

2022 Scoping Plan Update

Technical Workshop



NATURAL AND WORKING LANDS

JULY 20, 2021

Agenda

- Introduction and overview
- Tribal Government Representative
- NWL Inventory
- Target Development approach
 - EJ Advisory Committee Comments
 - Mid-point Q&A
 - 5-Minute Break
- Public Comments, Questions, and Discussion
- Next steps and closing



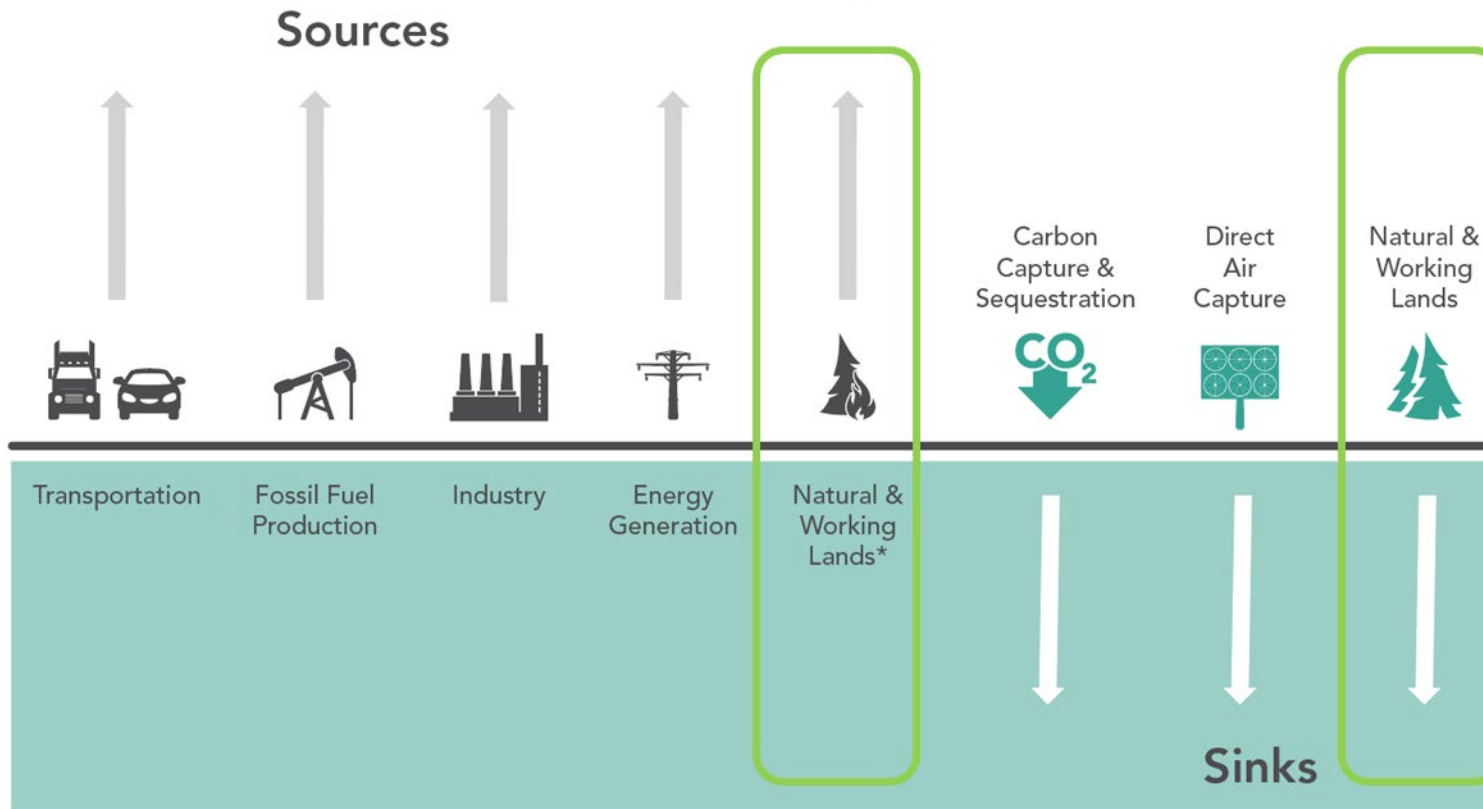
Purpose of Today's Workshop

- Share CARB's concept for quantifying a NWL carbon target
- Receive feedback on CARB's concept and modeling
- Answer technical questions
- Provide the opportunity to help shape CARB's NWL technical work



Science-based Target: Achieve Carbon Neutrality (CO₂e) Mid-Century

Sources Equal Sinks



*Natural and working land emissions come from wildfires, disease, land and ag management practices, and others

