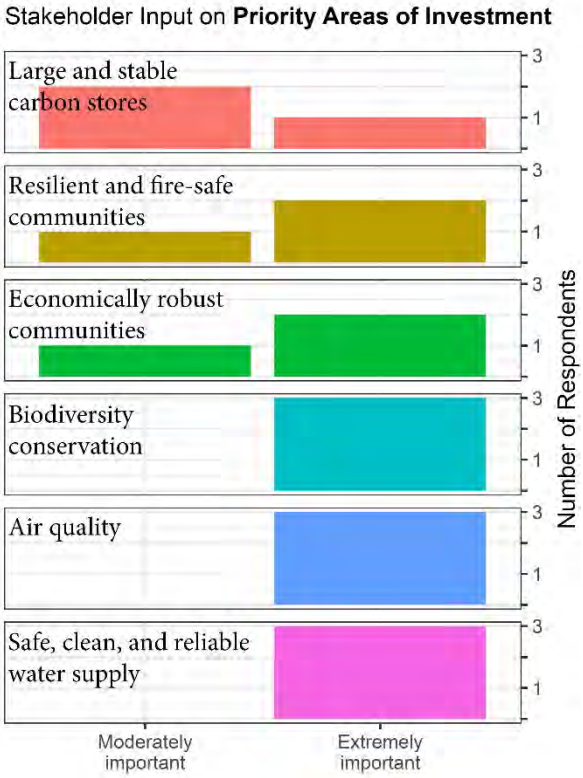

Importance of investments for **biodiversity conservation**
Increased protection of particular plant or animal species
Management of invasive or non-native plant or animal species
Restoration of wildlife habitat
Increase habitat connectivity
Reduce conflict between habitat management & treatment for wildfire hazard reduction
Integrate climate change adaptation into conservation planning
Public engagement to reduce human-wildlife conflict
Moderately important
Extremely important
Number of Respondents
0
1

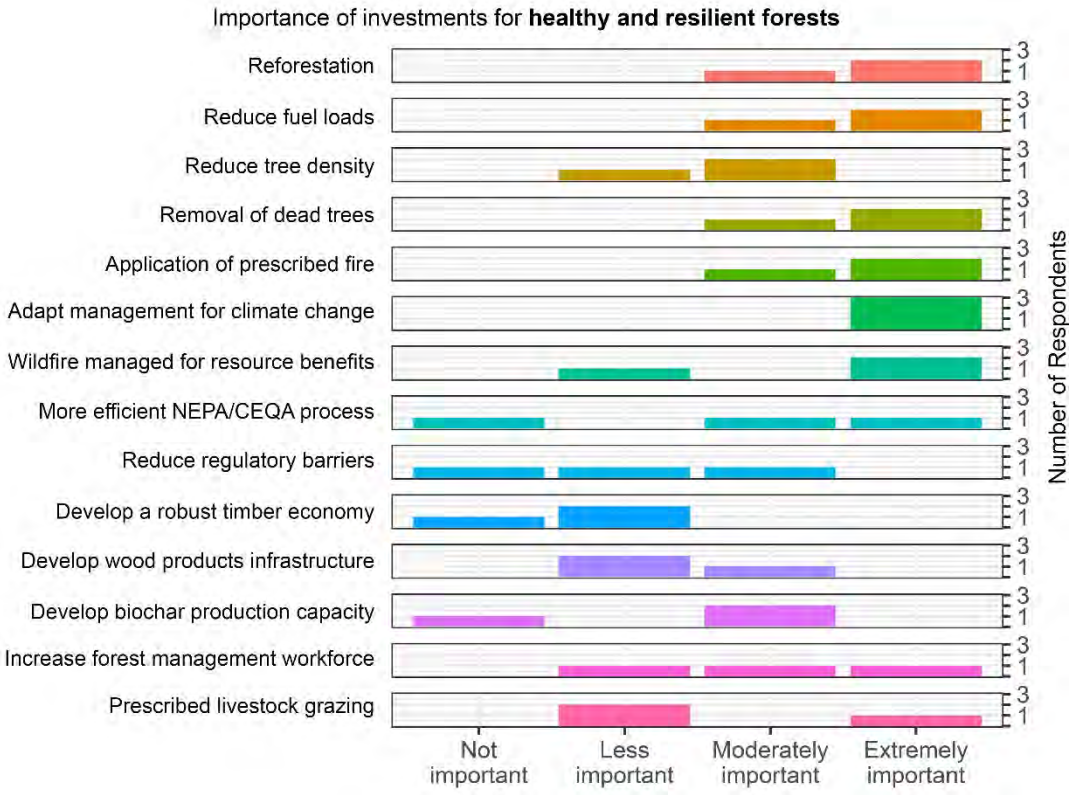
Please note: no survey participants responded to "Air quality" category for this county.

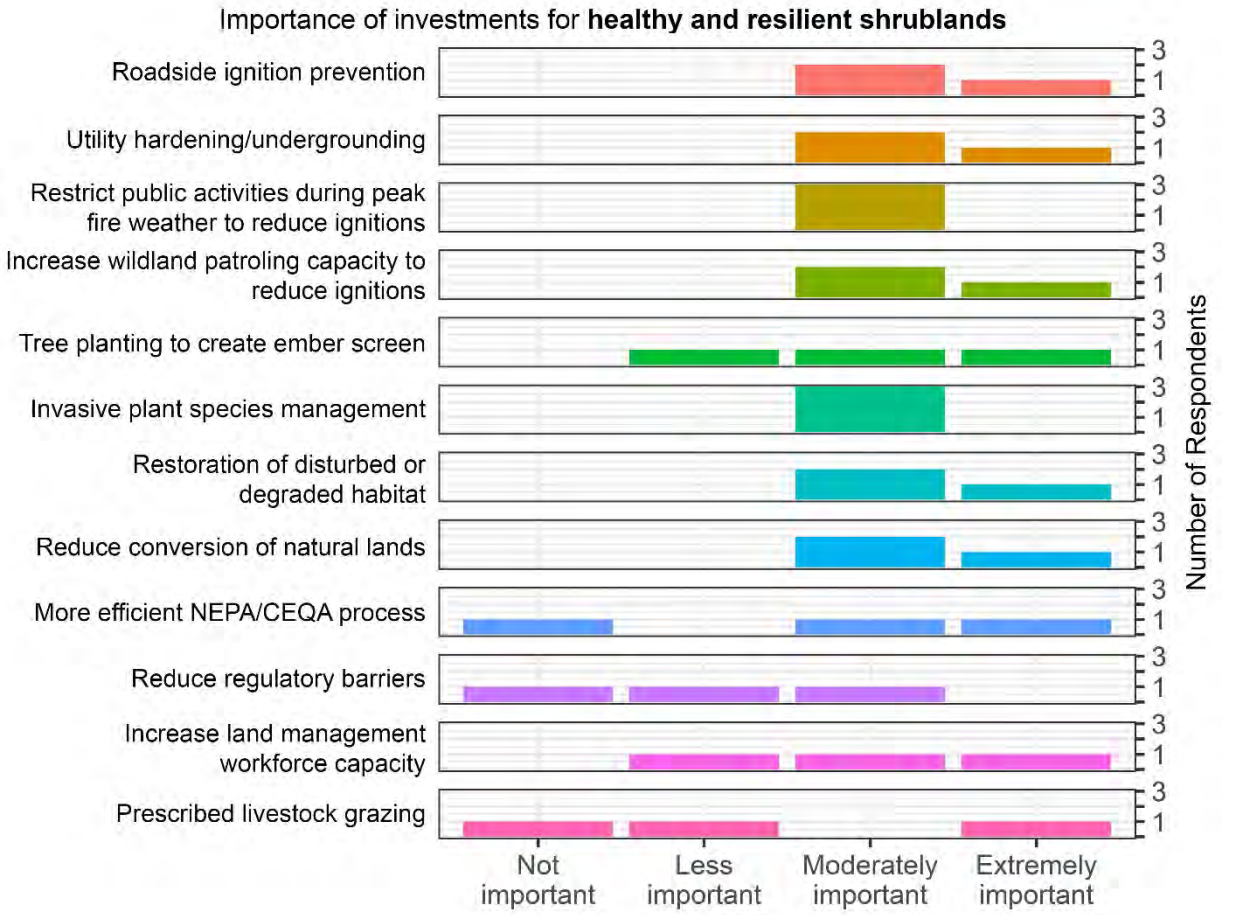
Please note: no survey participants responded to "Water Security" category for this county.

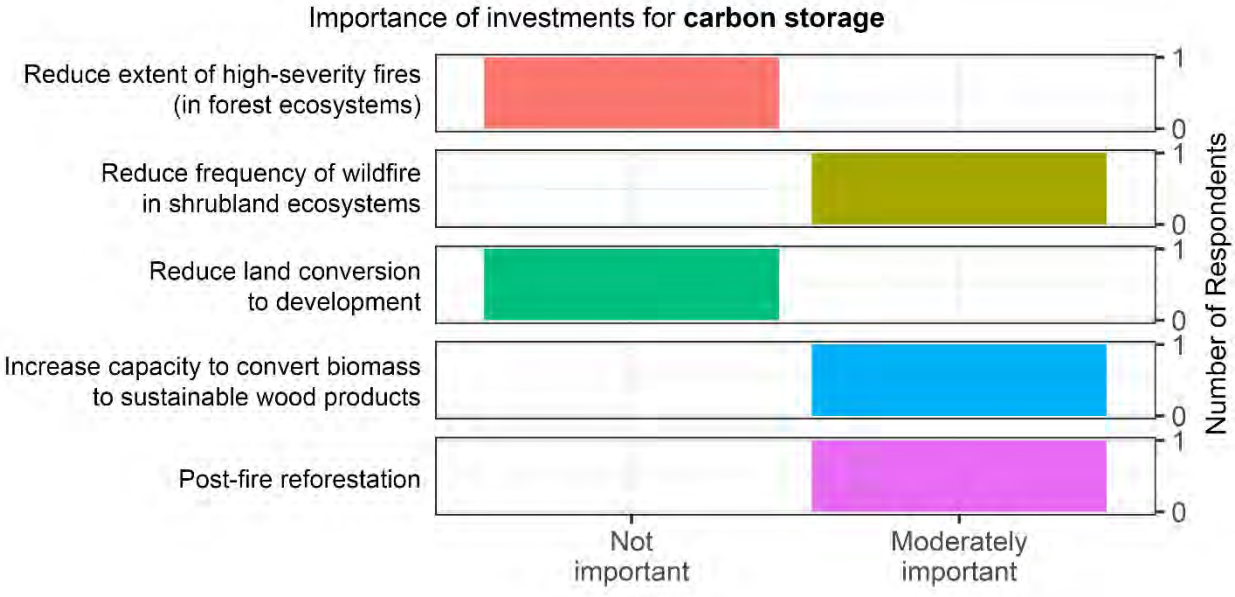
Central Coast Survey Results:

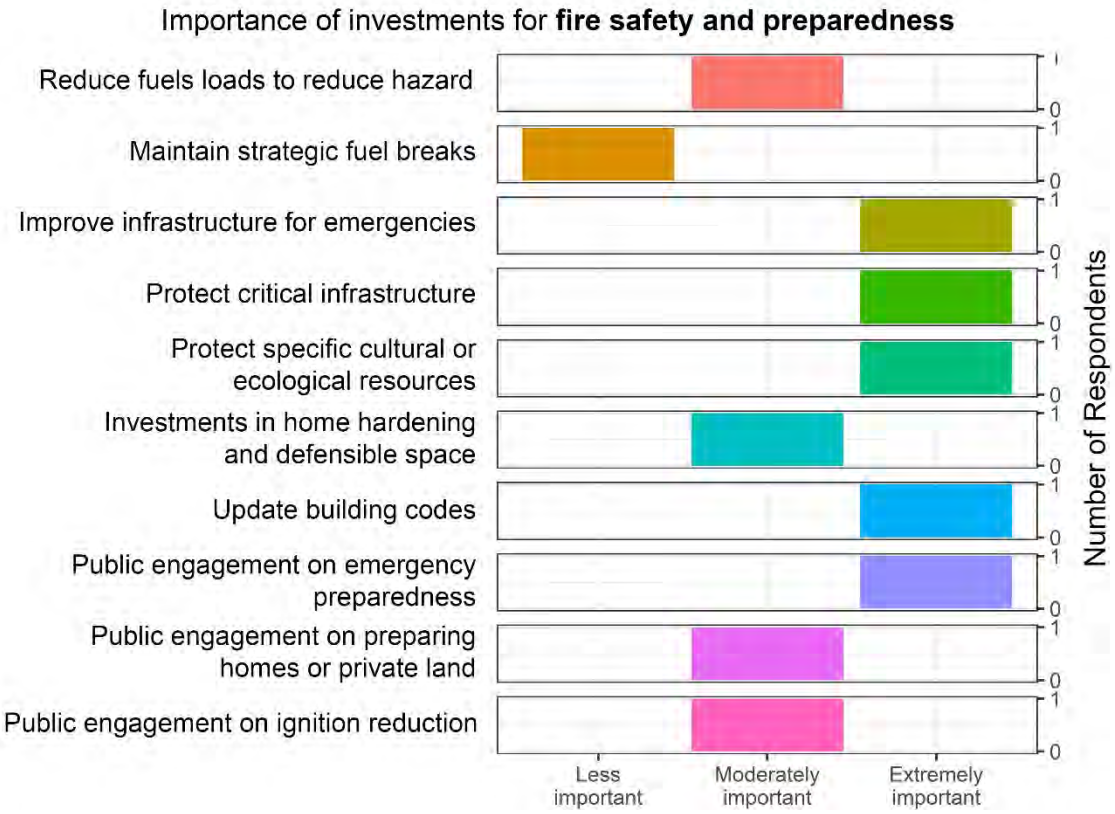
San Francisco County

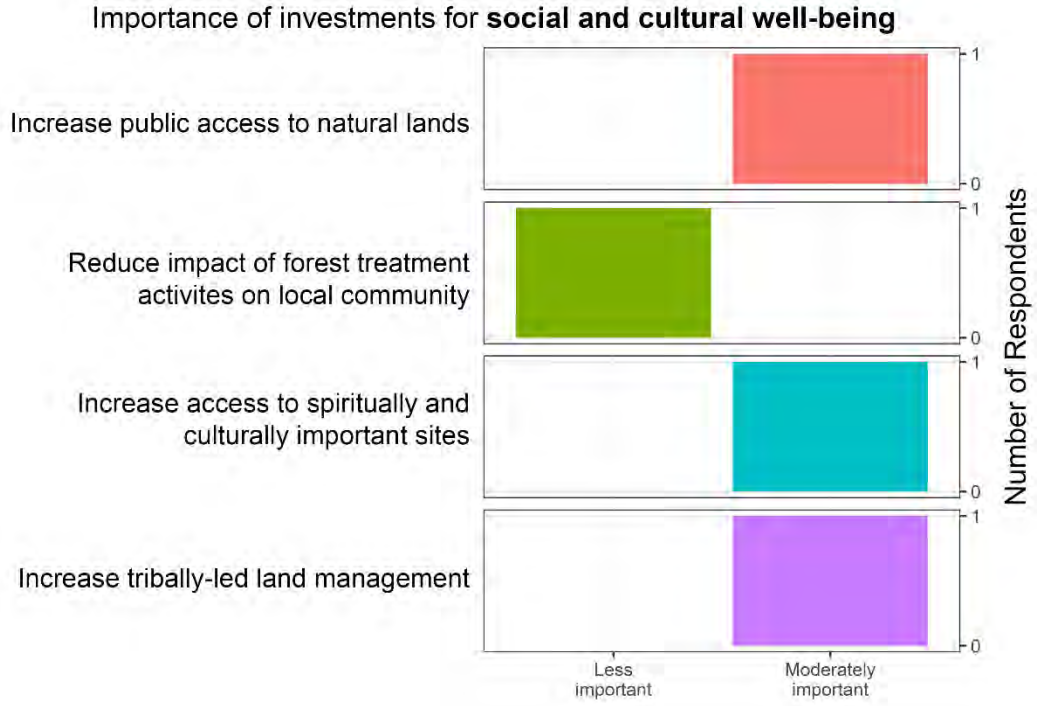





Importance of investments for **healthy and resilient shrublands**
Roadside ignition prevention
Utility hardening/undergrounding
Restrict public activities during peak fire weather to reduce ignitions
Increase wildland patroling capacity to reduce ignitions
Tree planting to create ember screen
Invasive plant species management
Restoration of disturbed or degraded habitat
Reduce conversion of natural lands
More efficient NEPA/CEQA process
Reduce regulatory barriers
Increase land management workforce capacity
Prescribed livestock grazing
3
1
Number of Respondents
Not important
Less important
Moderately important
Extremely important

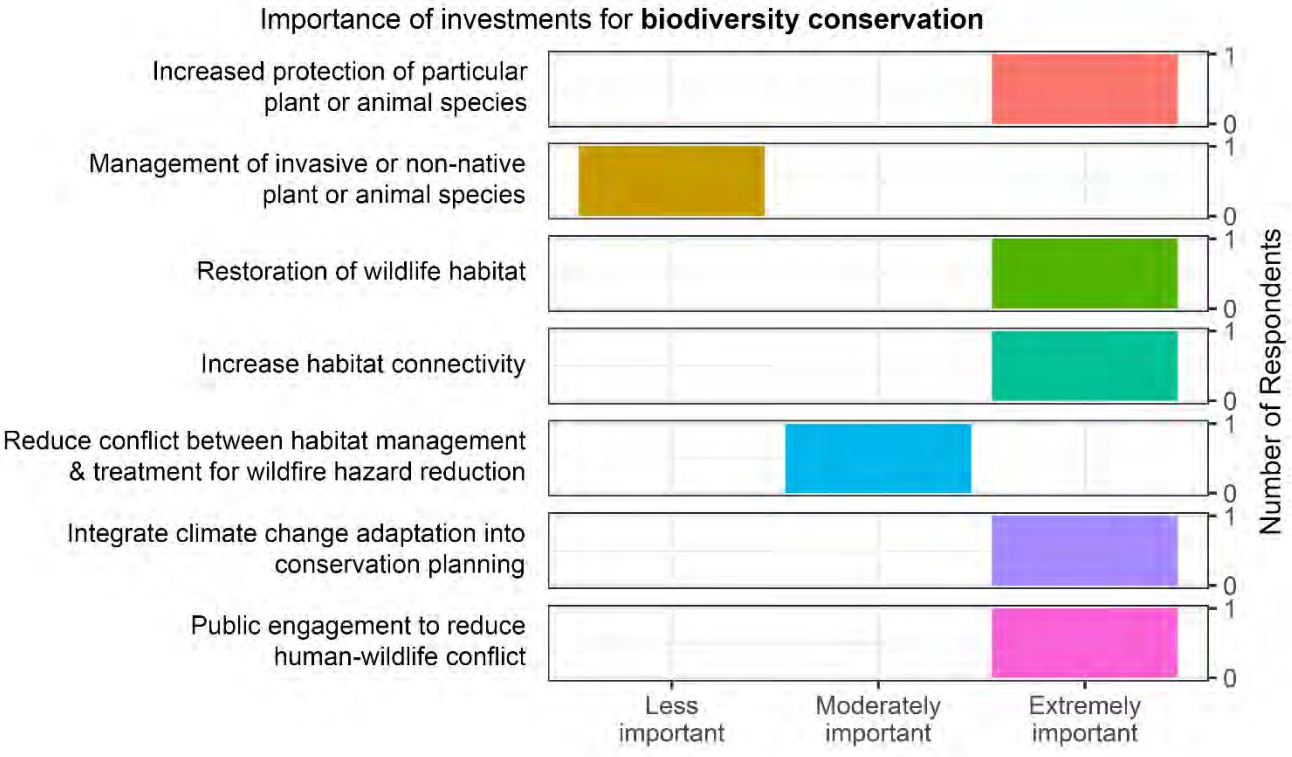

Importance of investments for **carbon storage**
Reduce extent of high-severity fires (in forest ecosystems)
Reduce frequency of wildfire in shrubland ecosystems
Reduce land conversion to development
Increase capacity to convert biomass to sustainable wood products
Post-fire reforestation
1
0
Number of Respondents
Not important
Moderately important

