



California Air Resources Board
Natural and Working Lands Alternative Scenarios
2022 Scoping Plan Update
February 28, 2022

I. Overview and Process

The Assembly Bill (AB) 32 Climate Change Scoping Plan is an actionable blueprint that lays out a cost-effective and technologically feasible path to ensure California meets its near- and long-term statewide greenhouse gas (GHG) emissions reduction targets. Consistent with AB 32 direction, each Scoping Plan has included a suite of policies and does not rely on a single approach, but rather on a combination of incentives, regulations, and carbon pricing. AB 32 also requires that the Scoping Plan be updated at least once every five years and calls for the California Air Resources Board (CARB or Board) to convene an Environmental Justice Advisory Committee (Committee), to advise the Board in developing the Scoping Plan, and any other pertinent matter in implementing AB 32. As has occurred with past Scoping Plans, once the 2022 Scoping Plan is finalized a series of actions are expected to be initiated to develop or refine measures (e.g., regulations, incentive programs) needed to implement the plan.

The CARB kicked off development of the 2022 Scoping Plan Update in June 2021 in coordination with other State agencies. The 2022 Scoping Plan Update will assess progress towards achieving the Senate Bill 32 (SB 32) 2030 target, identify the need for potential adjustments to stay on track, and lay out a path to achieve carbon neutrality no later than 2045. This Scoping Plan update will have the longest planning horizon of any previously-adopted version. This extended 2045 planning trajectory provides an opportunity to have a greater focus on the outcomes needed to achieve GHG emissions reductions. To model how Natural and Working Lands (NWL) can help California meet carbon neutrality, CARB staff will utilize multiple modeling tools¹ to understand the emissions sources and sinks from NWLs. As published previously, CARB will also be using PATHWAYS² to model energy-related Scoping Plan scenarios³ which will identify outcomes in terms of technologies, fuels, energy sources, and infrastructure that will need to be developed to transition away from fossil fuels by mid-century. Once completed, the NWL modeling will provide the state with a first look into the potential future of California land's GHG sources and sinks. The NWL and energy-related modeling will inform the adoption of a pathway to carbon neutrality for the State. The results of the scenario modeling will also be used to evaluate the public

¹ [Overview of CARB's Natural and Working Lands Modeling.](#)

² [PATHWAYS Model - E3 \(ethree.com\)](#)

³ [PATHWAYS Scenario Modeling Assumptions, posted December 15th, 2021](#)

health and economic benefits and impacts of the different scenarios. This will include air quality, public health, household costs, and state economic and jobs evaluations.

Achievement of the outcomes of the Scoping Plan will require the development of regulatory and policy measures, funding, research and deployment, permitting actions, and other programs and activities. The Scoping Plan provides an economy-wide framework spanning many years, and therefore does not delve into the design details of any program or regulation, nor does it supplant or create new statutes and regulations. These activities will occur as part of post-Scoping Plan adoption implementation involving multiple partners across the State.

The next steps related to modeling and public engagement are outlined in the table below.

Estimated Timing of Next Steps

Late February	Board Hearing for staff to present on the tools, approach, and elements for the emissions, health, and economic analyses underway
Late March/April 2022	Public workshop on NWL modeling results
Late March	Board hearing for staff to present and discuss the emissions, health, and economic modeling results of the different scenarios
Early May 2022	Release Draft Scoping Plan for 45-day public comment
June 2022	1 st Board Meeting. The Board may provide direction to CARB staff to modify any of the scenarios to inform the Final Scoping Plan, which will be presented at a 2 nd Board Meeting by the end of 2022.

II. Scenario Development

Since the June kick-off, CARB staff have been soliciting feedback from topical experts, affected stakeholders, and members of the AB 32 Environmental Justice Advisory Committee (EJ Advisory Committee) for both the NWL and PATHWAYS energy-related modeling. As part of the NWL modeling scenario development process, CARB staff hosted a [public workshop in July](#) to present the [modeling and target approach](#). CARB staff published the [draft set of scenarios for NWLs](#) on December 2, 2021 and also held a workshop on December 2, 2021 to [present and discuss the draft scenarios](#). CARB staff solicited written feedback on the draft NWL scenarios and received 91 comments. CARB staff also met with members of the EJ Advisory Committee in December 2021 and January 2022 to discuss the draft scenarios. In addition to this public process, CARB staff continued to consult with staff at other state agencies.