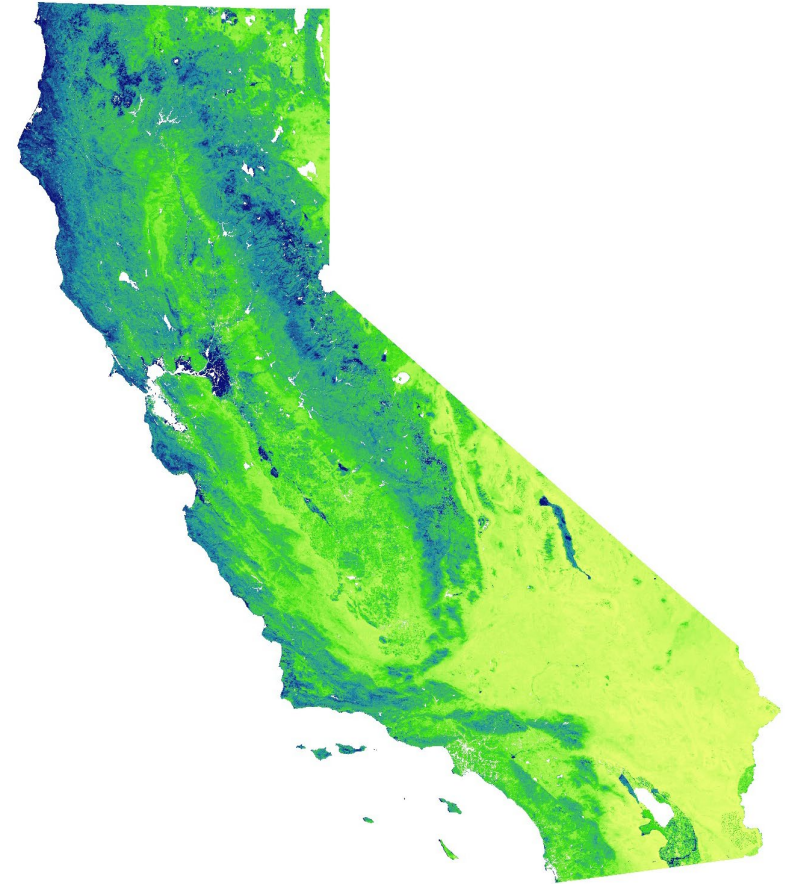
- Include NWL emission sources and sinks
- Prioritize minimizing emissions from sources
- Maximize sinks

California's Natural and Working Lands



NWL Scoping Plan History

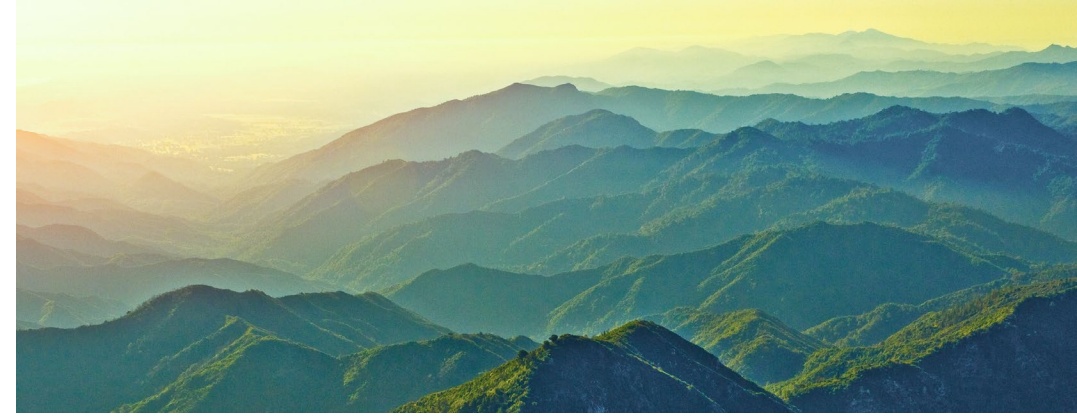
- 2008 Scoping Plan
 - Forests only
 - 5MMT sequestration by 2030
- 2013 Scoping Plan
 - Natural and Working Lands
 - Forest Carbon Plan
- 2017 Scoping Plan
 - Reduce NWL emissions 15-20 MMT
 - NWL Climate Change Implementation Plan
- Carbon Neutrality Executive Order (B-55-18)