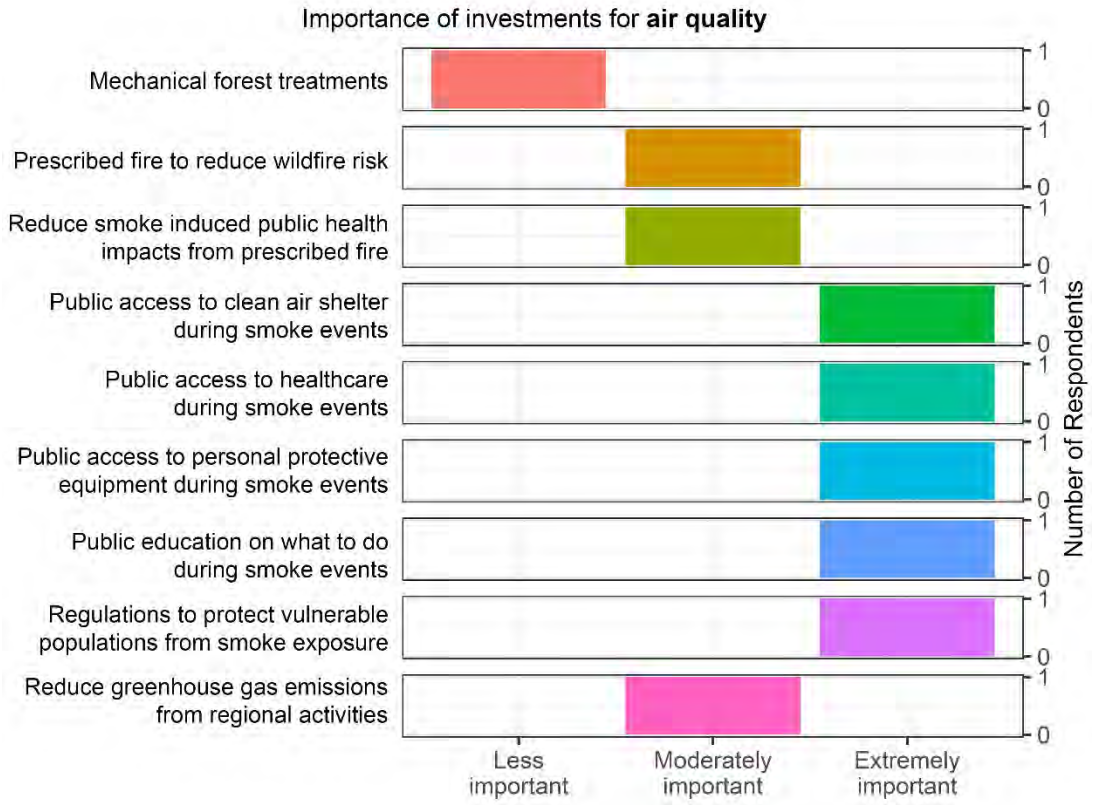

Importance of investments for **fire safety and preparedness**
Reduce fuels loads to reduce hazard
Maintain strategic fuel breaks
Improve infrastructure for emergencies
Protect critical infrastructure
Protect specific cultural or ecological resources
Investments in home hardening and defensible space
Update building codes
Public engagement on emergency preparedness
Public engagement on preparing homes or private land
Public engagement on ignition reduction
Less important
Moderately important
Extremely important
Number of Respondents

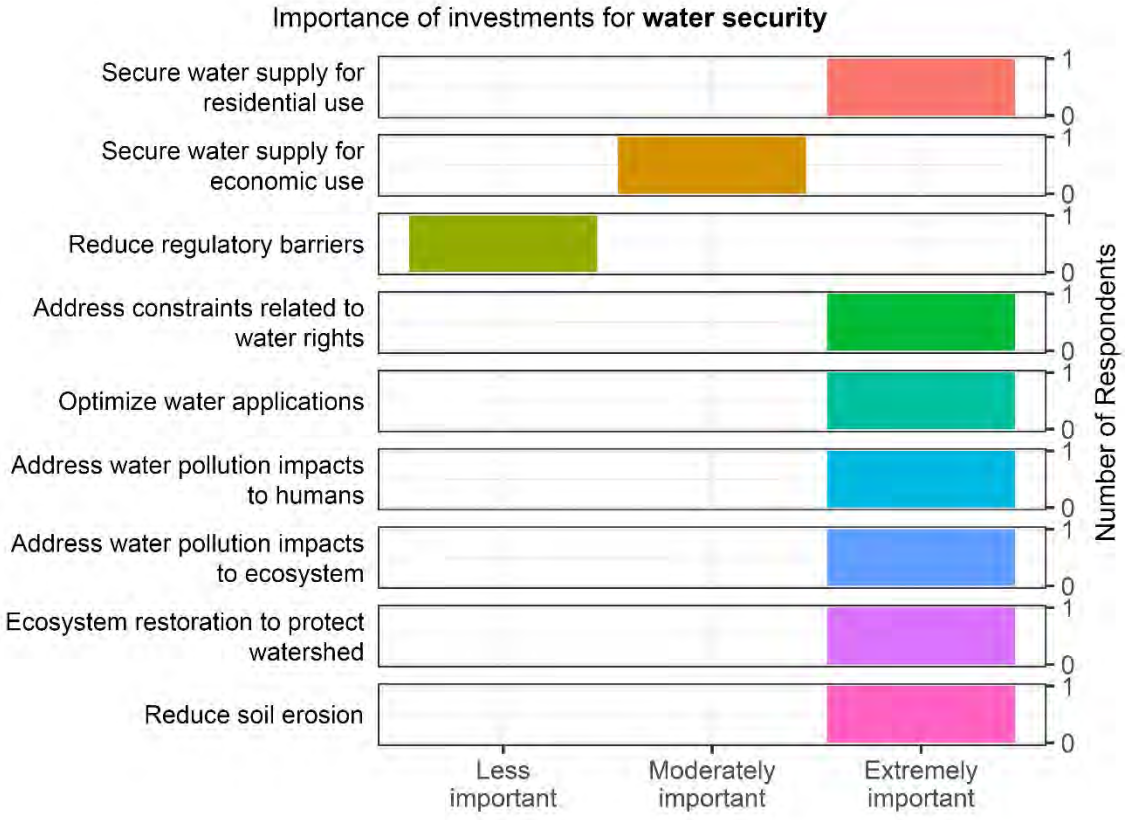

Importance of investments for **social and cultural well-being**
Increase public access to natural lands
Reduce impact of forest treatment activites on local community
Increase access to spiritually and culturally important sites
Increase tribally-led land management
Less important
Moderately important
Number of Respondents

Please note: no survey participants responded to

"Economically robust communities" category for this county.

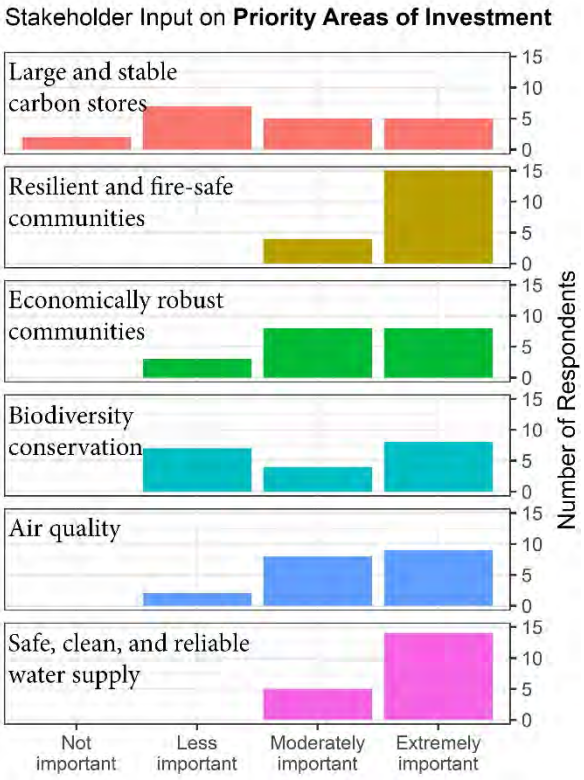


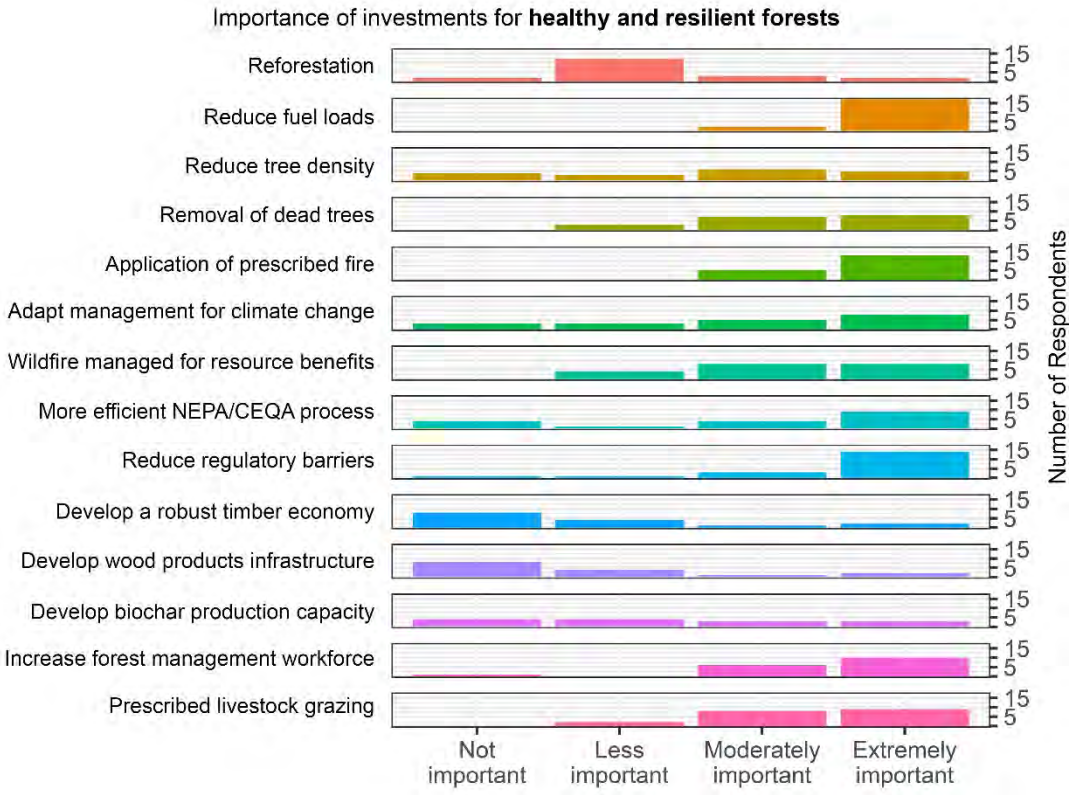

Importance of investments for **air quality**
Mechanical forest treatments
Prescribed fire to reduce wildfire risk
Reduce smoke induced public health impacts from prescribed fire
Public access to clean air shelter during smoke events
Public access to healthcare during smoke events
Public access to personal protective equipment during smoke events
Public education on what to do during smoke events
Regulations to protect vulnerable populations from smoke exposure
Reduce greenhouse gas emissions from regional activities
1
0
Number of Respondents
Less important
Moderately important
Extremely important

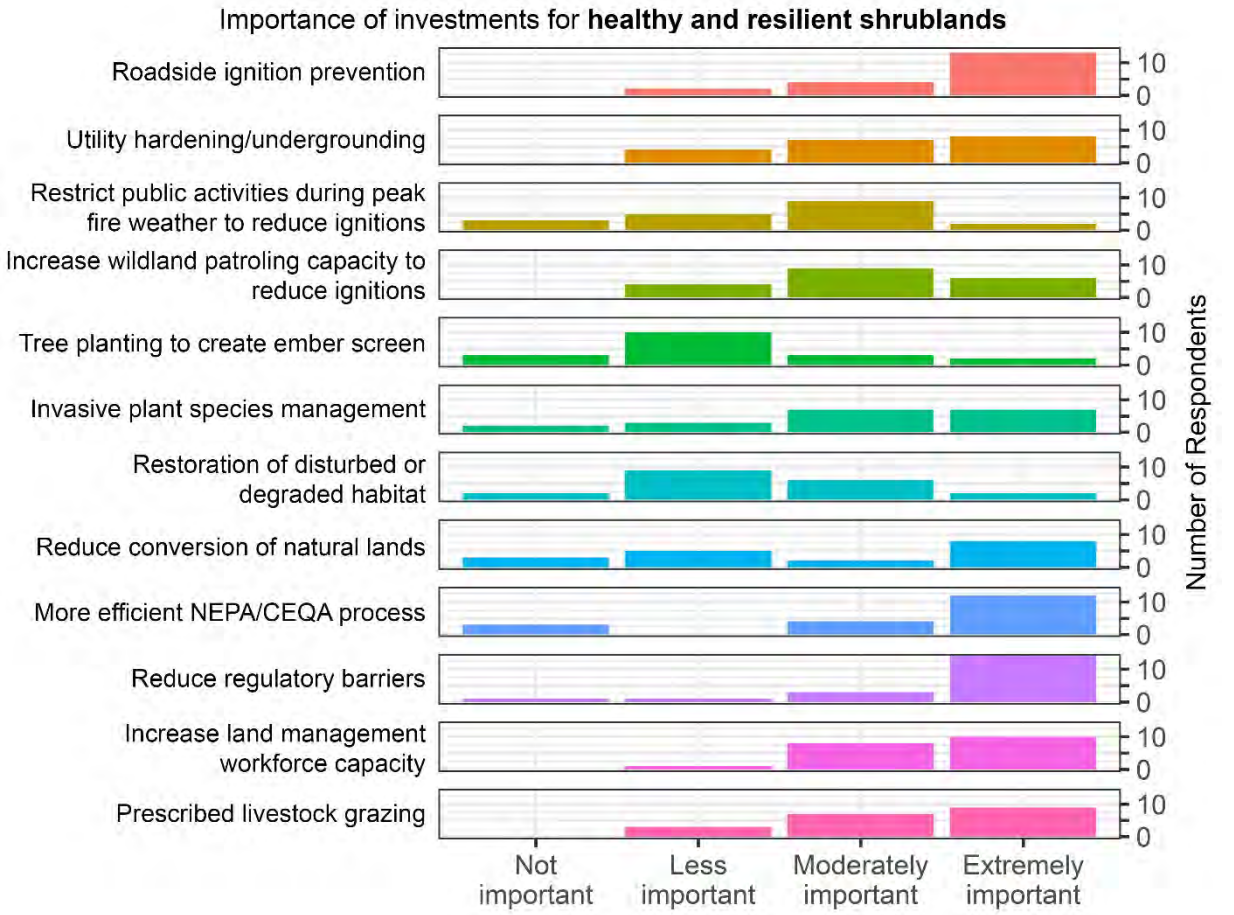

Importance of investments for **water security**
Secure water supply for residential use
Secure water supply for economic use
Reduce regulatory barriers
Address constraints related to water rights
Optimize water applications
Address water pollution impacts to humans
Address water pollution impacts to ecosystem
Ecosystem restoration to protect watershed
Reduce soil erosion
1
0
Number of Respondents
Less important
Moderately important
Extremely important

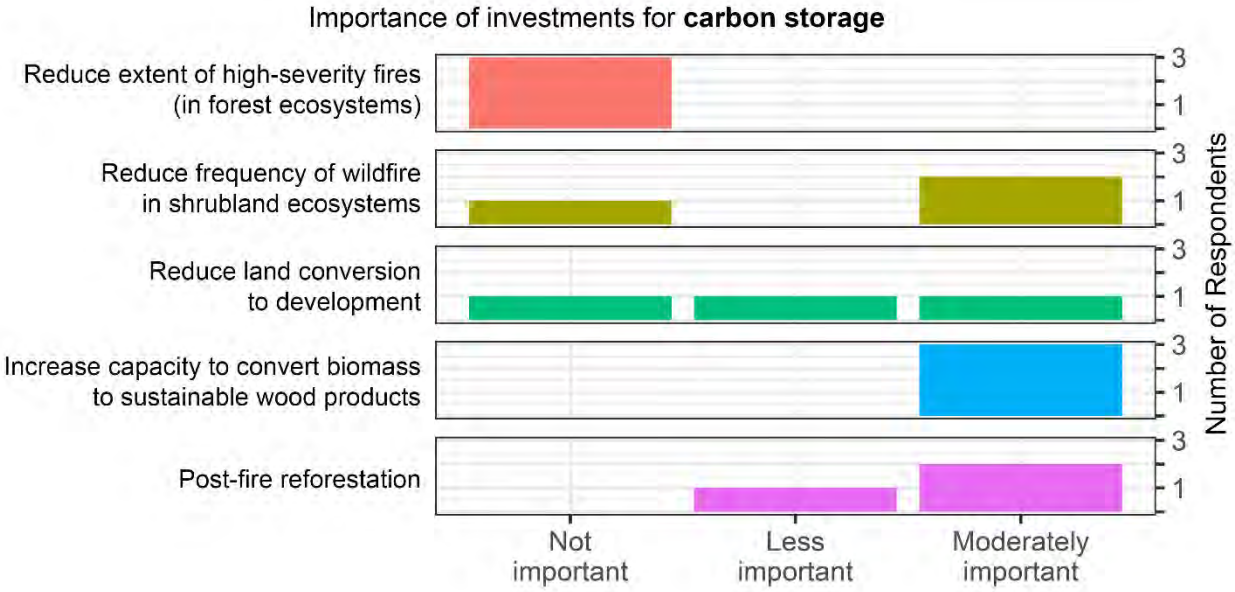
Central Coast Survey Results:

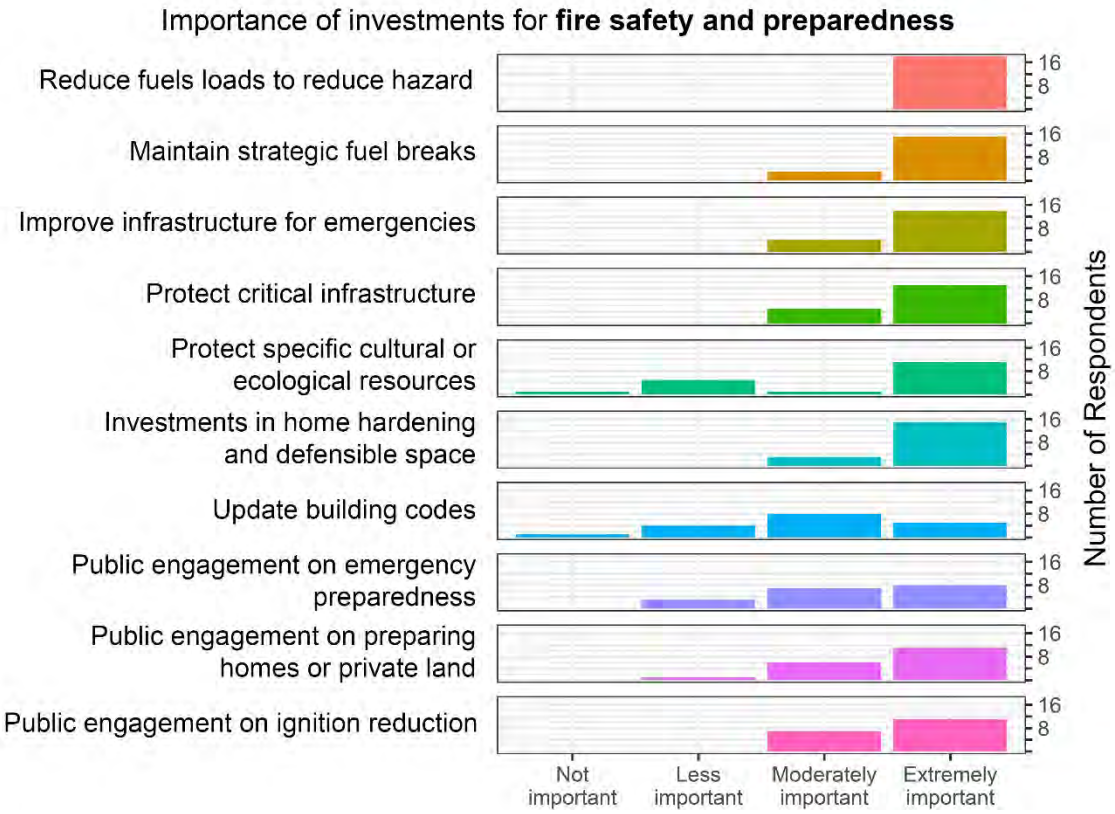
San Luis Obispo County

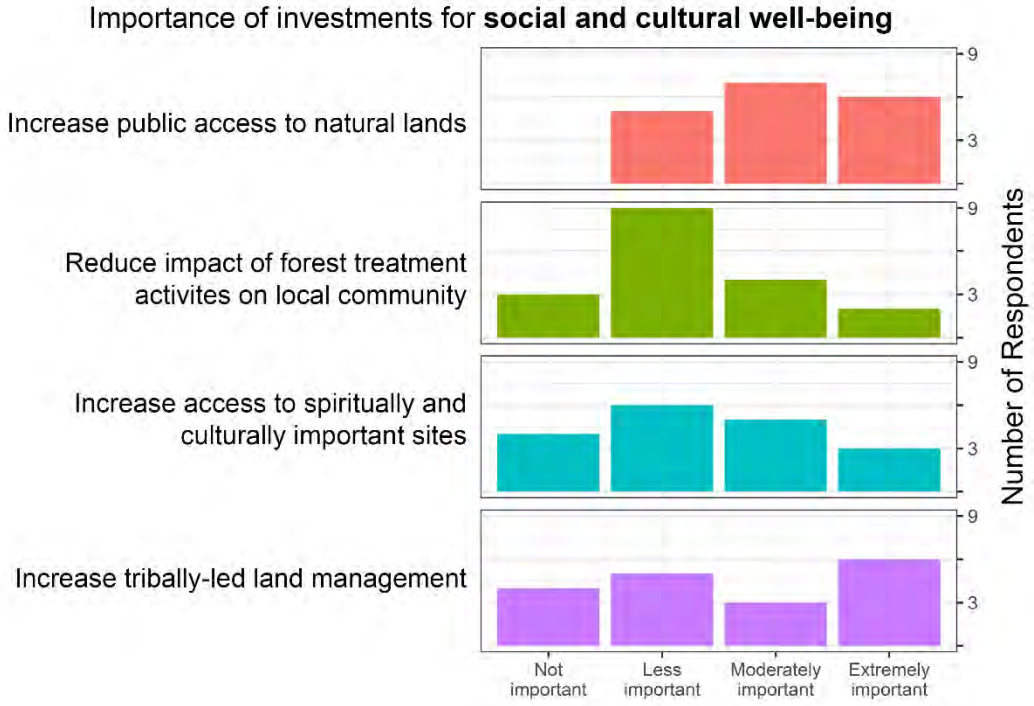


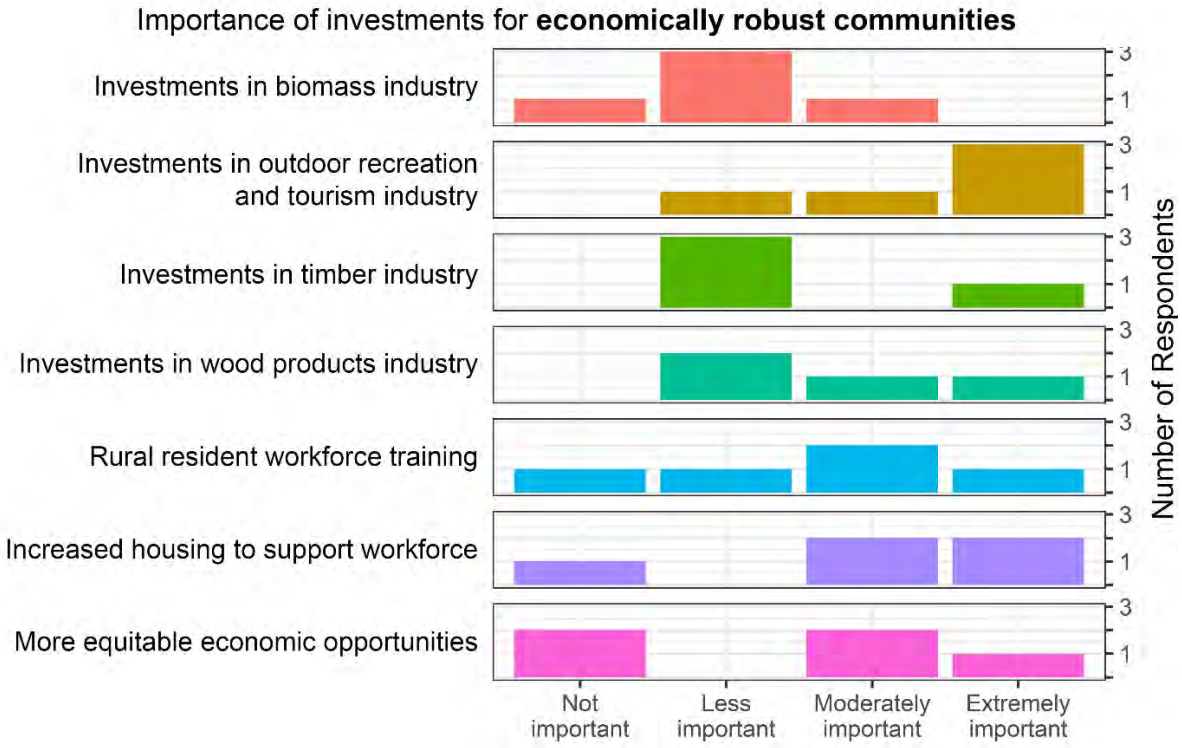


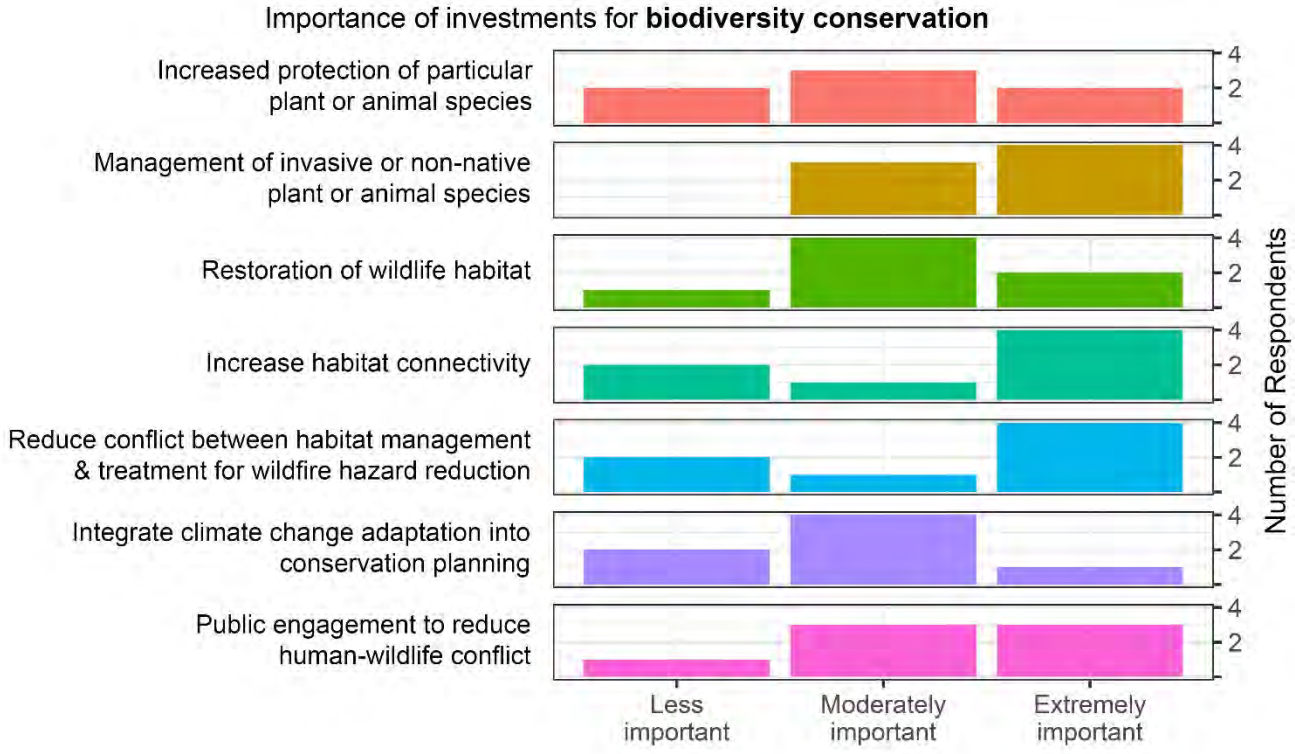

Importance of investments for **healthy and resilient shrublands**
Roadside ignition prevention
Utility hardening/undergrounding
Restrict public activities during peak fire weather to reduce ignitions
Increase wildland patroling capacity to reduce ignitions
Tree planting to create ember screen
Invasive plant species management
Restoration of disturbed or degraded habitat
Reduce conversion of natural lands
More efficient NEPA/CEQA process
Reduce regulatory barriers
Increase land management workforce capacity
Prescribed livestock grazing
10
0
Number of Respondents
Not important
Less important
Moderately important
Extremely important

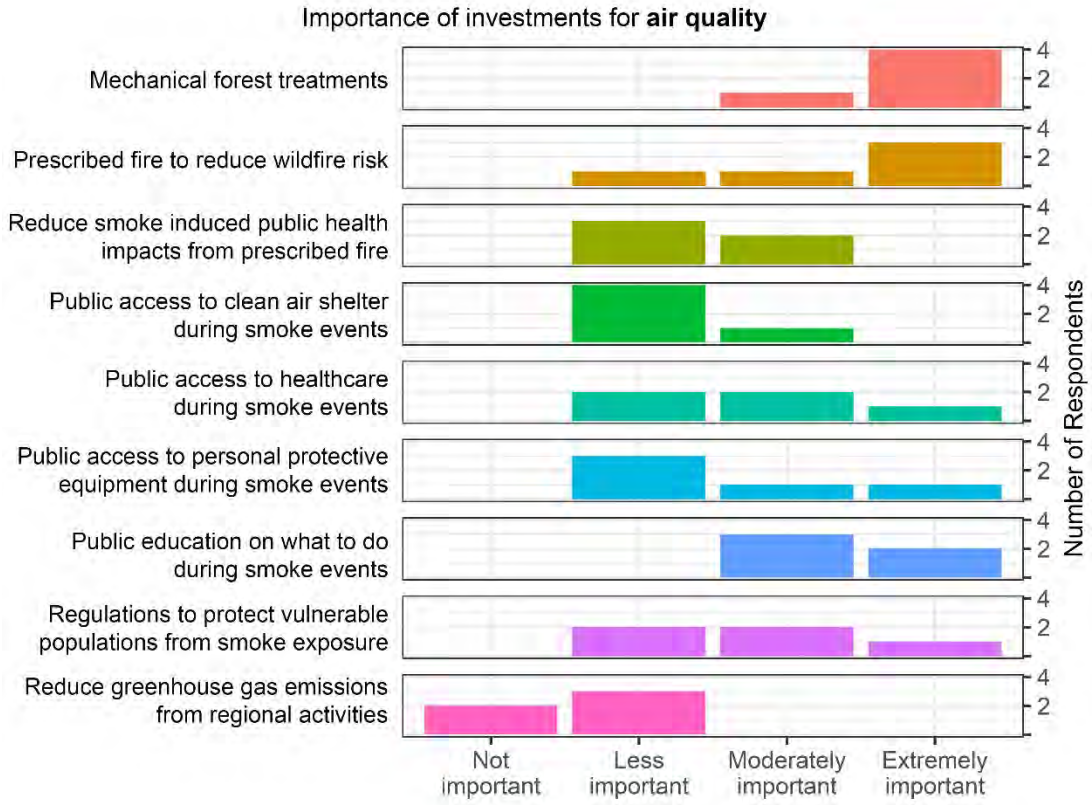

Importance of investments for **carbon storage**
Reduce extent of high-severity fires (in forest ecosystems)
Reduce frequency of wildfire in shrubland ecosystems
Reduce land conversion to development
Increase capacity to convert biomass to sustainable wood products
Post-fire reforestation
3
1
Number of Respondents
Not important
Less important
Moderately important

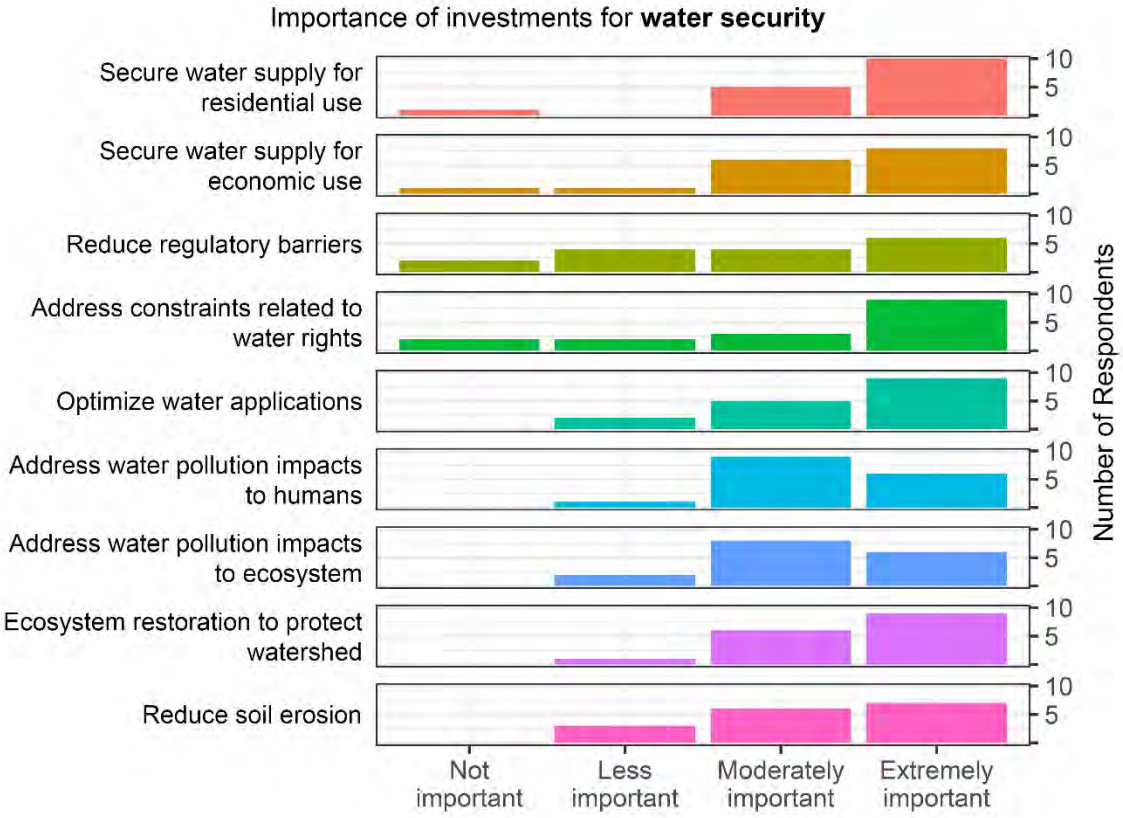

Importance of investments for **fire safety and preparedness**
Reduce fuels loads to reduce hazard
Maintain strategic fuel breaks
Improve infrastructure for emergencies
Protect critical infrastructure
Protect specific cultural or ecological resources
Investments in home hardening and defensible space
Update building codes
Public engagement on emergency preparedness
Public engagement on preparing homes or private land
Public engagement on ignition reduction
16
8
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **social and cultural well-being**
Increase public access to natural lands
Reduce impact of forest treatment activites on local community
Increase access to spiritually and culturally important sites
Increase tribally-led land management
9
3
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **economically robust communities**
Investments in biomass industry
Investments in outdoor recreation and tourism industry
Investments in timber industry
Investments in wood products industry
Rural resident workforce training
Increased housing to support workforce
More equitable economic opportunities
Number of Respondents
Not important
Less important
Moderately important
Extremely important

