Forests

SECTION 1. Importance of Forests

Forests cover one third—33 million acres—of the state and are responsible for most of its natural carbon sequestration capabilities; they comprise nearly 85% of California's natural carbon stores. Three forest types are considered here: Conifer, Oak, and Riparian. Forests, and specifically conifer forests, are the largest and most expandable of the state's biological carbon sinks, despite fragmentation of their ownership and management histories. Oak woodlands and hardwood forests are slower-growing, and their extent has been significantly reduced and degraded due to conversion for urban and agricultural uses. Riparian forests' extent has been reduced by over 90% and the remaining forests exist in fragments, primarily due to agricultural use and urbanization. Areas dominated by conifer forests are also the primary watersheds of the state, providing the large majority of the state's water supply. Forests occur within a wide range of habitats, from wet and dry meadows to riparian areas, and are therefore extraordinarily important as habitat for myriad species, making them critical for maintaining California's biodiversity as well.

Conifer Forests: California's conifer forests are some of the most biologically productive and diverse in the world as well as some of the longest lived, including, among others, coast redwood, ponderosa pine, and mixed conifer forest types. They are also economically productive, with high value timber and as the basis for jobs in forest management, sustaining rural forest economies. These forests are critical for both carbon and climate benefits, providing irreplaceable adaptation and mitigation services, water supply and quality, and biodiversity. Of the 24.5M acres of conifer forest, roughly half is in public ownership, primarily federal. Many of the most biologically productive forests—those capable of the greatest carbon sequestration increases—are in private ownership. While there are magnificent "reference forests" to be found in parks and some wilderness areas, most of California's forests have been significantly altered by hundreds of years of timber harvest. These forests are relatively young and have been simplified and altered in species composition, age class range, and forest structure as compared to pre-European conditions, and therefore they carry far less carbon than they are capable of accruing. The logging of old growth forests led to emissions of billions of tons of CO2. Historic fire suppression has also altered these forest landscapes, creating forests with unnatural fuel loads, altered species composition, and greater densities of trees in these previously fire-adapted systems.

Whereas public forests are likely to remain relatively flat in stocks overall, there is a significant opportunity to alter forest management on private conifer forests to increase resilient forest carbon stocks, due to their relatively very young ages (Gray, et al 2020). Further, these younger, more homogenous forests are more susceptible to fire, drought, pests, and the stresses of increased temperatures and major heat events. Of

private forests, the industrially owned are generally intensively managed for timber products, and market forces drive harvests at ages well below the natural carbon potential.

These very productive yet relatively young forests are the most expandable carbon sinks of the natural and working land types. Increases in carbon stocks and resilience are feasible by shifting working forests to, on average, older age classes which hold more carbon, and managing for more fire adapted forest conditions including adapting species composition and restoring structural diversity and greater heterogeneity in spacing. While managing to increase fire resilience by, for instance, increased thinning and prescribed fire, leads to intentional CO2 emissions, these emissions are more than offset by the gains from having healthier, faster growing older and resilient forests. Even while decreasing the density of forests by thinning them to more natural, lower densities of trees per acre, managing to restore the more natural forest conditions with larger, older trees would increase total carbon store in those forests by at least 25% (California's Forest Carbon Plan, 2018). Additionally, reducing the intensity and impacts of salvage-based harvests will retain more carbon as well as promote soil health and habitat values in the forest overall.

Gains of at least 150-300 MMT CO2e are feasible in the next 10 years by changing forest management practices in private forests, while keeping them in timber production. The range of benefit will be related to the overall acreage which is involved and the types of management choices for these forests. Further, as less than 5% of the California's private conifer forests are conserved, there is also a significant opportunity to make conservation investments to ensure lasting carbon stores while supporting these changes in forest management. As recommended by the State, priority should be given to source headwaters forests (FRAP, 2017). These changes would also lead to significantly enhanced watershed function and reliability, major gains for biodiversity, reduced threat of extreme fire, and significantly enhance ecosystem function, all of which also promote adaptation within a changing climate. There is thus great opportunity to increase the carbon stocks, climate resilience and other essential benefits of these forests while also addressing a suite of threats to them. Management to achieve these objectives will enhance and sustain employment in forest communities where forest management overall is a key element of rural economies.