As part of the 2022 Scoping Plan Update for carbon neutrality and in response to the Governor’s Executive Order N-82-20 to harness natural and working lands in the fight

against climate change, CARB staff have expanded the scale of the scientific analysis for NWL from previous Scoping Plan efforts. CARB staff are utilizing modeling tools for this expanded analysis to assess both the carbon and other ecological outcomes for forests, shrublands, grasslands, croplands, developed lands, wetlands, and sparsely vegetated lands and have worked to align the scenarios with both the landscape types and actions identified in other efforts called for in the Governor’s Executive Order (e.g. [California’s draft Climate Smart Land Strategy](#) and [draft Pathways to 30x30 Strategy](#)).

The table in Section III of this document summarizes revisions to the modeling assumptions made by CARB staff in response to public and agency feedback. The four scenarios are designed to explore the potential impacts of different levels of NWL management actions associated with each scenario. The business-as-usual (BAU) scenario, which is a scenario where no change to management occurs in the face of future climate change will be modeled and assessed, and is described below.

Key updates from the draft Scenarios include:

1. Staff clarified the scenario’s overarching objective or focus.
2. Staff updated the landscapes to provide alignment with landscapes identified in the Climate Smart Land Strategy
3. Staff revised the scenarios to provide clearer comparisons across the scenarios on the pace and scale of NWL actions.
4. Staff removed scenario 5 (Focused on resource utilization) that was previously included in the draft scenarios, after considerations of public feedback that the draft 5th scenario was infeasible and unlikely to produce beneficial climate, ecological, or health outcomes for California.
5. Staff included a complete list of management strategies to be modeled for each landscape type at the end of this document.

Descriptions of the 4 scenarios:

1. Alternative 1: Land management activities that prioritize short term carbon stocks in our forests and through increased climate smart agricultural practices on croplands.
2. Alternative 2: Current State commitments and plans will be the basis for the land management activities.
3. Alternative 3: Land management activities that prioritize restoring and enhancing ecosystem functions to improve carbon stock resilience to climate change impacts.
4. Alternative 4: Land management activities that prioritize reducing forest, shrubland, and grassland wildfire fuels.



Not listed on the table is the BAU scenario, where the same rate of land management activities that occurred between 2001-2014 will be modeled into the future. The management and land use practices that occur within the BAU scenario are derived from empirical data used by staff to quantify how each NWL land type was managed during this 2001-2014 period. For forests, shrublands/chaparral, and grasslands, BAU constitutes approximately 250,000 acres of annual statewide treatments. For croplands, BAU represents no healthy soil practices because during this period the healthy soil program did not yet exist. For land use change within all land types that consider land use change, historical rates of land conversion from 2001-2014 were also taken from empirical data and modeled into the future for the BAU.

	1 – Prioritize short-term carbon stocks, minimize disturbances.	2 – Prioritize implementation of strategies in current commitments/plans	3 – Prioritize restoration and climate resilient carbon stocks	4 – Prioritize forest wildfire reduction and other fuel reduction efforts
Forests	No forest management. No land conversion of forests, shrublands/chaparral, or grasslands. Maintain fire suppression at current levels.	<p>Implement 1M acre strategy, 30x30 strategy, NWL Implementation Plan, among other State commitments.</p> <p>~ 1 million acres treated Statewide annually in forests, shrublands/chaparral, and grasslands, comprised of regionally specific management strategies that includes prescribed fire, thinning, harvesting, and other management actions. No land conversion of forests, shrublands/chaparral, or grasslands.</p>	<p>Decrease fire severity and create more climate resilient carbon stocks by 2045.</p> <p>2-2.5 million acres treated Statewide annually in forests, shrublands/chaparral, and grasslands, comprised of regionally specific management strategies that includes prescribed fire, thinning, harvesting, and other management actions. No land conversion of forests, shrublands/chaparral, or grasslands.</p>	<p>Decrease wildfire emissions, wildfire around communities, and fire sizes.</p> <p>5-5.5 million acres treated Statewide annually in forests, shrublands/chaparral, and grasslands, comprised of regionally specific management strategies that includes prescribed fire, thinning, harvesting, and other management actions. This rate matches the historical rate of disturbance Statewide. No land conversion of forests, shrublands/chaparral, or grasslands.</p>