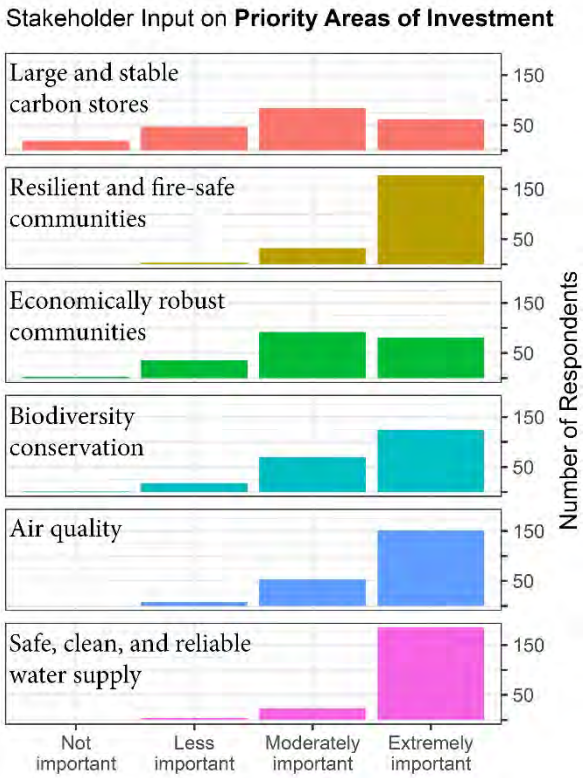

Importance of investments for **biodiversity conservation**
Increased protection of particular plant or animal species
Management of invasive or non-native plant or animal species
Restoration of wildlife habitat
Increase habitat connectivity
Reduce conflict between habitat management & treatment for wildfire hazard reduction
Integrate climate change adaptation into conservation planning
Public engagement to reduce human-wildlife conflict
Number of Respondents
Less important
Moderately important
Extremely important

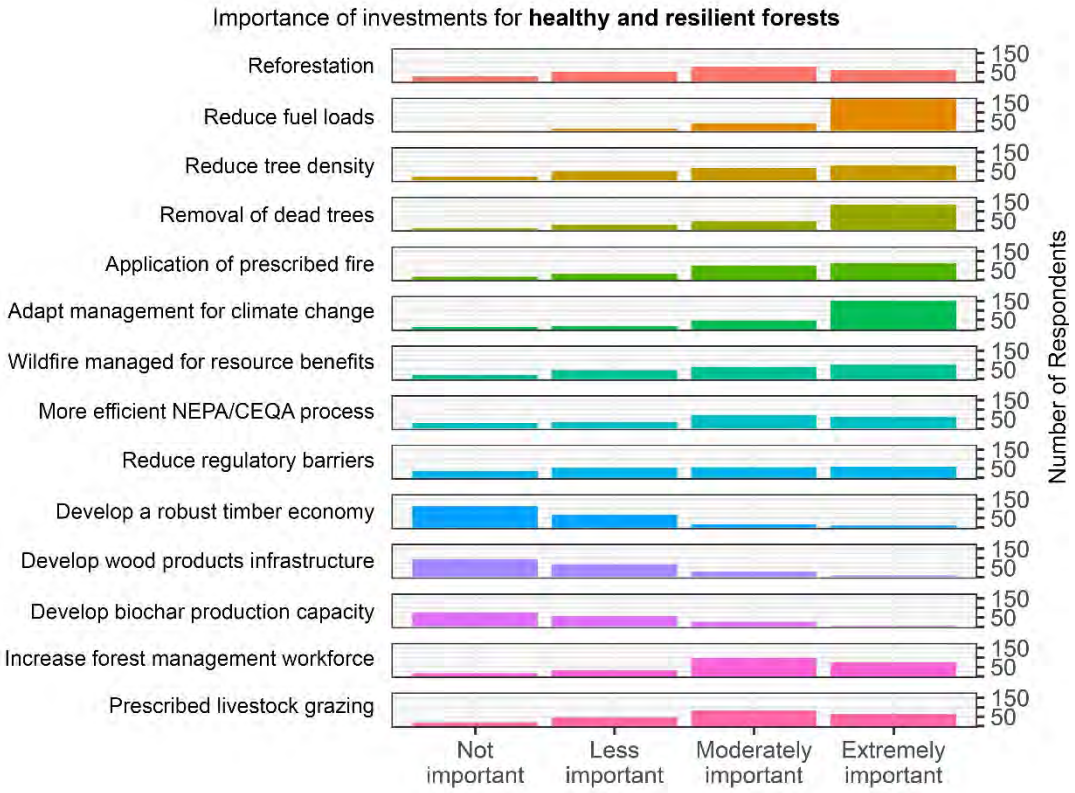

Importance of investments for **air quality**
Mechanical forest treatments
Prescribed fire to reduce wildfire risk
Reduce smoke induced public health impacts from prescribed fire
Public access to clean air shelter during smoke events
Public access to healthcare during smoke events
Public access to personal protective equipment during smoke events
Public education on what to do during smoke events
Regulations to protect vulnerable populations from smoke exposure
Reduce greenhouse gas emissions from regional activities
4
2
Number of Respondents
Not important
Less important
Moderately important
Extremely important

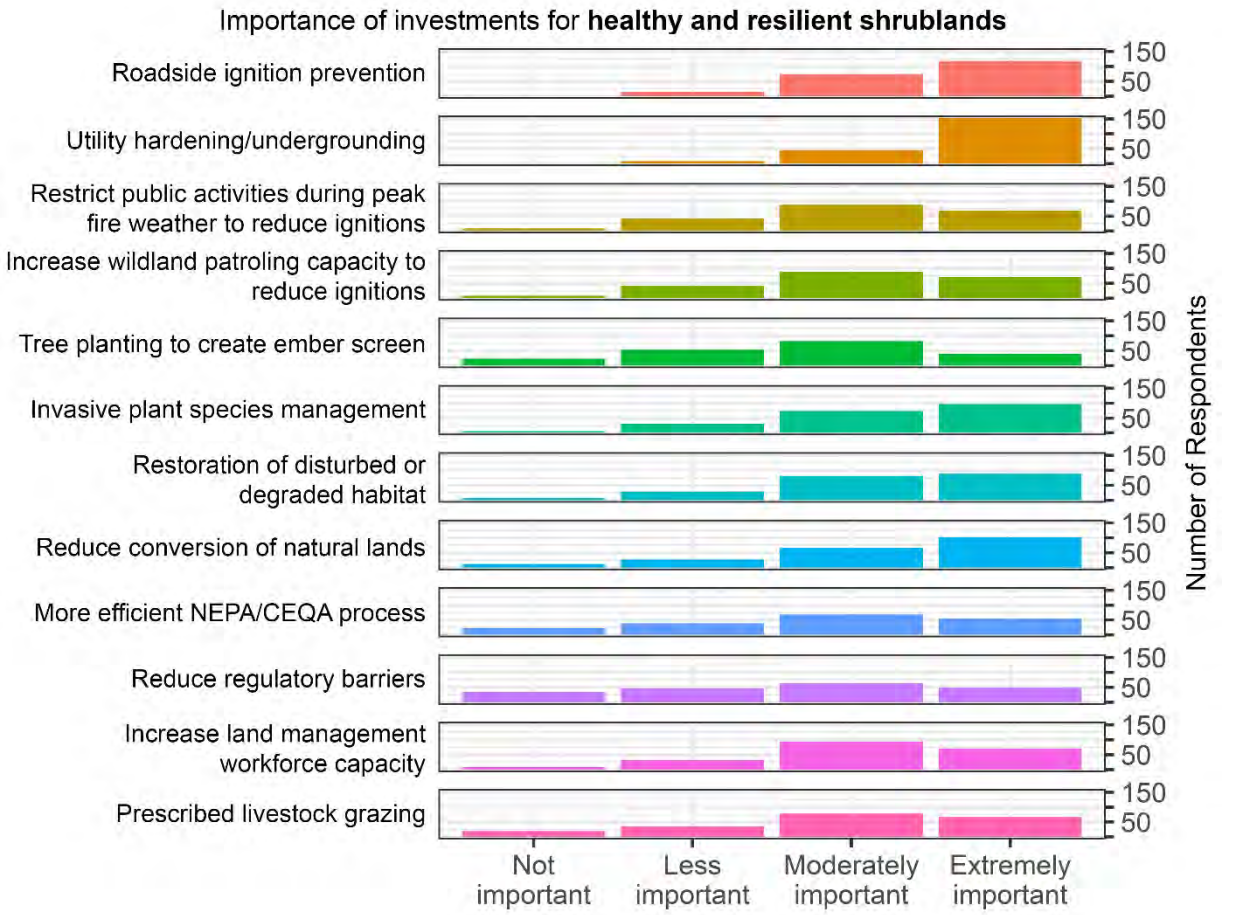

Importance of investments for **water security**
Secure water supply for residential use
Secure water supply for economic use
Reduce regulatory barriers
Address constraints related to water rights
Optimize water applications
Address water pollution impacts to humans
Address water pollution impacts to ecosystem
Ecosystem restoration to protect watershed
Reduce soil erosion
10
5
Number of Respondents
Not important
Less important
Moderately important
Extremely important

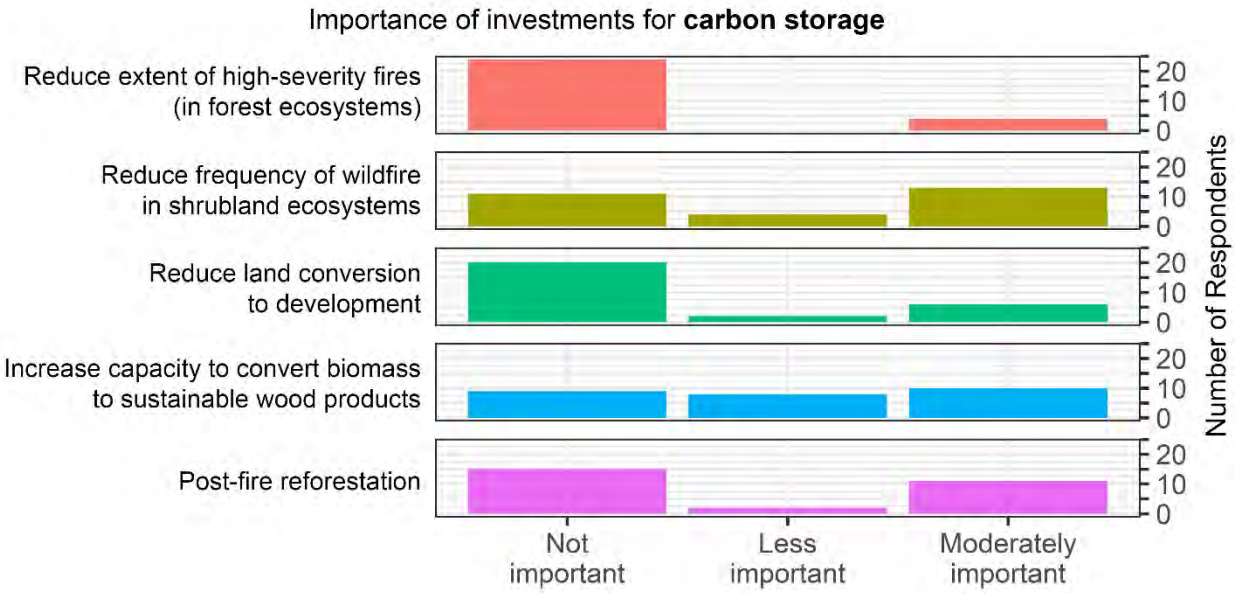
Central Coast Survey Results:

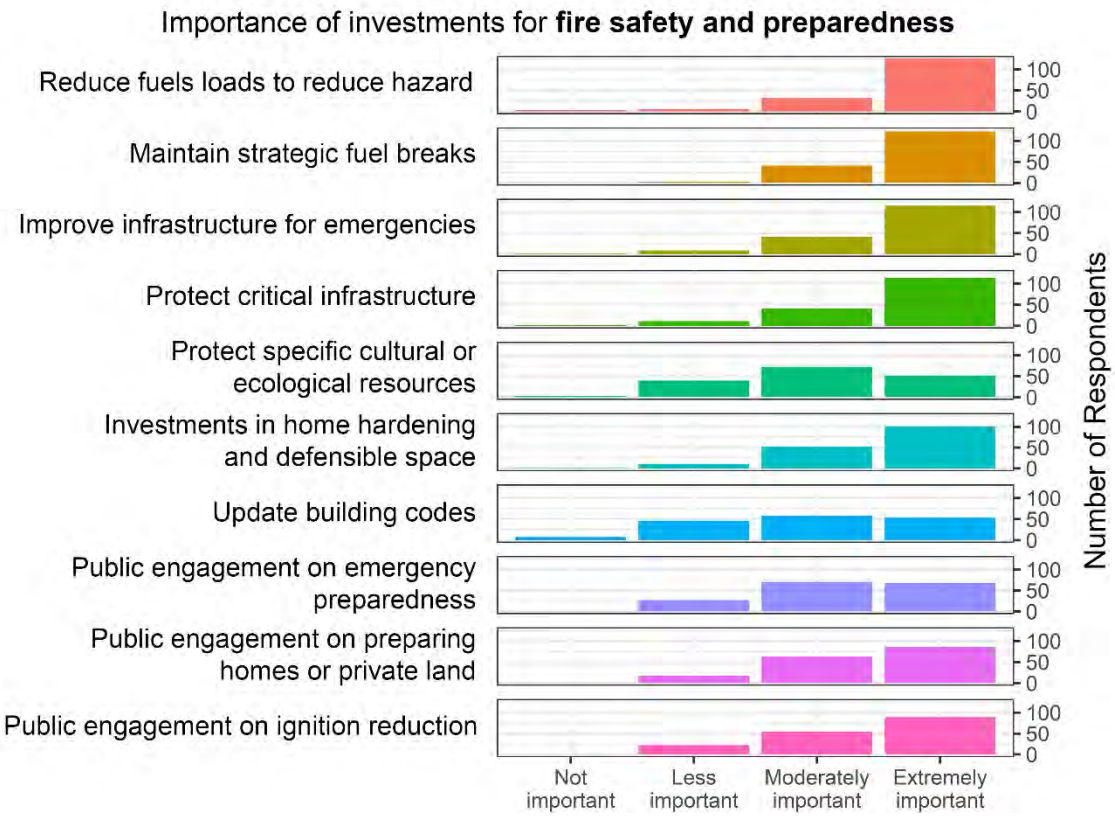
San Mateo County

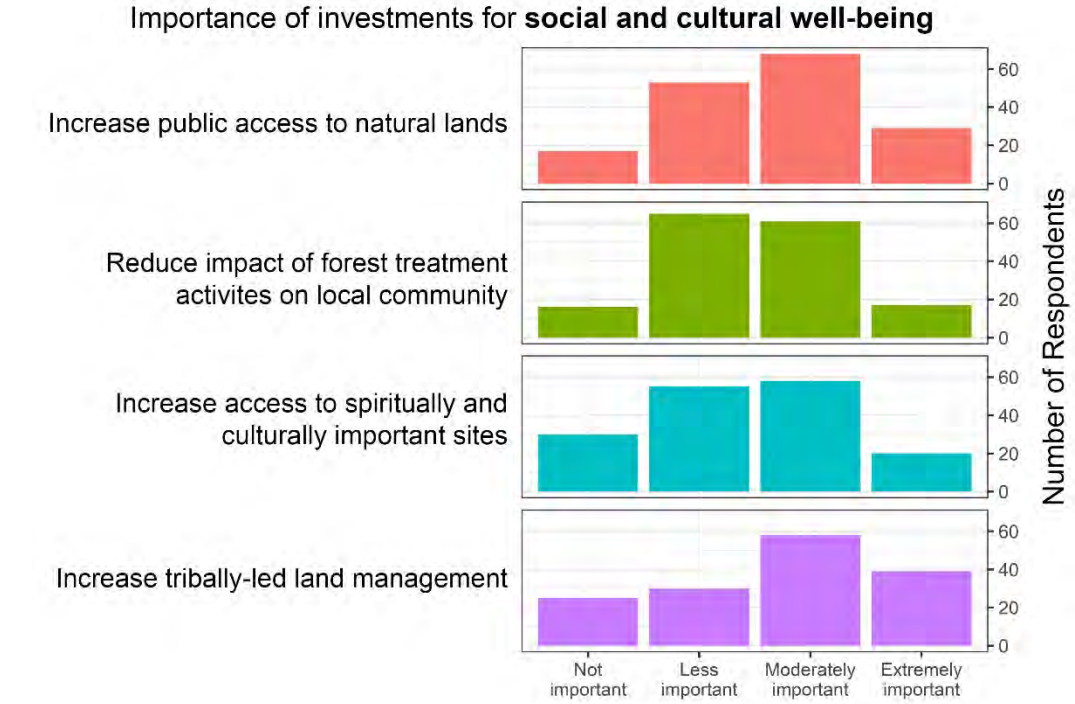


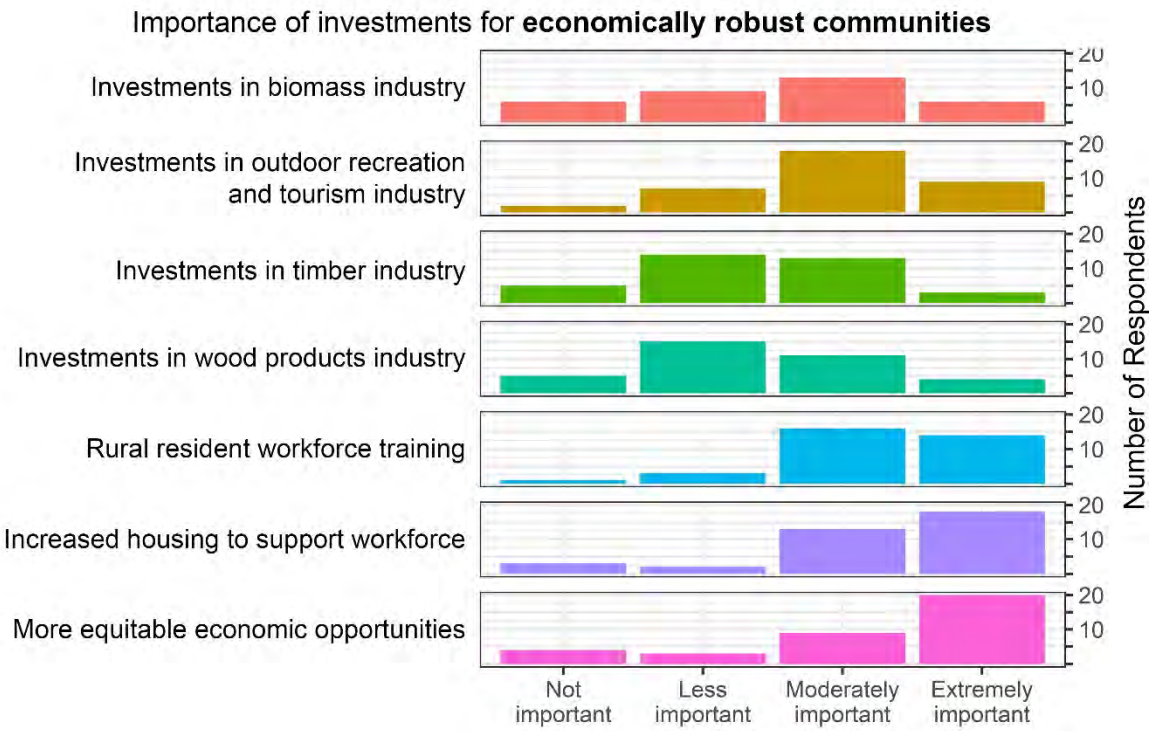


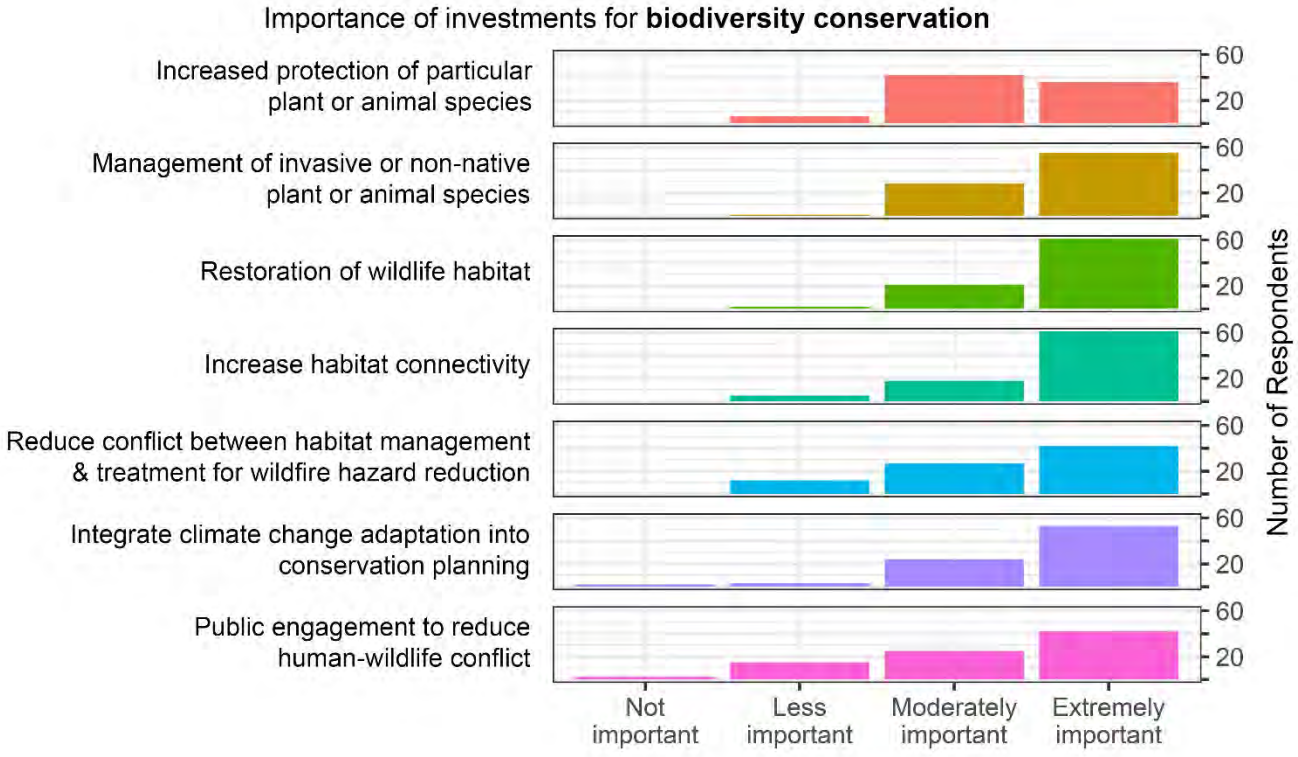

Importance of investments for **healthy and resilient shrublands**
Roadside ignition prevention
Utility hardening/undergrounding
Restrict public activities during peak fire weather to reduce ignitions
Increase wildland patroling capacity to reduce ignitions
Tree planting to create ember screen
Invasive plant species management
Restoration of disturbed or degraded habitat
Reduce conversion of natural lands
More efficient NEPA/CEQA process
Reduce regulatory barriers
Increase land management workforce capacity
Prescribed livestock grazing
150
50
Number of Respondents
Not important
Less important
Moderately important
Extremely important

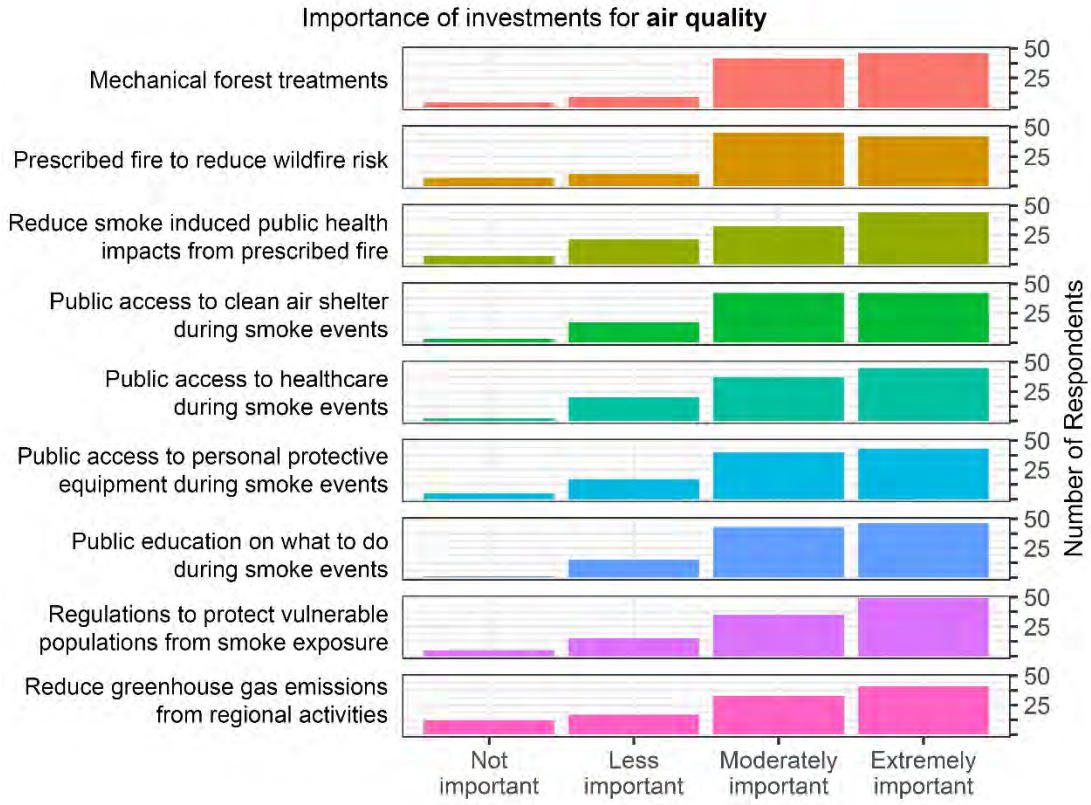

Importance of investments for **carbon storage**
Reduce extent of high-severity fires (in forest ecosystems)
Reduce frequency of wildfire in shrubland ecosystems
Reduce land conversion to development
Increase capacity to convert biomass to sustainable wood products
Post-fire reforestation
20
10
0
Number of Respondents
Not important
Less important
Moderately important

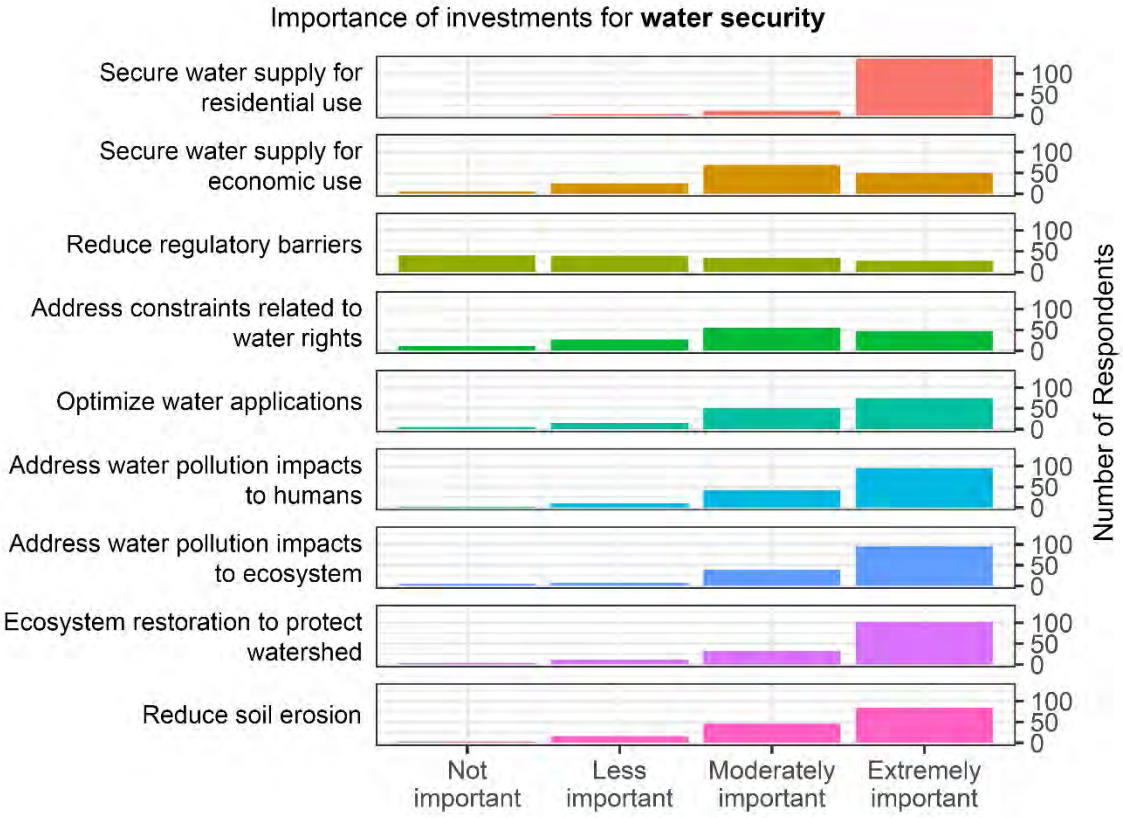

Importance of investments for **fire safety and preparedness**
Reduce fuels loads to reduce hazard
Maintain strategic fuel breaks
Improve infrastructure for emergencies
Protect critical infrastructure
Protect specific cultural or ecological resources
Investments in home hardening and defensible space
Update building codes
Public engagement on emergency preparedness
Public engagement on preparing homes or private land
Public engagement on ignition reduction
100
50
0
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **social and cultural well-being**
Increase public access to natural lands
Reduce impact of forest treatment activites on local community
Increase access to spiritually and culturally important sites
Increase tribally-led land management
60
40
20
0
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **economically robust communities**
Investments in biomass industry
Investments in outdoor recreation and tourism industry
Investments in timber industry
Investments in wood products industry
Rural resident workforce training
Increased housing to support workforce
More equitable economic opportunities
20
10
Number of Respondents
Not important
Less important
Moderately important
Extremely important

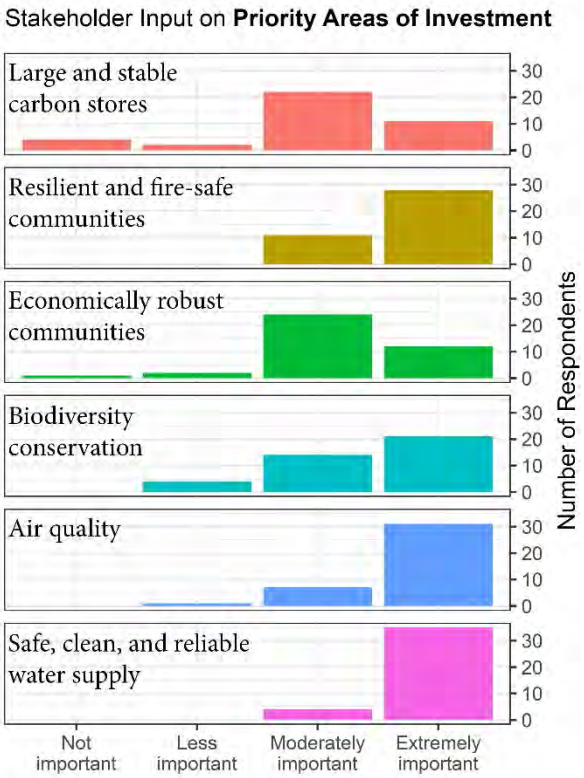

Importance of investments for **biodiversity conservation**
Increased protection of particular plant or animal species
Management of invasive or non-native plant or animal species
Restoration of wildlife habitat
Increase habitat connectivity
Reduce conflict between habitat management & treatment for wildfire hazard reduction
Integrate climate change adaptation into conservation planning
Public engagement to reduce human-wildlife conflict
60
20
Number of Respondents
Not important
Less important
Moderately important
Extremely important

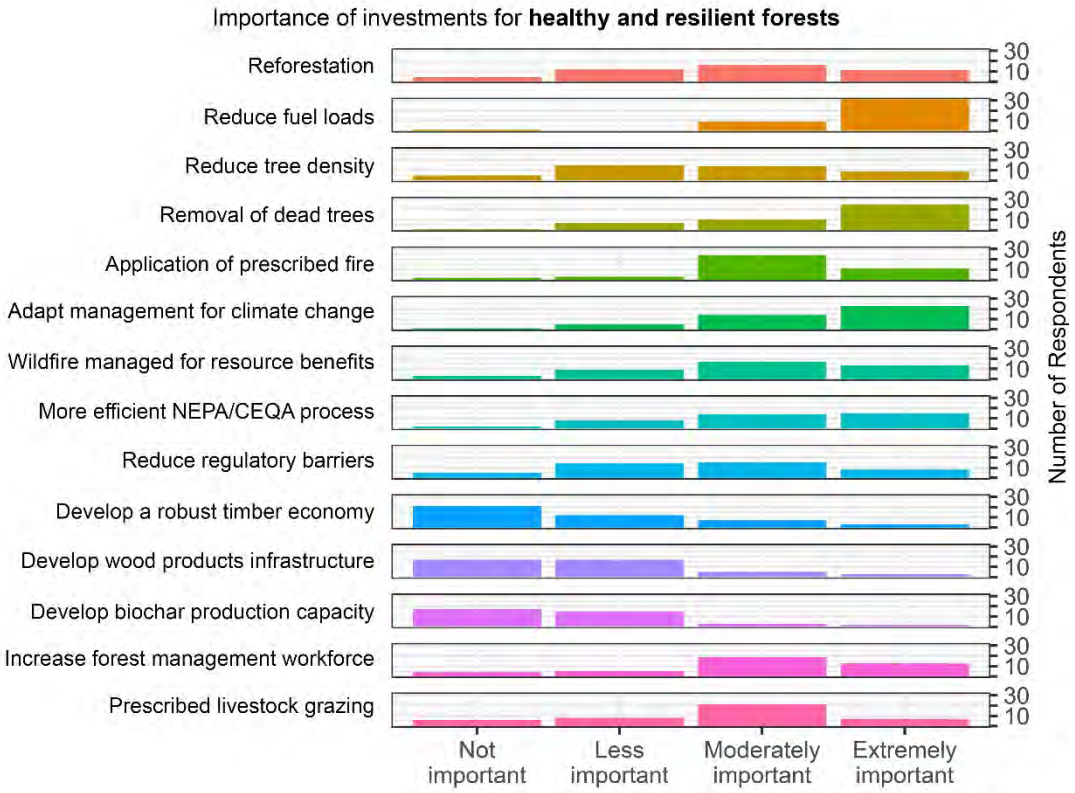

Importance of investments for **air quality**
Mechanical forest treatments
Prescribed fire to reduce wildfire risk
Reduce smoke induced public health impacts from prescribed fire
Public access to clean air shelter during smoke events
Public access to healthcare during smoke events
Public access to personal protective equipment during smoke events
Public education on what to do during smoke events
Regulations to protect vulnerable populations from smoke exposure
Reduce greenhouse gas emissions from regional activities
50
25
Number of Respondents
Not important
Less important
Moderately important
Extremely important