Riparian Forests: These are transitional zones between terrestrial and aquatic systems that exhibit characteristics of both systems. They are typically vegetated with lush growths of grasses, forbs, shrubs, and trees that are tolerant of periodic flooding and have sediments that are rich in nutrients and organic matter. Riparian systems look and function differently across the state but possess some common ecological and hydrological characteristics such as fish and wildlife habitat, water storage, flood control, nutrient cycling, water quality protection, recreational and economic benefits, including carbon sequestration – particularly in mature or in restored riparian zones.

The primary literature shows that the establishment of riparian forest will more than triple the baseline, unforested soil carbon stock, and that riparian forests hold on average 68–158 Mg C/ha in biomass at maturity (Dybala et al. 2018). Recognizing the importance of these aspects, the California Riparian Habitat Conservation Program to develop coordinated conservation efforts aimed at protecting and restoring California's riparian ecosystems was created by state legislation in 1991.

Oak Woodlands/Forests: These forests are important to California due to their scenic qualities, wildlife habitats, biodiversity, and cultural values as well as sequestering atmospheric carbon. With some estimates of oak woodland and forests at nearly 13 million acres (over five million hectares) of oak woodlands and mixed oak-conifer forests in California, these oak-related lands have sequestered over 325 million metric tons of carbon in live trees. Another 350 million metric tons of carbon are sequestered in understory vegetation, downed woody material, and soil horizons. Californian valley oak woodlands and savannas can be found in inland valleys and foothills throughout California, providing critical habitat for a diverse range of native plants and vertebrate species; these woodlands have been declining (Whipple et al. 2011). Because of their ecological and cultural significance, California's Valley oak woodlands and savannas are now being protected and restored at many sites within the species' historic range. However, California has an estimated risk of losing 750,000 acres of oak forest and woodland (and subsequently, 33 million tons of sequestered carbon) by the year 2040 (Gaman 2008, Gaman and Firman 2006). Further, modeling efforts have found that climate change may favor oak species, at the expense of conifers (Coffield et al. 2021) providing another incentive to invest in protection of oak forests and the habitats associated with them.

SECTION 2. Recommended actions, strategies, and implementation target(s)

Conifer Forests: These comprise the state's largest and most expandable biological carbon sink. By 2034, we must expand the amount and resiliency of forest carbon stocks on the most productive privately-owned conifer forest types with working forest conservation easements that improve natural forest structure and function on managed private forestlands. This includes Sierran and Klamath Mixed Conifer, Redwood, Douglas Fir and Ponderosa Pine types. Pair this with restoration investments to, as applicable, reduce stand density and improve structure and composition, and re-introduce managed and controlled fires. Build on state investments to improve fire conditions across the landscape and ownership types.

> **Target**: Increase carbon sequestration by at least 150-250 MMT CO2e by conserving 1-3 M acres of privately-owned managed conifer forest with working forest conservation easements by 2034, with priority for integration with fuels

management and other forest restoration. These easements should extend the average age of intensively managed forests (exclusive of Water and Lake Protection Zones), reduce salvage intensity, and promote larger older, more well-spaced stands with a natural diversity of species (using the state's Wildlife Habitat Relationships (WHR) classifications). The priority area for focus are those source watersheds supplying most of California's water for agriculture, drinking and environmental water, those most likely to remain most productive under climate change and those most critical for biodiversity protection.

Riparian Forests and related Habitats: There are approximately 350,000 acres of riparian habitat in California, and of this 145,000 are riparian woodlands (Rohde et al. 2021). Riparian forests have been significantly converted to other uses in the state, with a concomitant loss of critical climate adaptation benefits, especially water quality and flow regulation services and providing habitat for myriad species. Protecting mature riparian habitats and restoring altered riparian habitats are two recommended actions to enhance carbon storage in addition to the widely recognized benefits of riparian habitat restoration. Actively planting riparian forest significantly accelerates the biomass carbon accumulation, with initial growth rates (in the first 10 years) more than double those of naturally regenerating riparian forest (Dybala et al. 2018).

> **Target**: Accelerate WCB CA Riparian Habitat Conservation Program to at least 2,000 acres/year target of riparian habitat, prioritizing regionally appropriate projects that focus on functional elements of riparian forest can include co-benefits, particularly for Oak species and for desert or sparsely vegetated ecosystems. Increase riparian restoration by at least double current acreages by 2030.