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Shrublands/Chaparral	No shrubland management. No land conversion of forests, shrublands/chaparral, or grasslands. Maintain fire suppression at current levels.	The ~1 million acres treated includes management of shrublands and chaparral to reduce fuels surrounding communities using mechanical treatments appropriate for shrublands and chaparral. Limited prescribed burning in chaparral. No land conversion of forests, shrublands/chaparral, or grasslands.	The 2-2.5 million acres treated includes regionally specific increased management of shrubland and chaparral to reduce fuels surrounding communities using mechanical treatments appropriate for shrublands and chaparral. Limited prescribed burning in chaparral. No land conversion of forests, shrublands/chaparral, or grasslands.	The 5-5.5 million acres treated includes regionally specific increased management of shrubland and chaparral to reduce fuels surrounding structures using mechanical treatments appropriate for shrublands and chaparral. Limited prescribed burning in chaparral. No land conversion of forests, shrublands/chaparral, or grasslands.
Grasslands	No grassland management that would remove above ground carbon. No land conversion of forests, shrublands/chaparral, or grasslands. Maintain fire suppression at current levels.	The ~1 million acres treated includes management of grasslands to reduce fuels surrounding communities using management strategies appropriate for grasslands. No land	The 2-2.5 million acres treated includes increased management of grasslands interspersed in forests to reduce fuels surrounding communities using management strategies	The 5-5.5 million acres treated includes increased management of grasslands interspersed in forests to reduce fuels surrounding structures using management strategies appropriate

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		conversion of forests, shrublands/chaparral, or grasslands.	appropriate for grasslands. No land conversion of forests, shrublands/chaparral, or grasslands.	for grasslands. No land conversion of forests, shrublands/chaparral, or grasslands.
Croplands	Maximize climate smart ag practices for annual and perennial crops at upper bounds of topography, water, and agronomic constraints for carbon – ~ 100,000 acres annually. Only model land conversion away from ag resulting from SGMA, maximize annual crop ag land easements/conservation – ~ 11,000 acres annually.	Implement climate smart practices for annual and perennial crops on ~80,000 acres annually. Land easements/conservation on annual crops at ~8,000 acres annually. Increase organic agriculture to 25% of all cultivated acres by 2045 (~97,000 acres annually).	Implement climate smart practices for annual and perennial crops on ~50,000 acres annually. Land easements/conservation on annual crops at ~6,000 acres annually. Increase organic agriculture to 20% of all cultivated acres by 2045 (~65,000 acres annually).	Implement climate smart practices for annual and perennial crops on ~25,000 acres annually. Land easements/conservation on annual crops at ~3,000 acres annually. Increase organic agriculture to 15% of all cultivated acres by 2045 (~32,000 acres annually).

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	Maximize organic agriculture to feasible extent (30% of all cultivated acres in organic ag by 2045, or ~ 130,000 acres annually).			
Developed Lands	Maximize tree cover at upper bounds of biological and physical constraints – investment in tree maintenance and planting increase by 2000% over current levels, and tree watering is 1000% less sensitive to drought. Establish defensible space that accounts for property boundaries.	Investment increase of 200% above current levels and tree watering is 200% less sensitive to drought. Establish defensible space that accounts for property boundaries.	Investment increase of 20% above current levels and tree watering is 30% less sensitive to drought. Establish defensible space that accounts for property boundaries.	Investment increase of 2% above current levels and tree watering is 10% less sensitive to drought. Establish defensible space regardless of property boundaries.