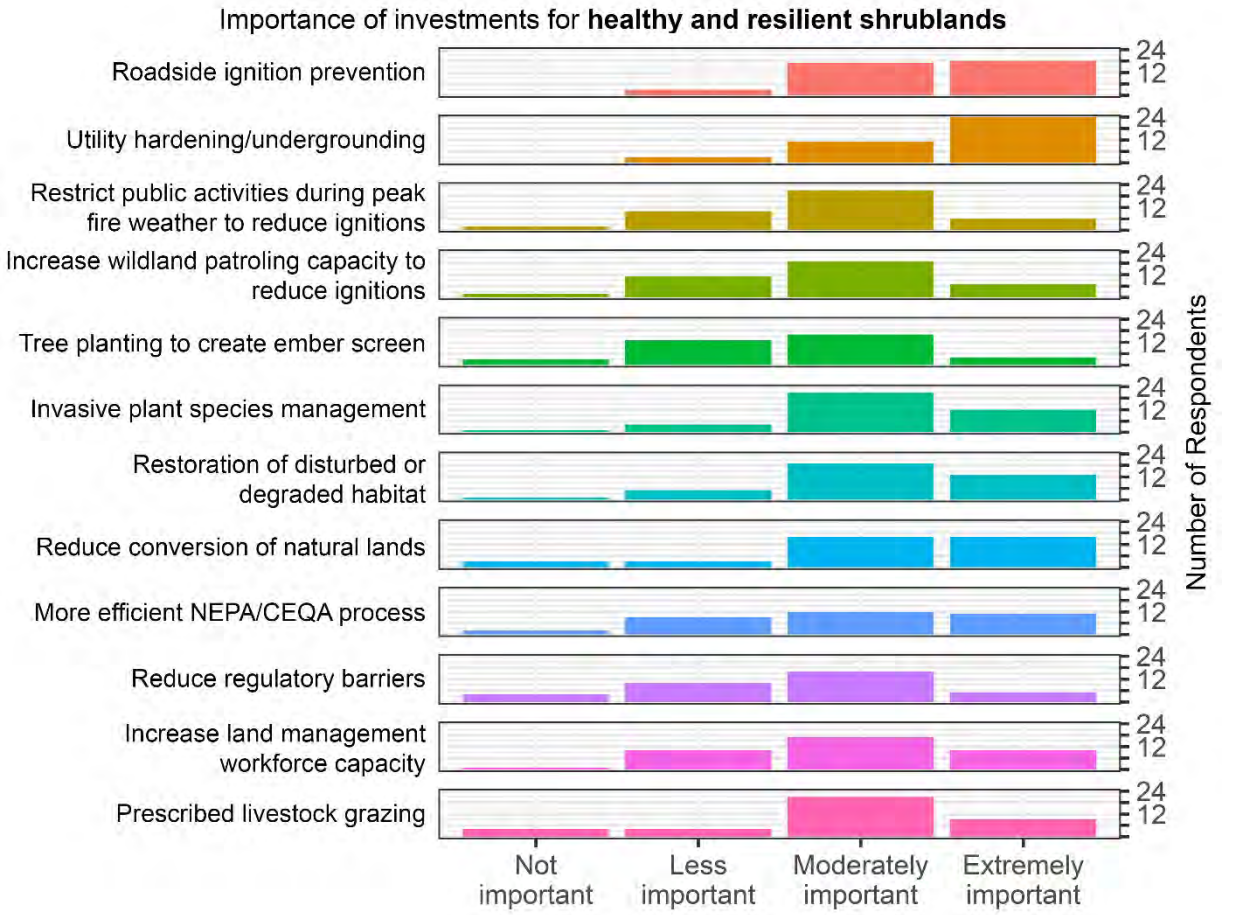

Importance of investments for **water security**
Secure water supply for residential use
Secure water supply for economic use
Reduce regulatory barriers
Address constraints related to water rights
Optimize water applications
Address water pollution impacts to humans
Address water pollution impacts to ecosystem
Ecosystem restoration to protect watershed
Reduce soil erosion
100
50
0
Number of Respondents
Not important
Less important
Moderately important
Extremely important

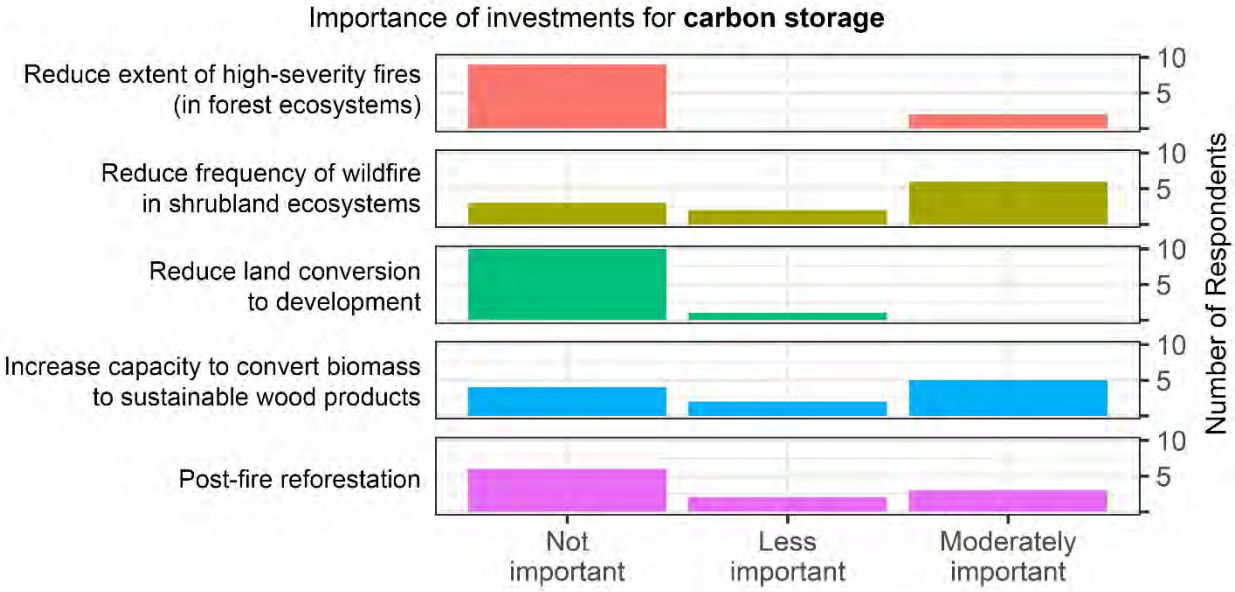
Central Coast Survey Results:

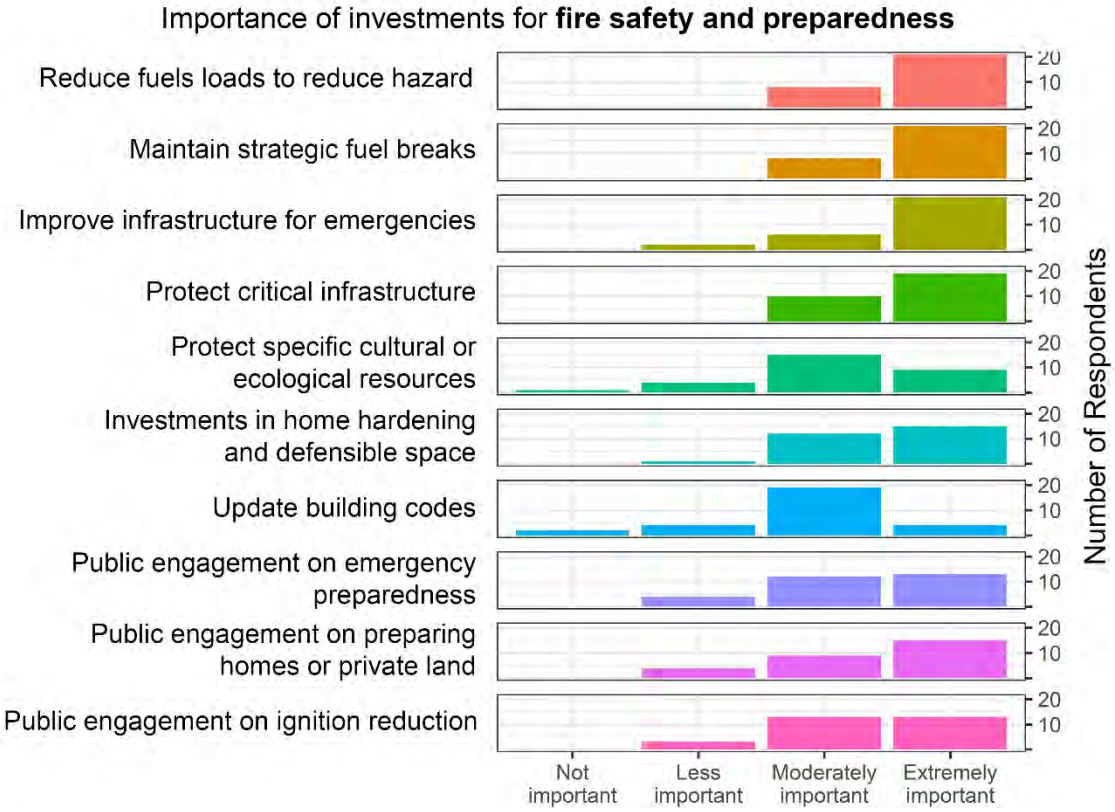
Santa Clara County

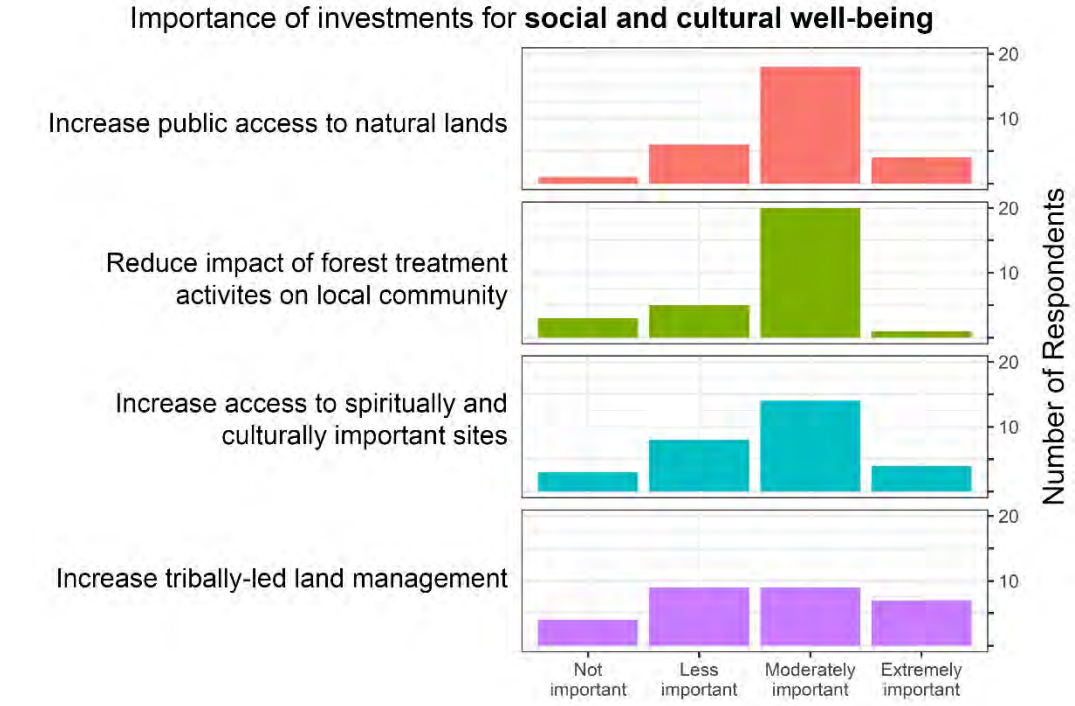


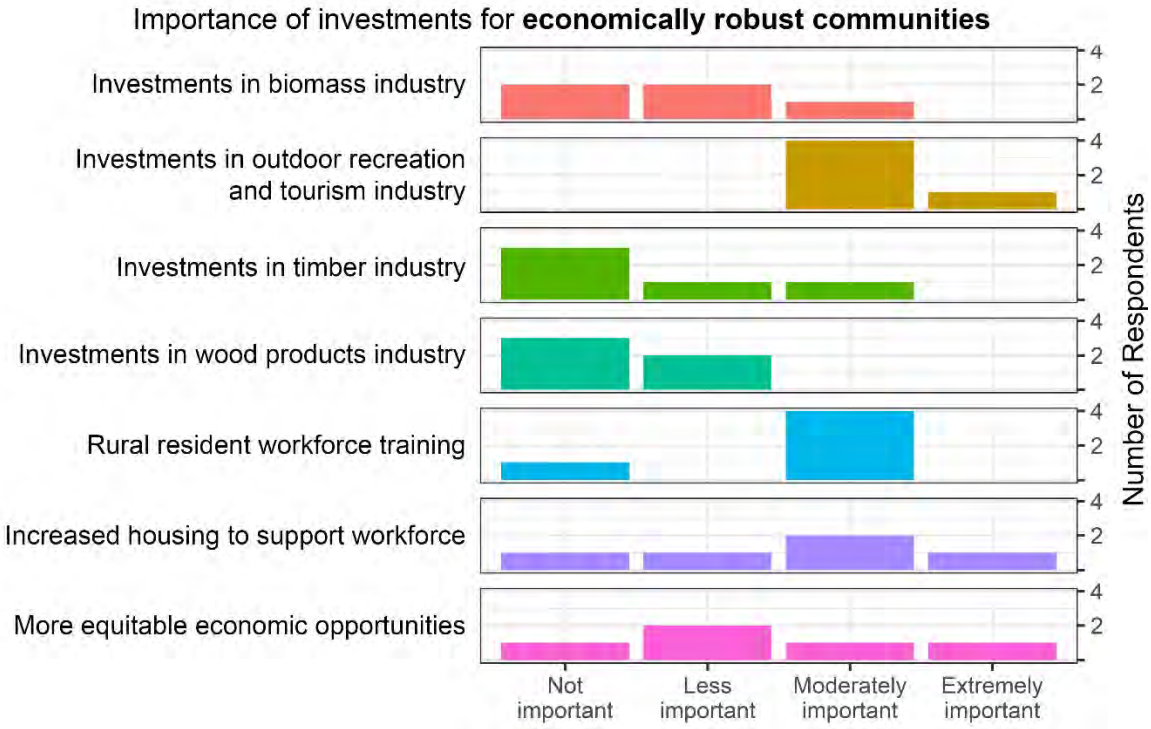


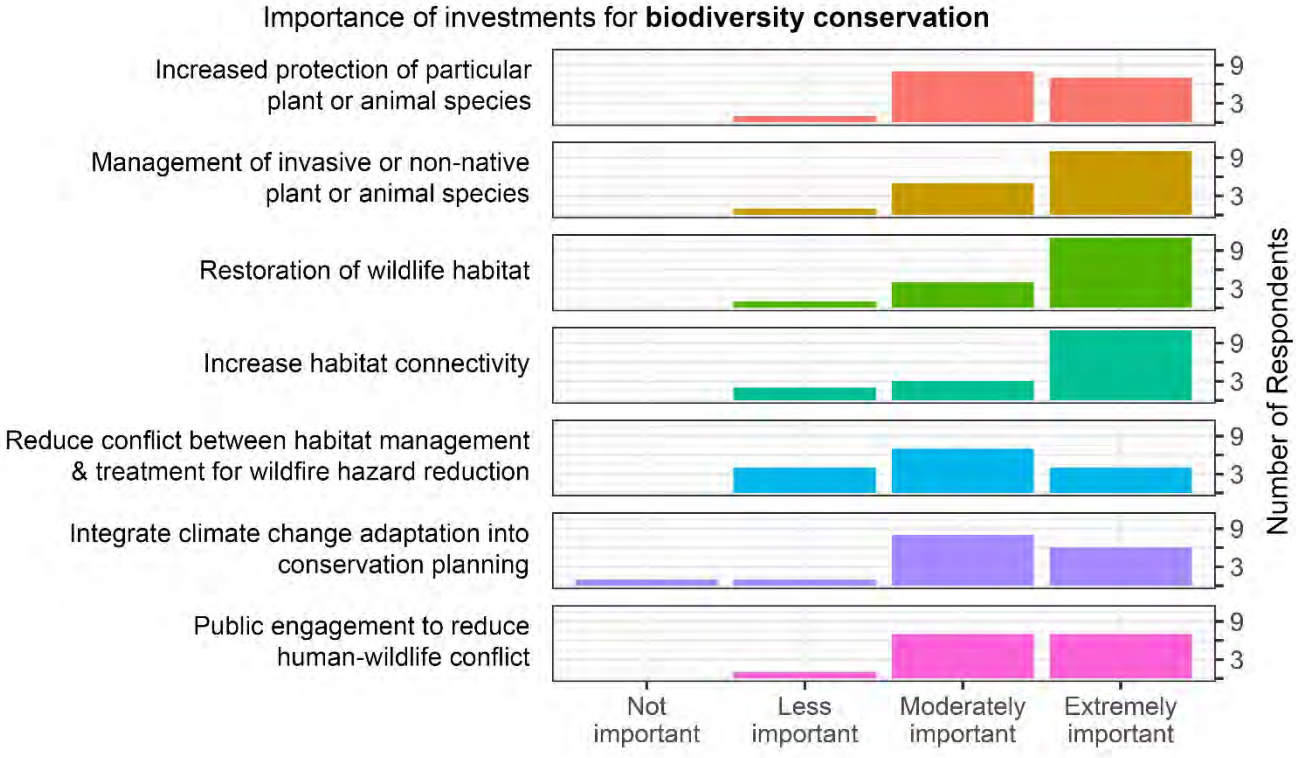

Importance of investments for **healthy and resilient shrublands**
Roadside ignition prevention
Utility hardening/undergrounding
Restrict public activities during peak fire weather to reduce ignitions
Increase wildland patroling capacity to reduce ignitions
Tree planting to create ember screen
Invasive plant species management
Restoration of disturbed or degraded habitat
Reduce conversion of natural lands
More efficient NEPA/CEQA process
Reduce regulatory barriers
Increase land management workforce capacity
Prescribed livestock grazing
24
12
Number of Respondents
Not important
Less important
Moderately important
Extremely important