Oak Woodland and Forest: By 2034 prioritize and protect existing oak forests and replant oak woodland habitat in California to achieve desired densities and age structure targets. Although there is limited potential for large-scale restoration of complete valley-floor ecosystems, extant fragments do remain throughout much of California, particularly in the Sacramento/San Joaquin regions and it is possible that density and distribution patterns similar to the native oak woodlands and savannas could be strategically reintroduced within California valley floors (Whipple et al. 2011) at spatial patterns and range of historical oak densities of 2–30 trees per hectare as well as set minimum densities or age structure targets. Valley oaks could be reintroduced in urban and residential areas as well as in surrounding rangelands at densities comparable to the native oak woodlands and savannas, thereby restoring aspects of ecologically and culturally significant ecosystems, including wildlife habitat and genetic connectivity within the landscape.

> **Target**: Conserve and restore the following oak woodland types and geographies: mixed-Oregon White Oak (*Quercus garryana*) and California black

oak (*Q. Kelloggii*) - particularly in northwestern CA; Blue Oak/Blue Oak Pine habitats; replanting or "re-oaking" in Los Angeles/San Diego/Riverside/Orange counties.

Fire Resilience and Forest Restoration: California's forests are all fire-adapted, but fire suppression has drastically altered forest function, composition, structure, and resilience. The current ARB Scoping Plan recommends fire and fuels management on 2.5M acres annually across all forests, shrub, and grasslands. This needs to be more regionally and land type specific, as some systems are more threatened by too much and/or high severity fire (coastal chapparal), while others suffer from too little fire (much of the mixed conifer regions). Efforts need to focus in on fuels management in mixed conifer forest and appropriate oak woodlands (+/- 2 million acres), with the goal of expanding managed fire as the preferred treatment and reducing mechanical approaches. Reforestation should be focused/limited to areas where intense fires have limited natural regeneration.

> **Target:** By 2034, advance fire management to shift at least 75% of landscape fires to beneficial ecological and social outcomes across state. Maintain 2.5M acre fuels management goal, prioritizing up to 2M acres of mixed conifer annually for treatment across public and private lands and with an expansion of efforts in oak woodland areas as feasible. By 2034, have shifted fuels management to be at least 50% via managed and prescribed fire.

SECTION 3. Pathways

Conifer Forests: Allocate minimum of $2B to achieve targeted C gains. An investment of $2B could result in an effective cost (averaged across forest types) of under $35/T at 10 years, dropping to under $20/ton by year 20, and declining thereafter. Utilize a combination of:

- Public funding for the acquisition of working forest conservation easements (WFCES) that is commensurate to that which is spent to achieve carbon reductions in other emissions sectors. This can include new or increased allocations to programs such as the Wildlife Conservation Board, Sierra Nevada Conservancy, Coastal Conservancy, and others, wildfire funding, bonds raised for climate mitigation and adaptation.
- Establish tradeable tax credits for donated easements (or donated portions therof). Tradeable tax credits benefit a broader range of taxpayers, especially lower income populations, than tax credits alone.

Riparian Forests: Increase investment to WCB CA Riparian Habitat Conservation Program (CRHCP) for riparian easement and restoration opportunities. Administrative and funding structures like block grants and/or a small grants program, with technical

support starting with the application stage, to ensure funds are accessible to all communities across the state are recommended. Development in riparian habitats should be avoided and riparian habitat restoration or conservation projects should prioritize those which can have co-benefits, particularly for oak species.

Oak Woodlands: A clarification of the CEQA process related to Oak woodlands and carbon sequestration is needed. Serious consideration of county requirements for oak mitigation is highly recommended and with a focus on integrating CA state carbon sequestration standards, prioritizing and incentivizing development that avoids impacts to oak woodlands rather than options to mitigate or replant, where planting or replanting is warranted - establishing monitoring requirements at the city and county level that evaluate mitigation efficiency and determine rates of planting and re-planting rates that avoid losses and promote expansion of oak habitat, and the development of incentives for voluntary oak woodland conservation. Conservation options such as fee or conservation easement purchases should be implemented and especially for Blue Oak types. Expand use of prescribed burns, as appropriate, to improve restoration of understory communities and promote longevity of oak stands.

Fire Resilience: By 2025, scale up, and speed up implementation of, prescribed fire operations at CAL FIRE to enable the agency to implement managed/prescribed fire at the hundreds of thousands of acres level annually by utilizing the same systems and authorizations for prescribed and managed fire as for fire suppression. By 2026, have a state-developed template permit system for fuels management on smaller privately owned forests (under 500 acres in ownership) that streamlines family forest fuels management, with priority for watershed implementation. Overall, expand engagement with Tribes for use of Traditional Ecological/Indigenous Knowledge in fire management, with a strong concentration on oak woodlands and mountain meadow mosaics within conifer and mixed conifer systems.