Learning from our Tribal Partners

- Remarks from Javier Kinney, Yurok Tribe





Natural & Working Lands Inventory

OVERVIEW FOR THE 2021 SCOPING PLAN

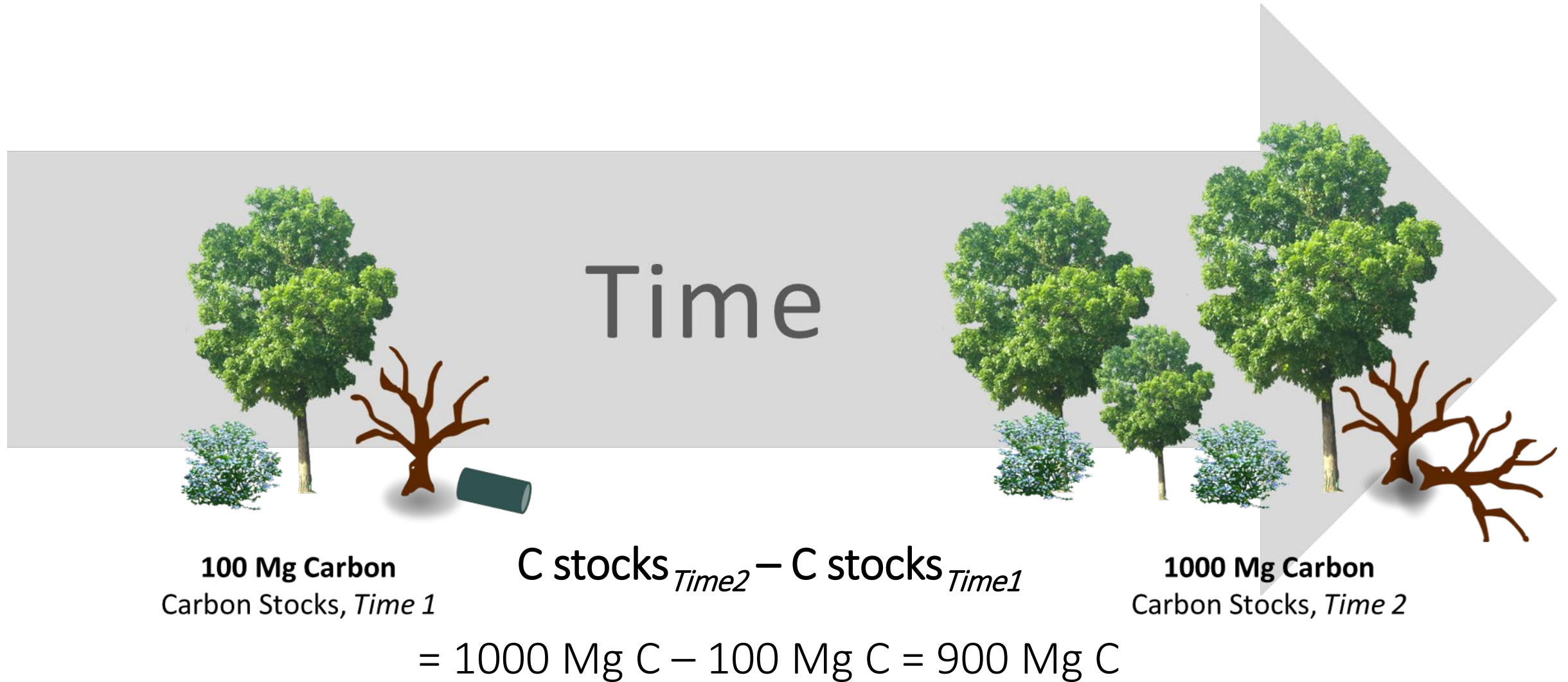
Natural & Working Lands (NWL) Inventory Purposes

- AB 1803 tasked CARB with maintaining the AB 32 GHG inventory, then SB 859 tasked CARB with creating and maintaining the NWL inventory
- Provides a quantitative estimate of the existing ecosystem carbon stored in California's land base
 - Evaluates carbon stocks/stock change and attributes carbon stock change to disturbances
- Important tool for tracking impacts of human activities and interventions, and monitoring progress toward the State's long-term objectives for NWL
 - Serves as the initial condition for future scenario modeling and target setting