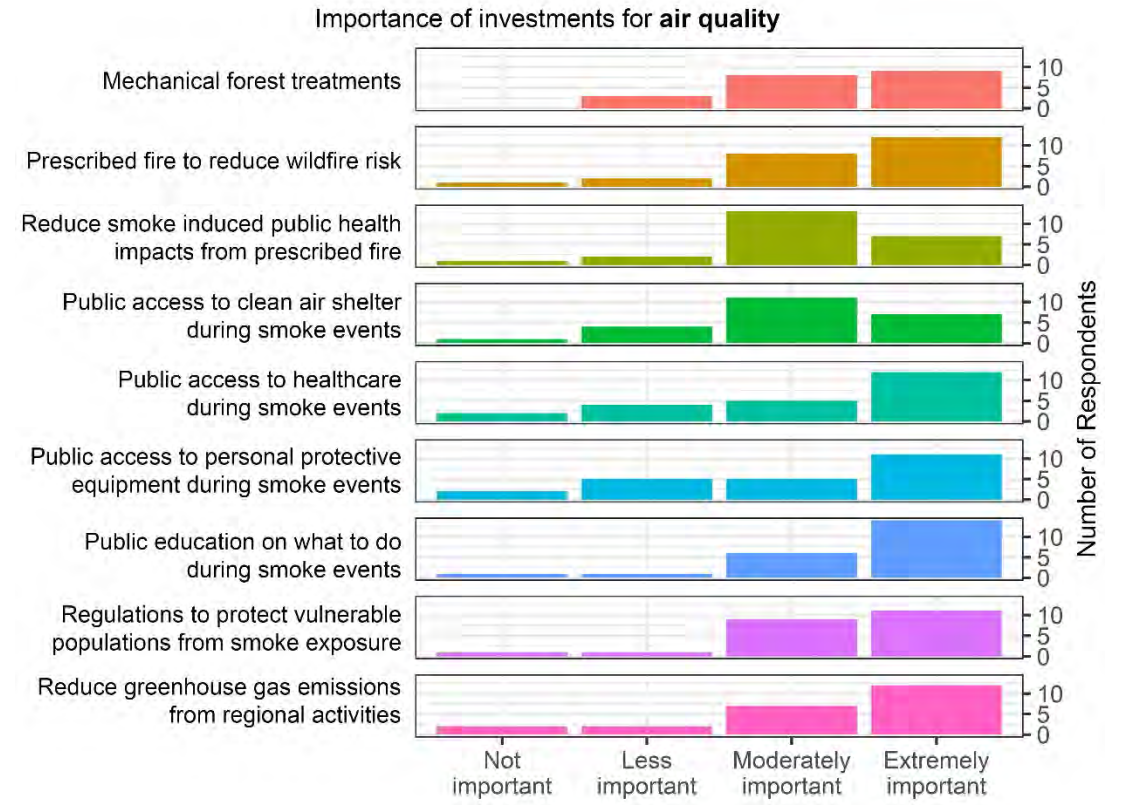

Importance of investments for **carbon storage**
Reduce extent of high-severity fires (in forest ecosystems)
Reduce frequency of wildfire in shrubland ecosystems
Reduce land conversion to development
Increase capacity to convert biomass to sustainable wood products
Post-fire reforestation
10
5
Number of Respondents
Not important
Less important
Moderately important

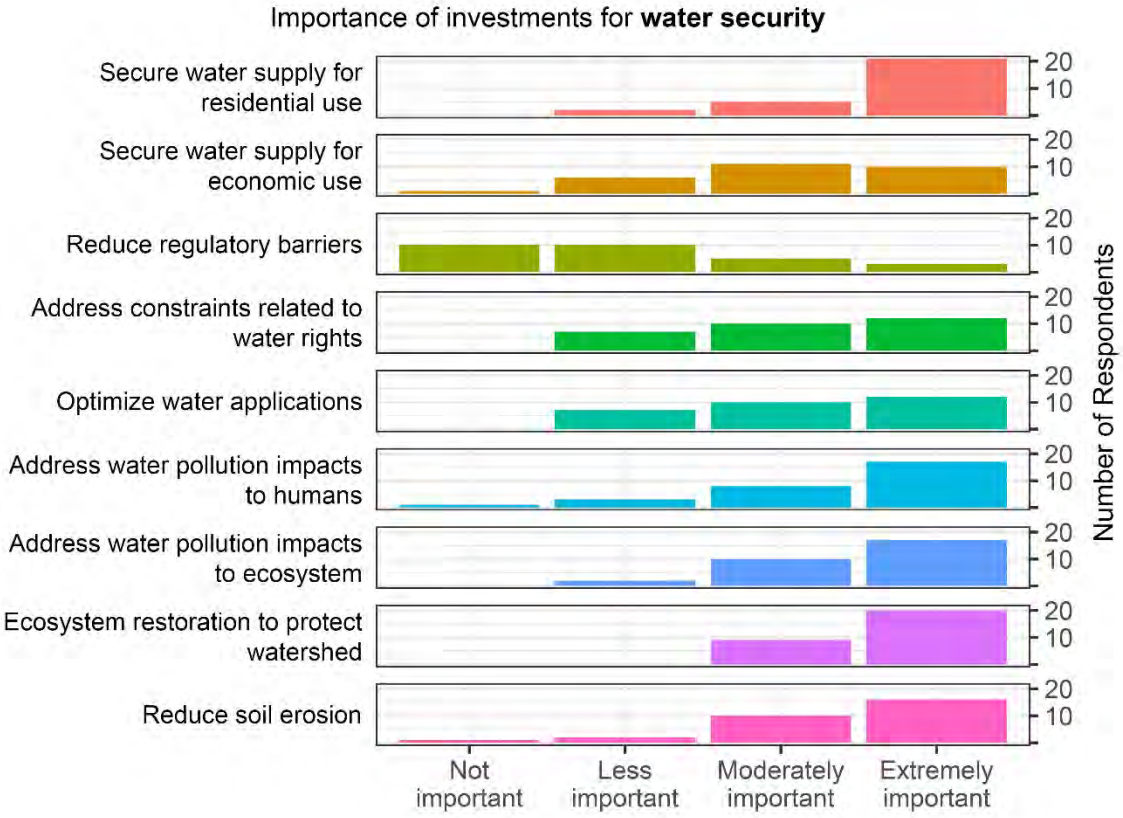

Importance of investments for **fire safety and preparedness**
Reduce fuels loads to reduce hazard
Maintain strategic fuel breaks
Improve infrastructure for emergencies
Protect critical infrastructure
Protect specific cultural or ecological resources
Investments in home hardening and defensible space
Update building codes
Public engagement on emergency preparedness
Public engagement on preparing homes or private land
Public engagement on ignition reduction
20
10
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **social and cultural well-being**
Increase public access to natural lands
Reduce impact of forest treatment activites on local community
Increase access to spiritually and culturally important sites
Increase tribally-led land management
20
10
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **economically robust communities**
Investments in biomass industry
Investments in outdoor recreation and tourism industry
Investments in timber industry
Investments in wood products industry
Rural resident workforce training
Increased housing to support workforce
More equitable economic opportunities
Number of Respondents
4
2
Not important
Less important
Moderately important
Extremely important

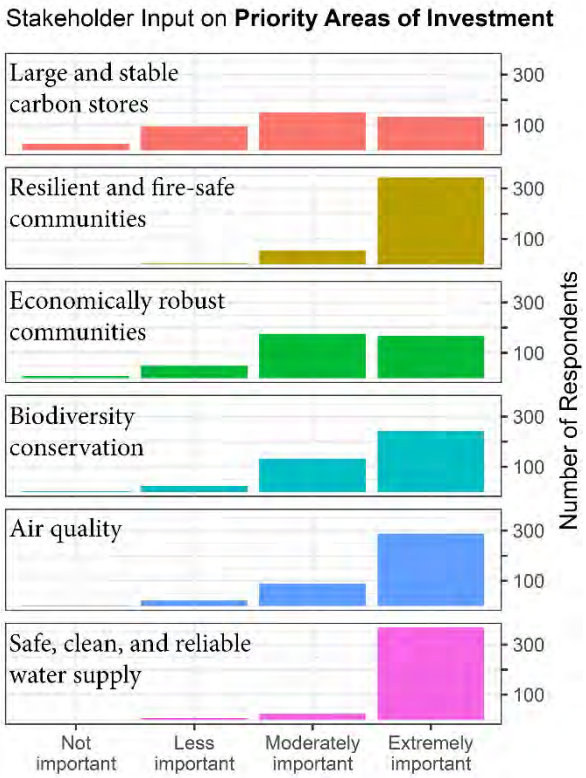

Importance of investments for **biodiversity conservation**
Increased protection of particular plant or animal species
Management of invasive or non-native plant or animal species
Restoration of wildlife habitat
Increase habitat connectivity
Reduce conflict between habitat management & treatment for wildfire hazard reduction
Integrate climate change adaptation into conservation planning
Public engagement to reduce human-wildlife conflict
Number of Respondents
9
3
Not important
Less important
Moderately important
Extremely important

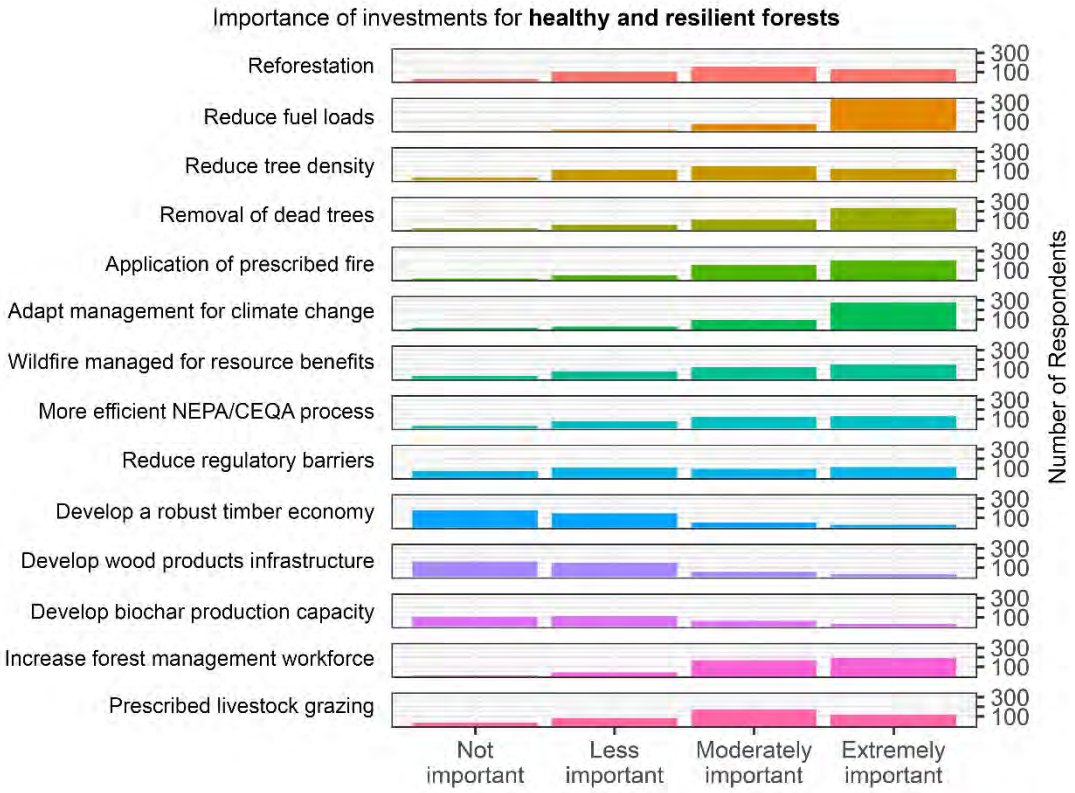

Importance of investments for **air quality**
Mechanical forest treatments
Prescribed fire to reduce wildfire risk
Reduce smoke induced public health impacts from prescribed fire
Public access to clean air shelter during smoke events
Public access to healthcare during smoke events
Public access to personal protective equipment during smoke events
Public education on what to do during smoke events
Regulations to protect vulnerable populations from smoke exposure
Reduce greenhouse gas emissions from regional activities
10
5
0
Number of Respondents
Not important
Less important
Moderately important
Extremely important

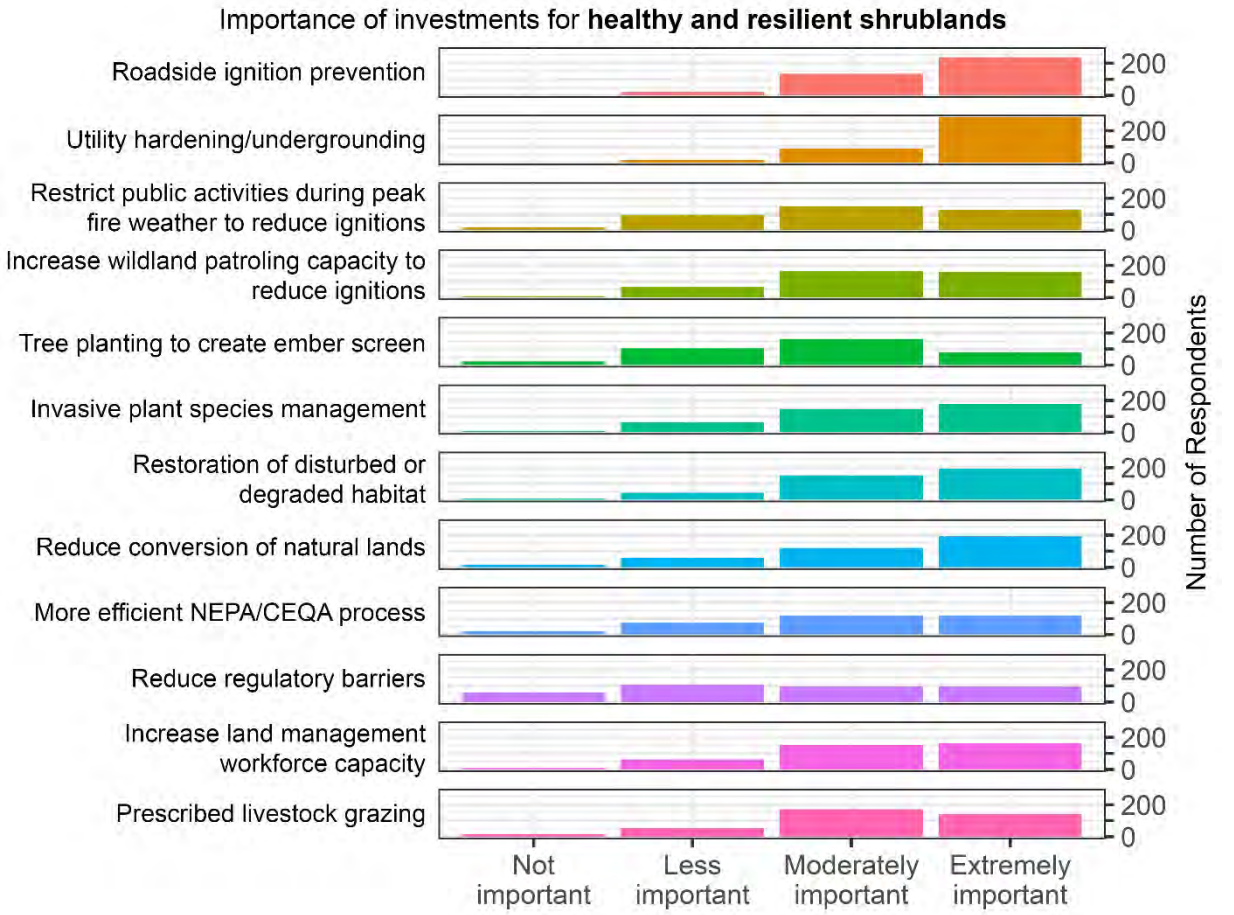

Importance of investments for **water security**
Secure water supply for residential use
Secure water supply for economic use
Reduce regulatory barriers
Address constraints related to water rights
Optimize water applications
Address water pollution impacts to humans
Address water pollution impacts to ecosystem
Ecosystem restoration to protect watershed
Reduce soil erosion
20
10
Number of Respondents
Not important
Less important
Moderately important
Extremely important

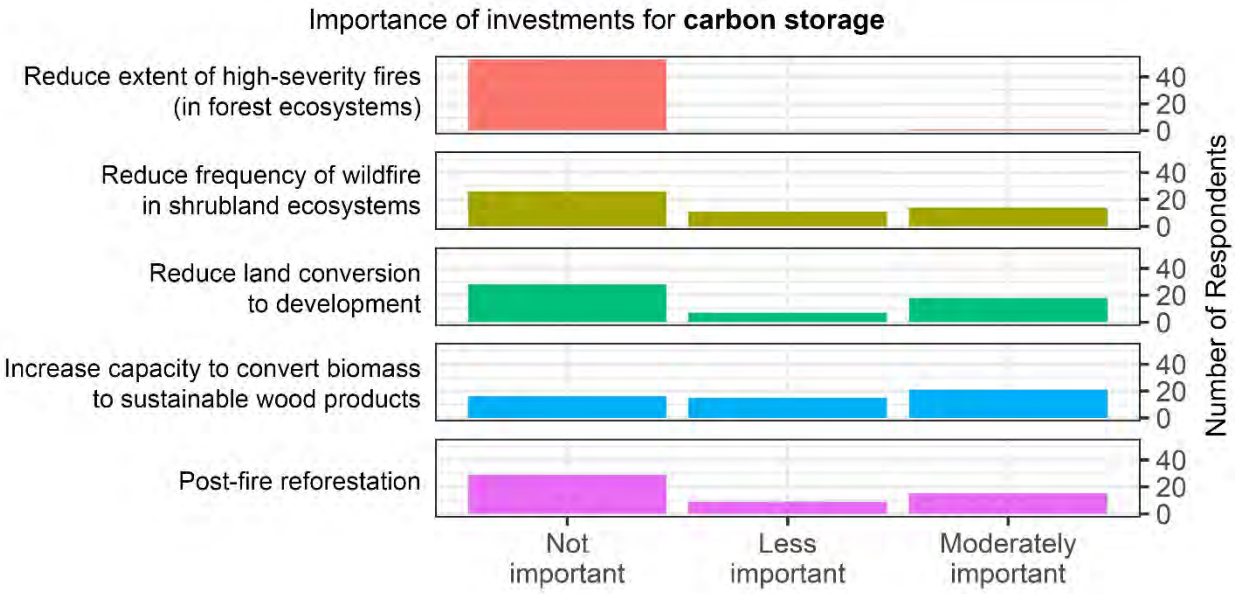
Central Coast Survey Results:

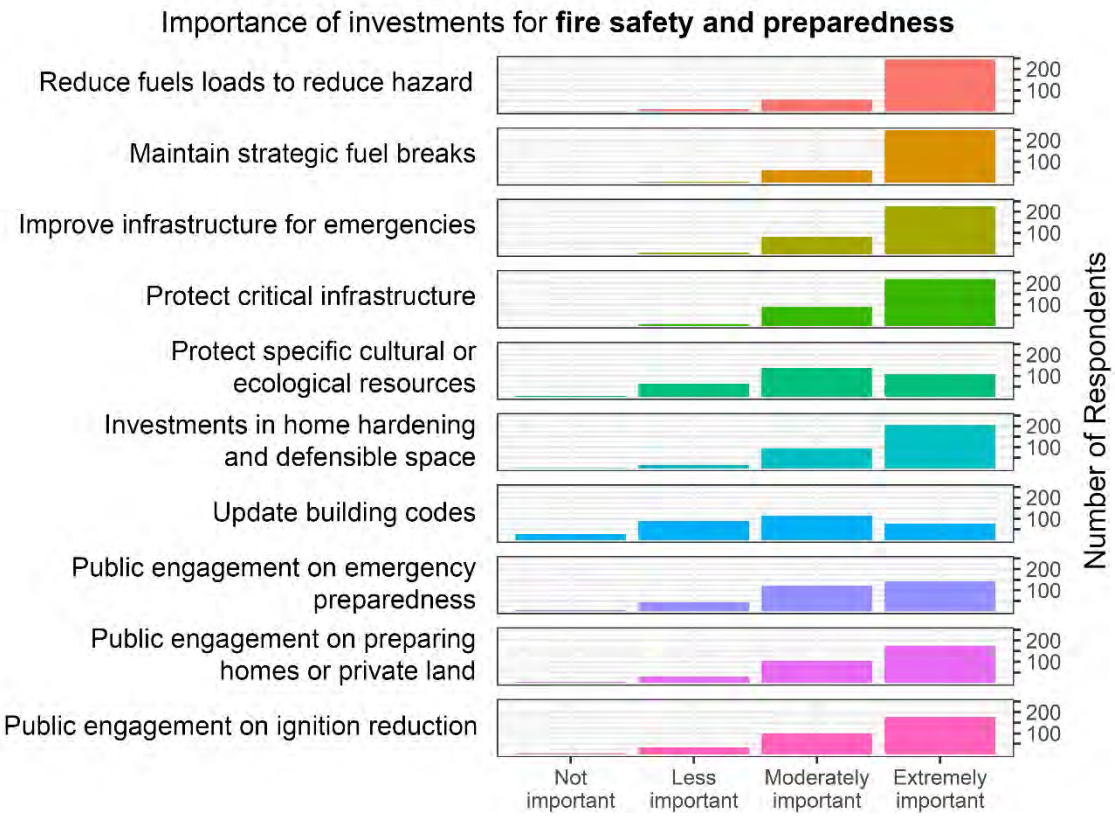
Santa Cruz County

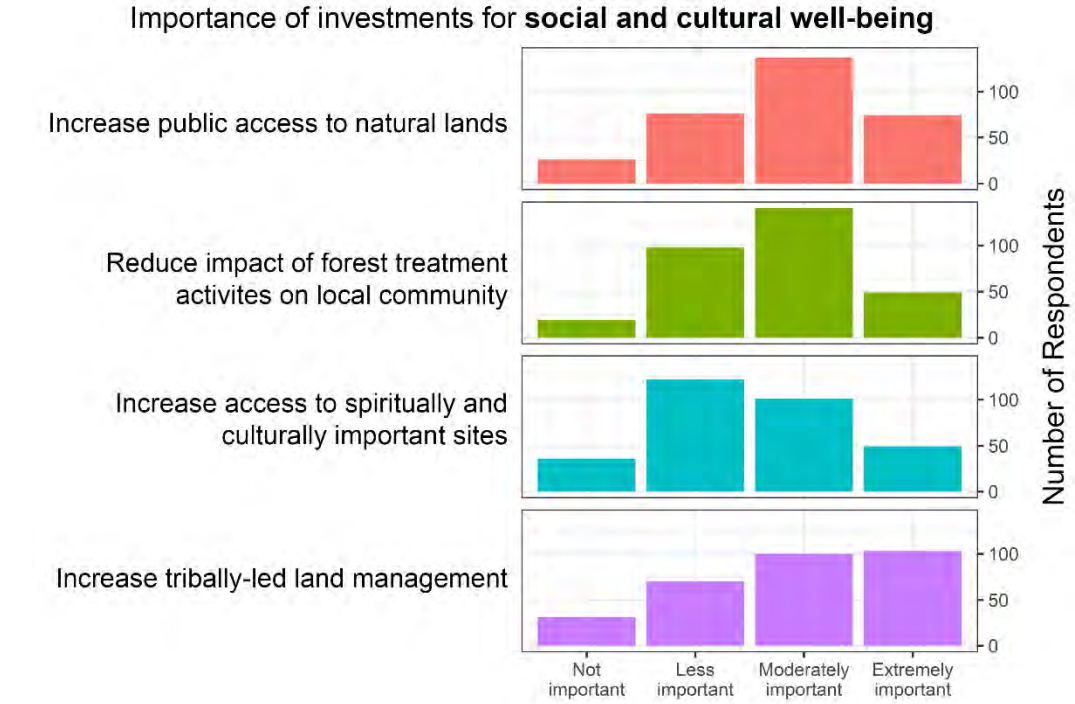


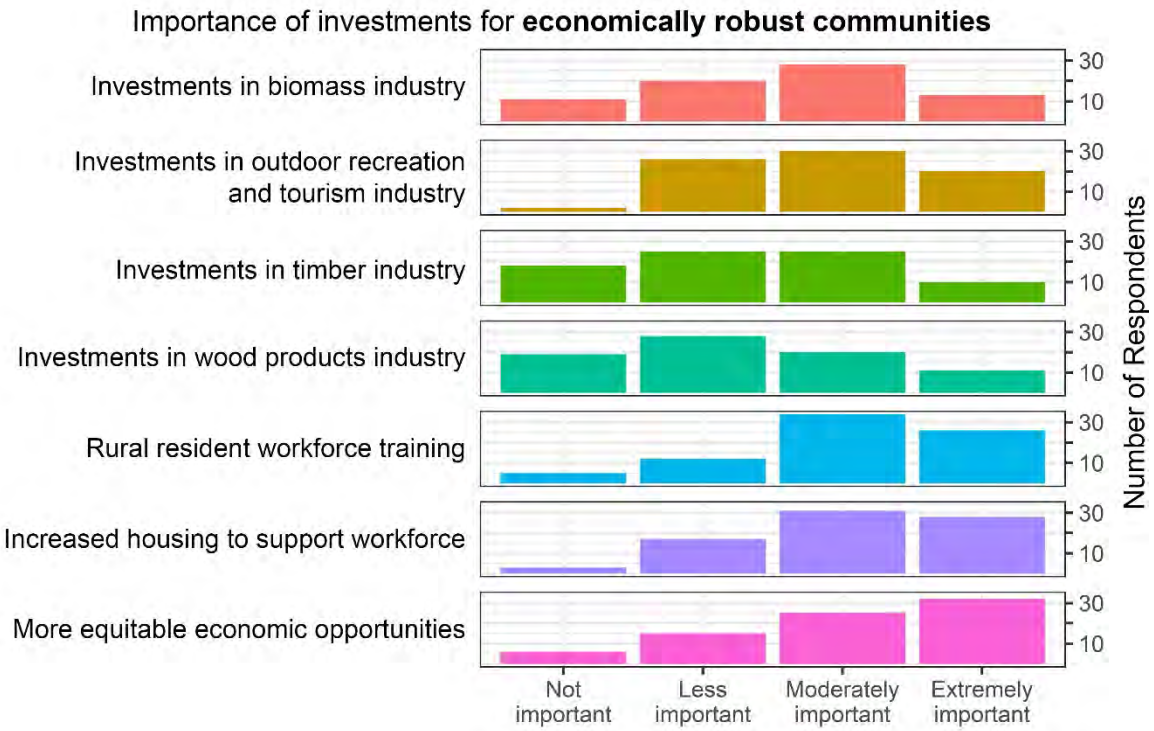


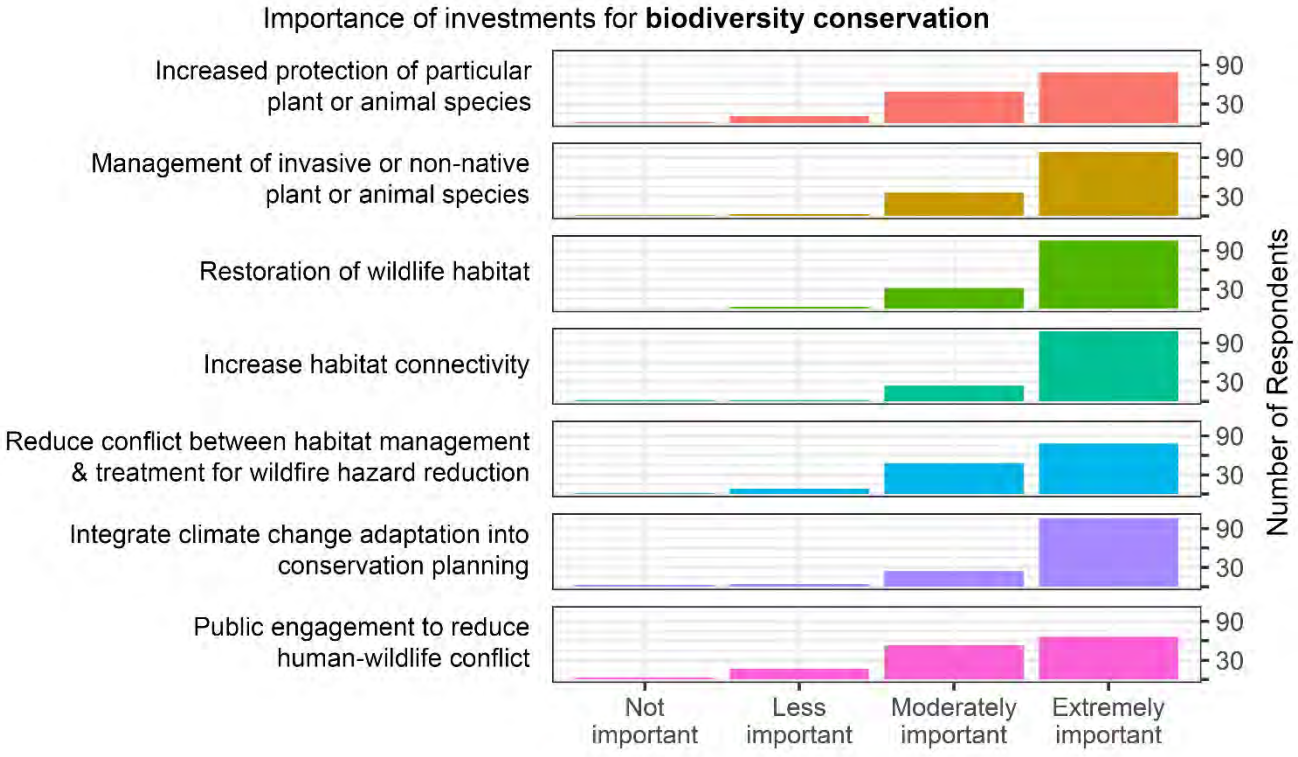

Importance of investments for **healthy and resilient shrublands**
Roadside ignition prevention
Utility hardening/undergrounding
Restrict public activities during peak fire weather to reduce ignitions
Increase wildland patroling capacity to reduce ignitions
Tree planting to create ember screen
Invasive plant species management
Restoration of disturbed or degraded habitat
Reduce conversion of natural lands
More efficient NEPA/CEQA process
Reduce regulatory barriers
Increase land management workforce capacity
Prescribed livestock grazing
200
0
Not important
Less important
Moderately important
Extremely important
Number of Respondents

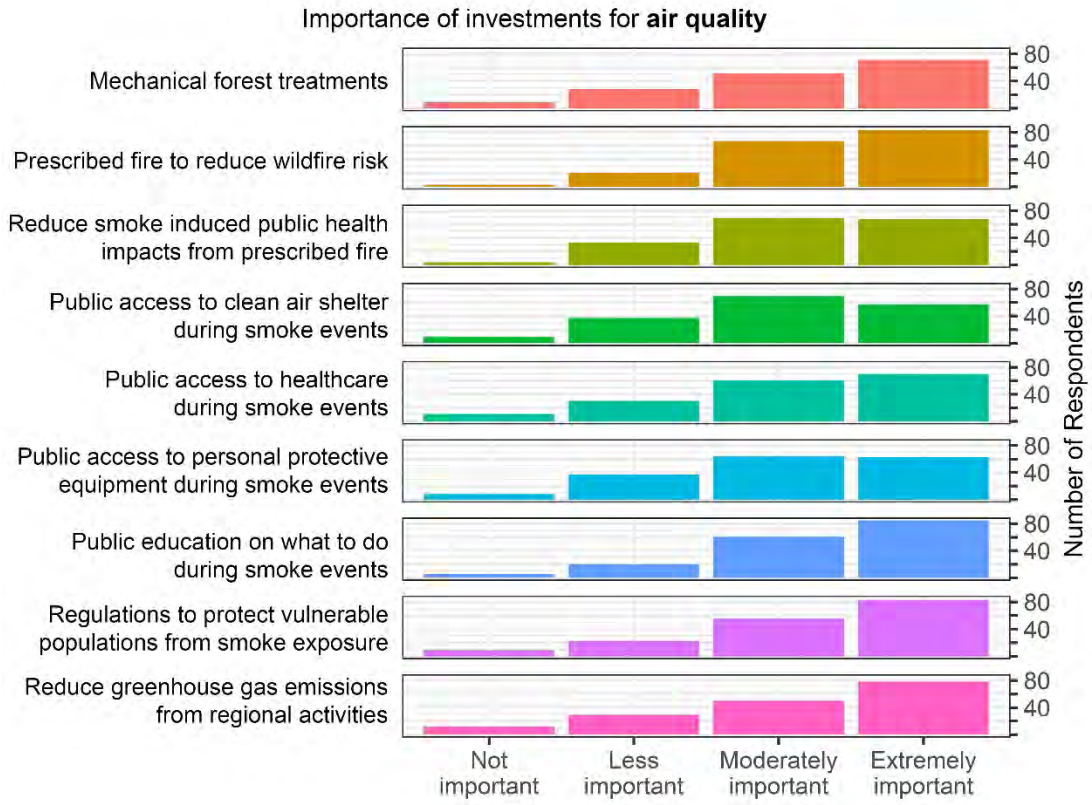

Importance of investments for **carbon storage**
Reduce extent of high-severity fires (in forest ecosystems)
Reduce frequency of wildfire in shrubland ecosystems
Reduce land conversion to development
Increase capacity to convert biomass to sustainable wood products
Post-fire reforestation
40
20
0
Not important
Less important
Moderately important
Number of Respondents

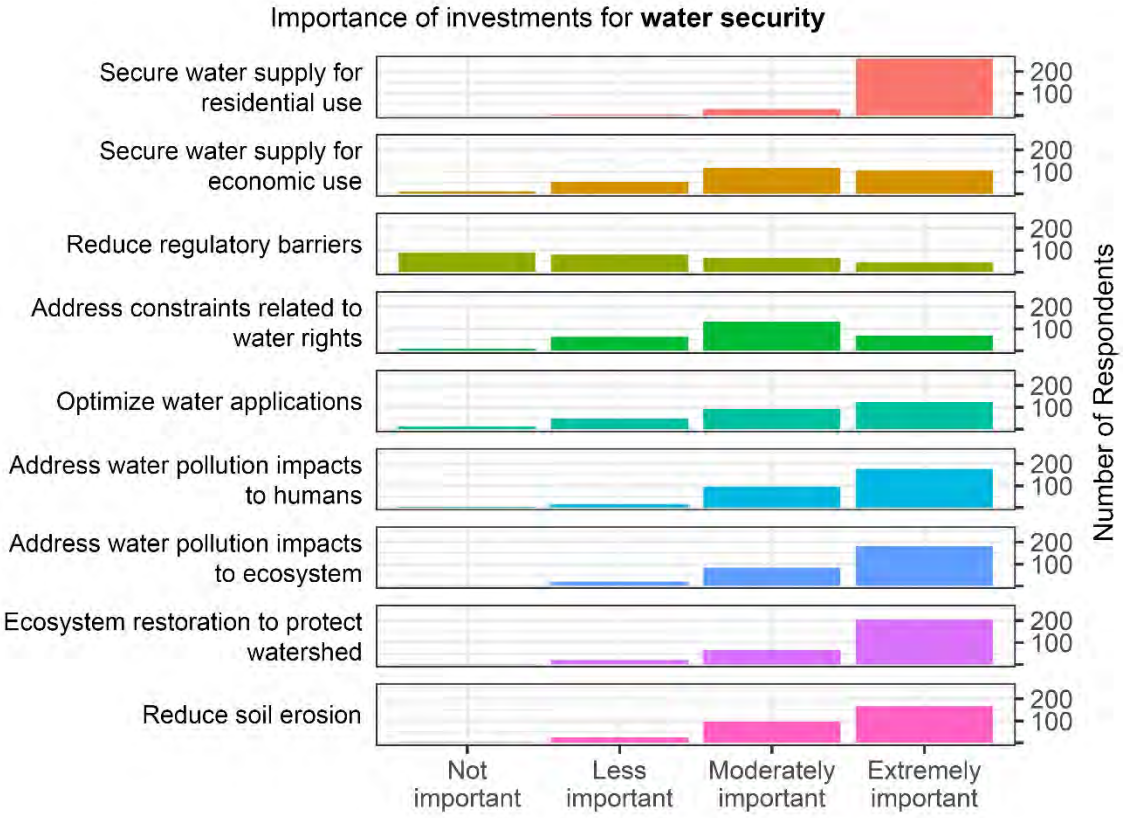

Importance of investments for **fire safety and preparedness**
Reduce fuels loads to reduce hazard
Maintain strategic fuel breaks
Improve infrastructure for emergencies
Protect critical infrastructure
Protect specific cultural or ecological resources
Investments in home hardening and defensible space
Update building codes
Public engagement on emergency preparedness
Public engagement on preparing homes or private land
Public engagement on ignition reduction
200
100
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **social and cultural well-being**
Increase public access to natural lands
Reduce impact of forest treatment activites on local community
Increase access to spiritually and culturally important sites
Increase tribally-led land management
100
50
0
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **economically robust communities**
Investments in biomass industry
Investments in outdoor recreation and tourism industry
Investments in timber industry
Investments in wood products industry
Rural resident workforce training
Increased housing to support workforce
More equitable economic opportunities
30
10
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **biodiversity conservation**
Increased protection of particular plant or animal species
Management of invasive or non-native plant or animal species
Restoration of wildlife habitat
Increase habitat connectivity
Reduce conflict between habitat management & treatment for wildfire hazard reduction
Integrate climate change adaptation into conservation planning
Public engagement to reduce human-wildlife conflict
90
30
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **air quality**
Mechanical forest treatments
Prescribed fire to reduce wildfire risk
Reduce smoke induced public health impacts from prescribed fire
Public access to clean air shelter during smoke events
Public access to healthcare during smoke events
Public access to personal protective equipment during smoke events
Public education on what to do during smoke events
Regulations to protect vulnerable populations from smoke exposure
Reduce greenhouse gas emissions from regional activities
80
40
Number of Respondents
Not important
Less important
Moderately important
Extremely important


Importance of investments for **water security**
Secure water supply for residential use
Secure water supply for economic use
Reduce regulatory barriers
Address constraints related to water rights
Optimize water applications
Address water pollution impacts to humans
Address water pollution impacts to ecosystem
Ecosystem restoration to protect watershed
Reduce soil erosion
200
100
Number of Respondents
Not important
Less important
Moderately important
Extremely important