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Wetlands	Restore delta wetlands at the upper bounds of biological and feasibility constraints – 120,000 acres.	Restore 18,000 acres of delta wetlands, in line with existing State commitments and plans.	Restore 60,000 acres of delta wetlands.	Restore 18,000 acres of delta wetlands, in line with existing State commitments and plans. Same as alt 2
Sparsely Vegetated Lands	No land conversion.	Land conversion at 25% of BAU land conversion rate.	Land conversion at 50% of BAU land conversion rate.	Land conversion at 75% of BAU land conversion rate.

Management Strategies for Modeling by Landscape Type

CARB staff are utilizing multiple models to analyze the carbon impacts of land management actions, climate change, wildfire and water use on California's diverse natural and working lands by 2045 and by the end-of-the century. The list below represents the management actions CARB staff plan to model. This list is not a comprehensive list of all management actions possible on California's lands, nor will all management actions listed here be implemented in all regions of California. Management strategies will need to align with local and regional conditions to achieve desired outcomes. California's Natural and Working Lands Climate Smart Strategy includes a more comprehensive listing of priority nature-based solutions and management actions. As part of the 2022 Scoping Plan effort, CARB staff will model as many of the management actions identified in draft Natural and Working Lands Climate Smart Land Strategy as were feasible by CARB for the 2022 Scoping Plan. The management actions that were included in the model were selected because of the depth of science available and the State of California's previous work to quantify these action's impacts on ecological systems. CARB is also aligning definitions of NWL cover types with the Natural and Working Lands Climate Smart Strategy and IPCC categories, where possible⁴.

Forests⁵ cover approximately 27% of California. Management strategies to be modeled for forests: biological/chemical/herbaceous treatments (e.g. herbicide application), clearcut, various timber harvests (e.g. variable retention, seedtree/shelterwood, selection harvesting), mastication, other mechanical treatments (e.g. piling of dead material, understory thinning), prescribed burning, and thinning. Avoided land conversion to another land use is also included in the modeling. Wildfire is modeled and is responsive to management strategies and climate conditions.

Shrublands and chaparral cover approximately 31% of California. Management strategies to be modeled for shrublands and chaparral: biological/chemical/herbaceous treatments, prescribed burning, mechanical treatment, such as mastication, crushing, mowing, piling, etc.; and avoided conversion from shrubland to another land use. Wildfire is modeled and is responsive to management strategies and climate conditions.

Grasslands cover approximately 9% of California. Management strategies to be modeled for grasslands: biological/chemical/herbaceous treatments, prescribed burning; and avoided land conversion from grasslands to another land use. Wildfire is modeled and is responsive to management strategies and climate conditions.

Croplands cover approximately nine percent of California. Management strategies to be modeled for row crops: cover cropping, no till, reduced till, compost amendment, transition to organic farming, avoided conversion of annual crop ag land through easements, establishing riparian forest buffers, alley cropping, establishing windbreaks/shelterbelts, establishing tree

⁴ [NWL Climate Smart Strategy appendix](#)

⁵ Includes mountain meadow and riparian zones



and shrubs in croplands, and establishing hedgerows. For perennial crops, windbreaks/shelterbelts, hedgerows, conversion from annual crops to perennial crops, and avoided conversion to other land-uses are modelled.

Developed lands cover approximately six percent of California. Management strategies to be modeled for developed lands: Increasing tree canopy cover through planting trees and improved management of existing trees; and removing vegetation surrounding structures in accordance with the CALFIRE Defensible Space PRC 4291.

Wetlands cover approximately 2 percent of California. Management strategies to be modeled for wetlands: Restoring wetlands through submerging cultivated land in the Sacramento-San Joaquin Delta; and avoided land conversion in the Sacramento-San Joaquin Delta.

Sparsely vegetated lands cover approximately 10% of the state. Management strategies modeled for sparsely vegetated lands: Avoided conversion of sparsely vegetated lands to another land use.