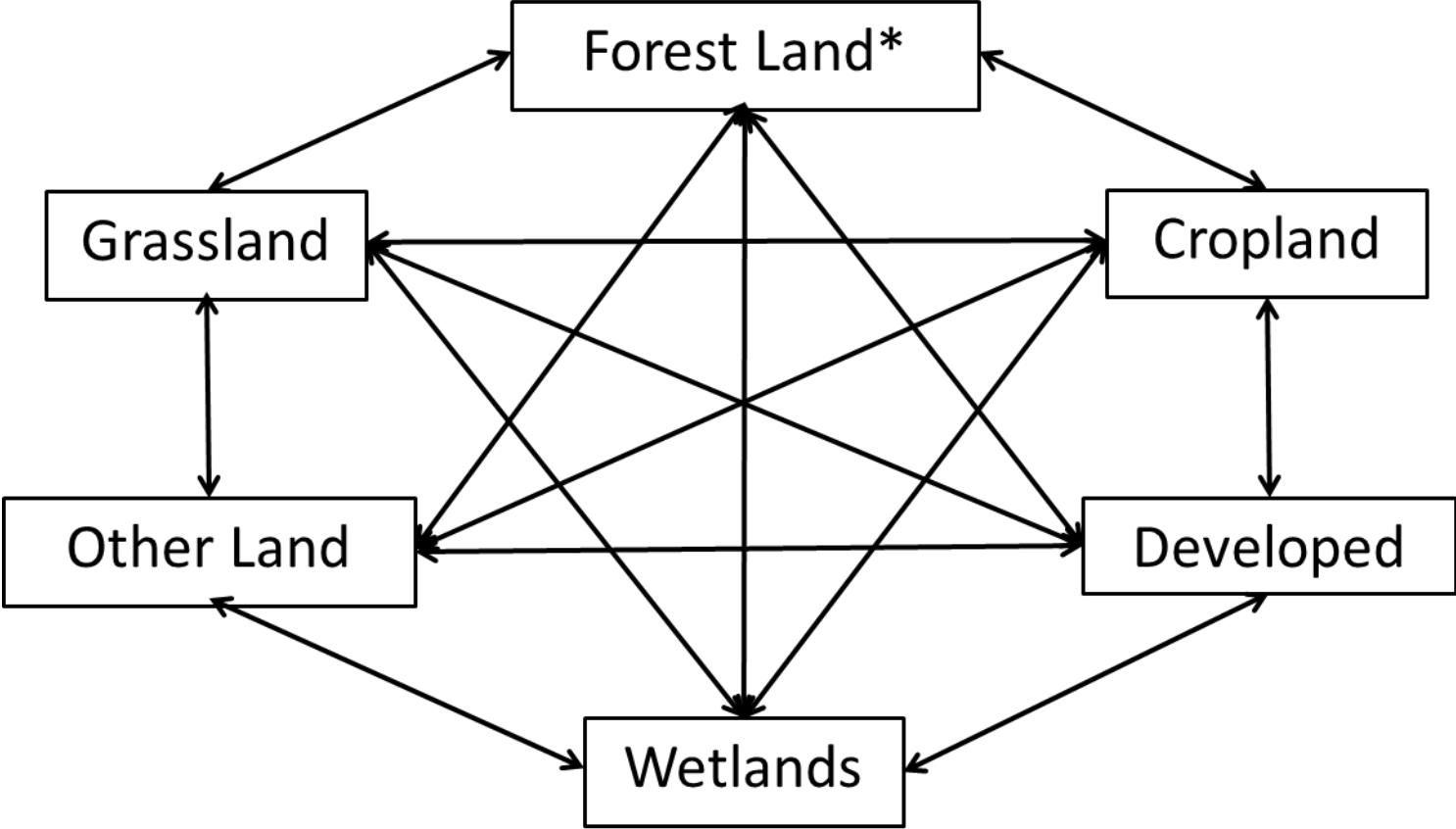
NWL Inventory Features

- Geospatially explicit (shows how much carbon is where)
- Wall-to-wall (covers all of California)
- Tracks change in carbon stocks and land cover over time
- Quantifies carbon by land cover type and by carbon pool
 - Live aboveground biomass (leaves, branches, trunks, etc.)
 - Dead aboveground biomass (snags, litter, etc.)
 - Live belowground biomass (roots)
 - Soil organic carbon

Stock Difference Method

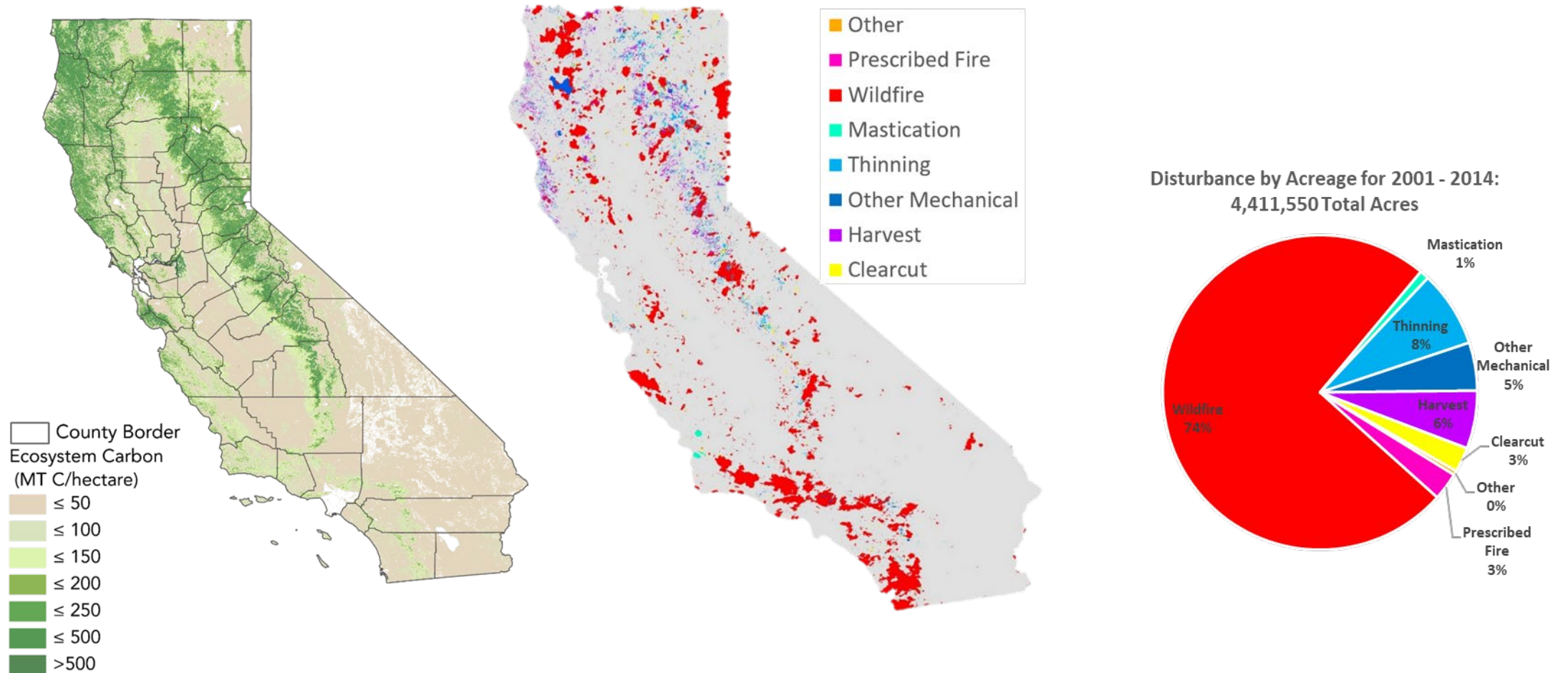


IPCC Conceptual Framework: stasis vs transition

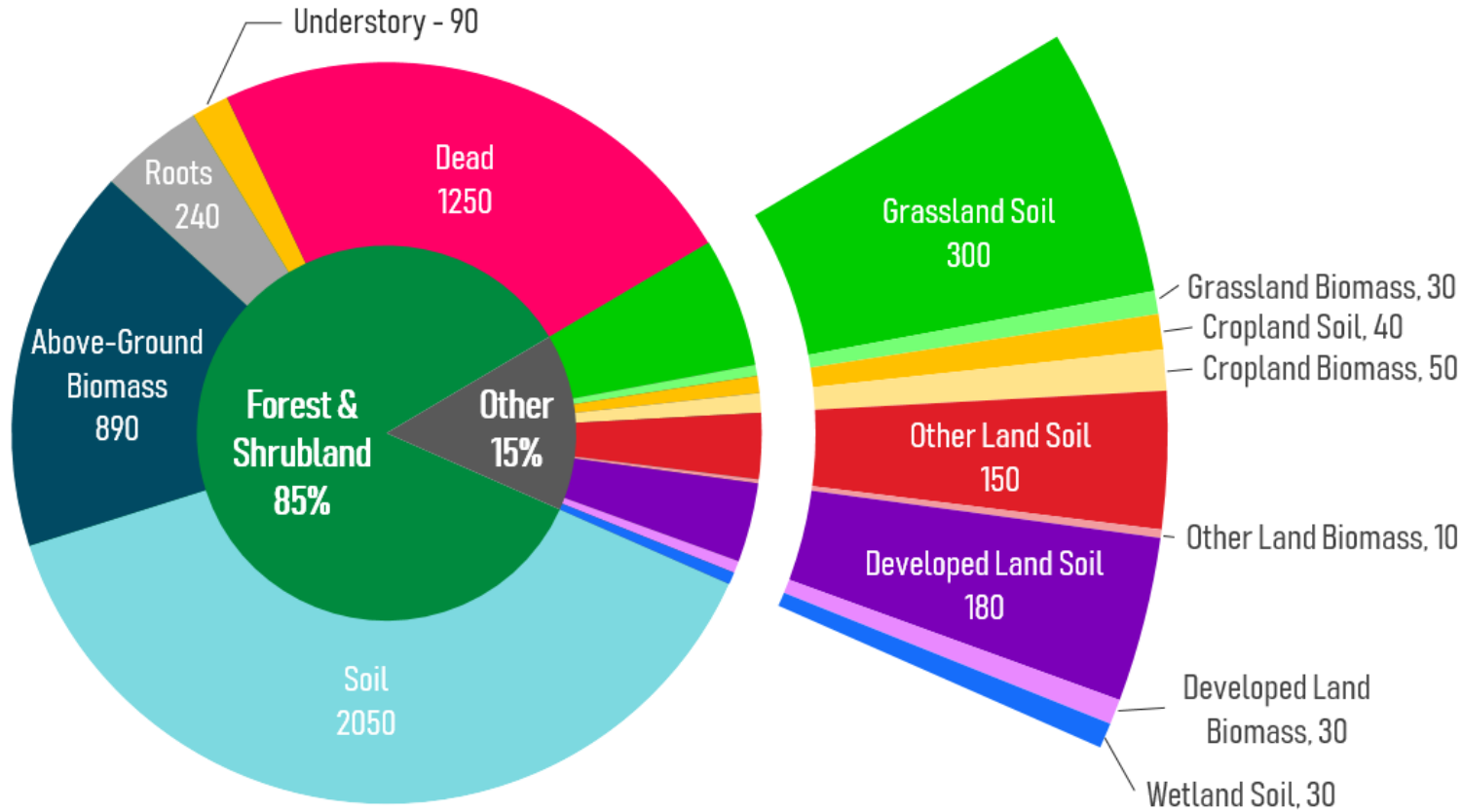


*Tree-dominated & shrub-dominated lands

Geospatially Explicit Inventory Outputs

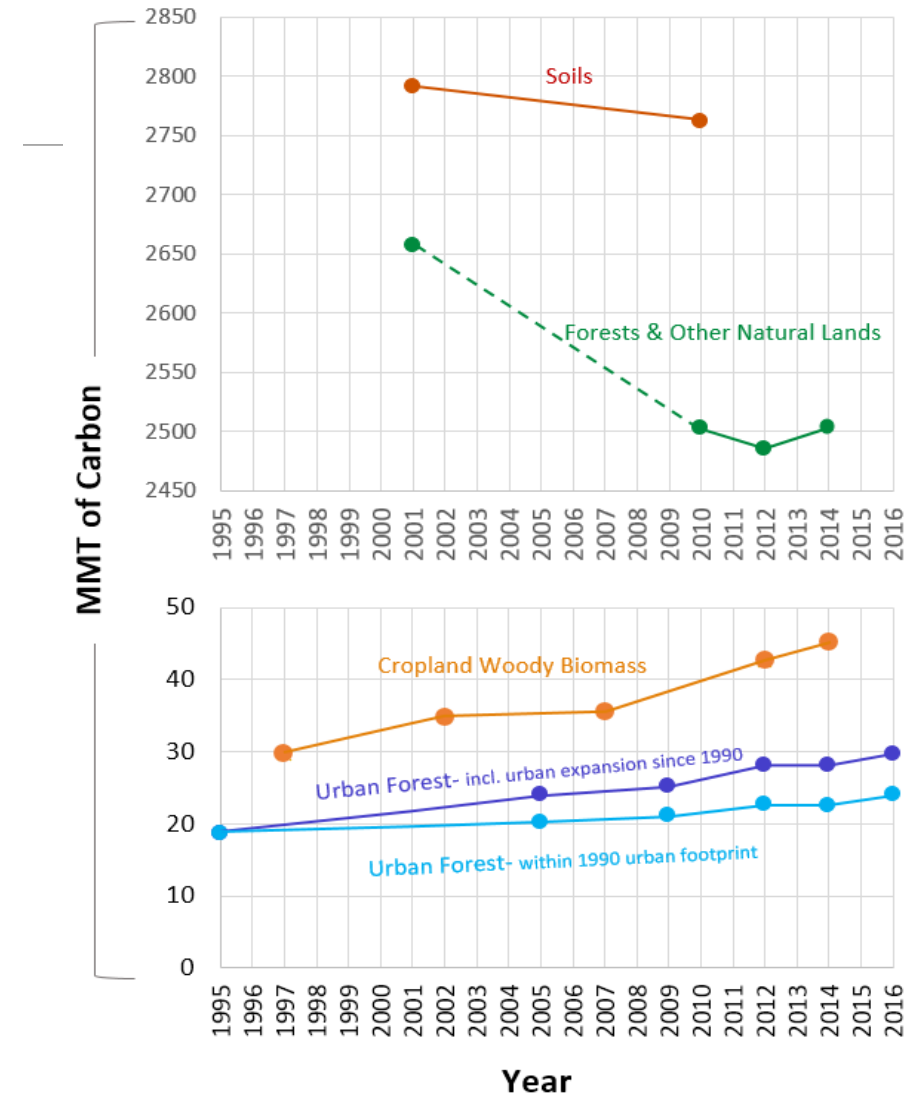


NWL Inventory Summary



5,340 MMT of carbon

2014 distribution of biomass and soil carbon stocks on the California landscape (rounded to the nearest 10 MMT)



Inventory Scope

Natural & Working Lands

Included

- Biomass carbon and soil *organic* carbon in the 6 IPCC land cover categories
- Methane emissions from wetlands

Excluded

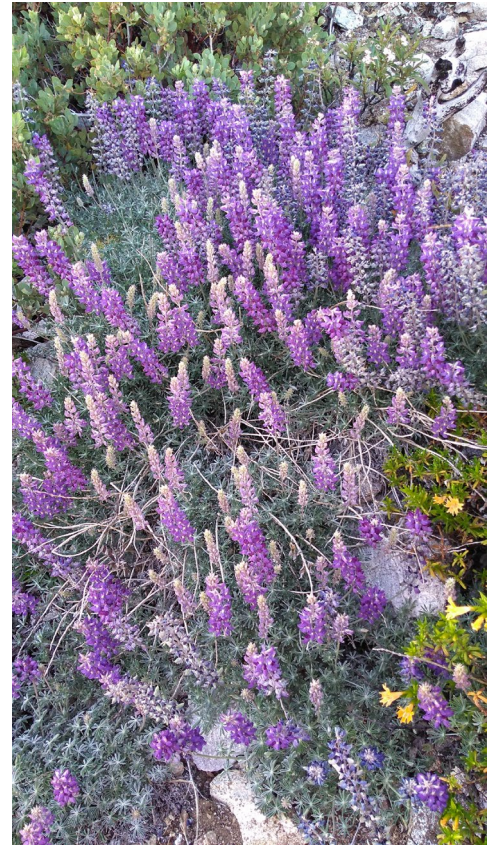
- Carbon in submerged or offshore ecosystems
- Soil *inorganic* carbon
- Avoided Emissions

AB 32 GHG Inventory

- Fertilizers
- Fuel use in agricultural & forestry equipment
- Livestock manure management
- Livestock enteric fermentation
- Crop management*

*Includes crop residue burning, cultivation of histosol soils, rice cultivation, & lime/dolomite soil treatments

Target Development Approach



Natural and Working Lands Boundaries

- Lands and wetlands
- Perennial vegetation
- On site carbon stocks in live and dead plant biomass, and soil
- Carbon fluxes associated with photosynthesis, respiration, and decomposition
- Biomass carbon stock changes associated with natural disturbances
- Carbon stock changes associated with actions that directly change biomass or soil carbon stocks
- Harvested wood products and vegetative waste (cross-sectoral)

Principles for NWL Target Setting

- Include emissions/sequestration and carbon stocks
- Focus on ecosystem benefits and impacts as a whole
- Include regional priorities
- Target is not predetermined (bottom-up process)
- Utilize latest science and publicly accessible data/models
- Focus on largest NWL carbon pools
- Scale up/improve over time

NWL Target and Carbon Neutrality

- Preliminary analysis indicates anthropogenic emissions remain in 2045
- Additional NWL emissions makes meeting CN by 2045 more challenging
- Need to understand magnitude of NWL benefits and impacts
- NWL target informs target-setting for traditional AB 32 sectors

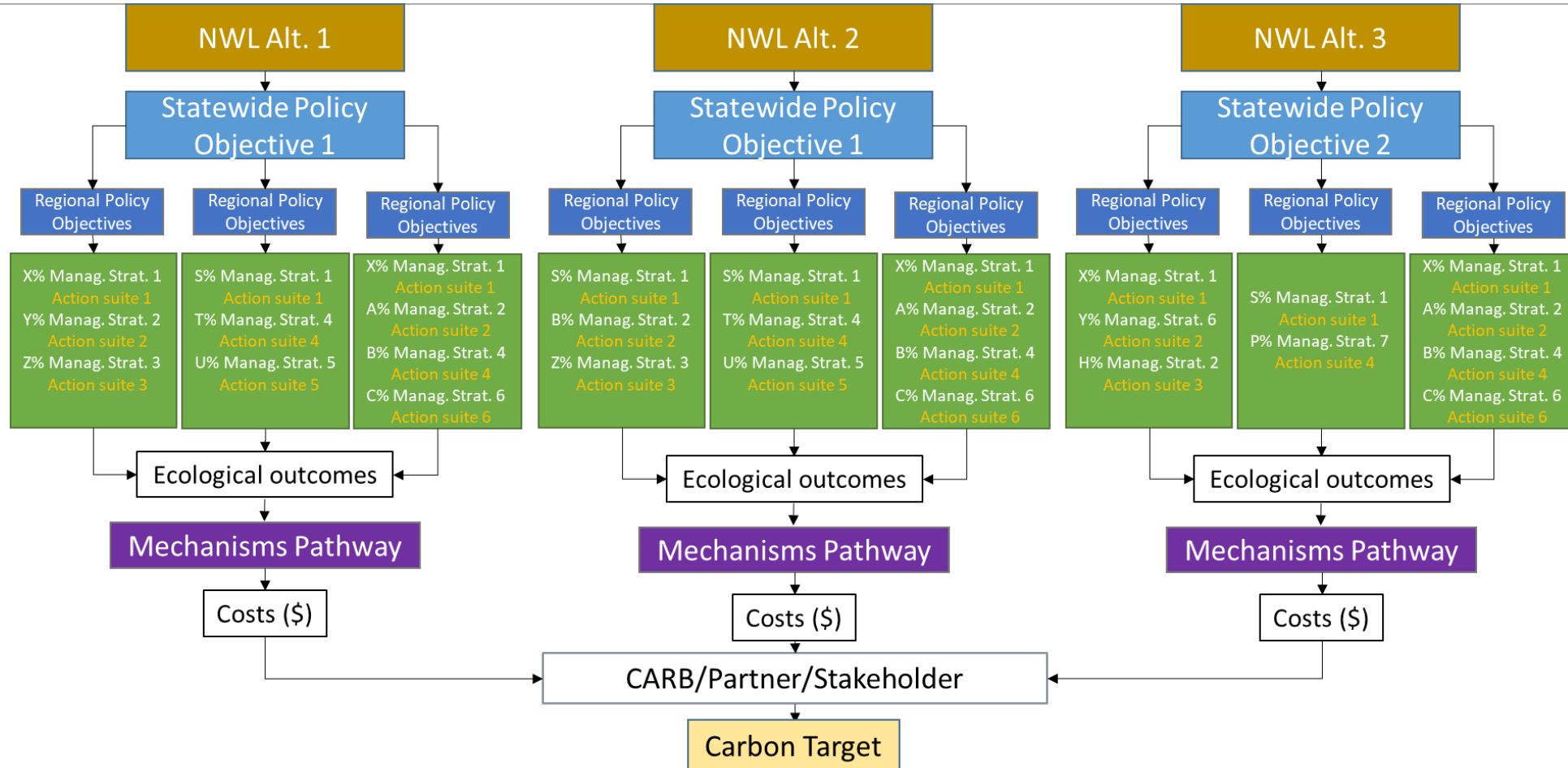
What is needed for NWL target setting?

- Understanding current carbon stocks
- Understanding what happens in the absence of action
- Understanding effect of current and future management actions
- Deciding on the units for the target
 - e.g., CO₂ / yr, acreage, C stock change, etc.
- Creating a repeatable process to evaluate various future scenarios
- **Identify a carbon target all California NWL**

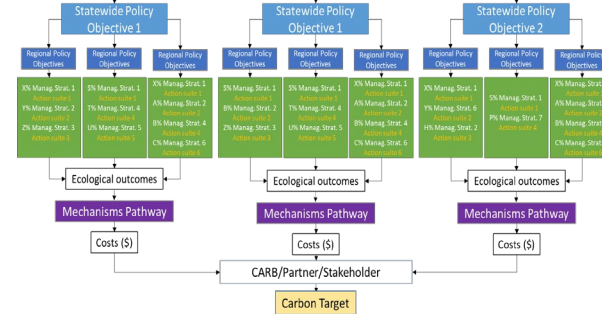
TOOLS FOR TARGET SETTING

- ❖ Carbon stock inventories
- ❖ Scientific literature
- ❖ Modeling
- ❖ Results of past NWL actions
- ❖ State and regional planning documents
- ❖ Interagency coordination
- ❖ Public workshops

Target Setting Process for NWL



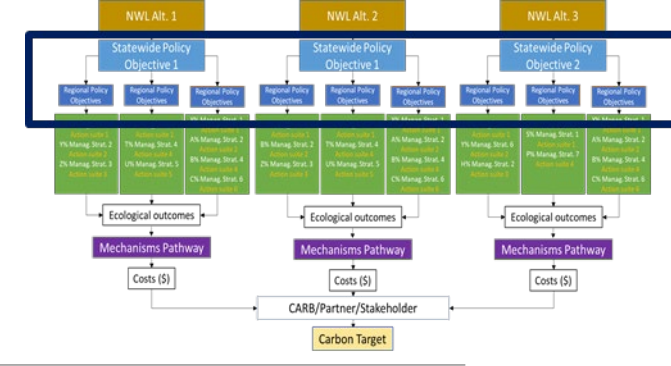
Target Setting Definitions



Policy Objective	Management Strategy	Action	Mechanism Pathway
<p>A jurisdictional goal on how lands are managed into the future. This should be the ends that are desired in terms of on-the-ground management.</p>	<p>An overall approach to on-the-ground land management, including where, when, and what type of actions occur.</p>	<p>On-the-ground activity that alters the landscape. A management strategy is made of up individual actions.</p>	<p>A portfolio of levers that California can use to elicit the desired changes in management strategies (legislation, incentives, regulation, etc).</p>
<ul style="list-style-type: none"> • Treat 1M acres of forest and shrublands per year • Increase cover crops by X% • Increase urban canopy cover by Y% 	<p>Within a watershed</p> <ul style="list-style-type: none"> • Thin 100 acres/3 years • Prescribe burn 400 acres/1 year • Clear cut 80 acres/2 years 	<ul style="list-style-type: none"> • Thinning • Clear cuts • Prescribed burning • Cover cropping • Planting • Etc. 	<ul style="list-style-type: none"> • Ecosystem services markets • Conservation easements • Biomass products and fuels incentives • Subsidies • Etc.

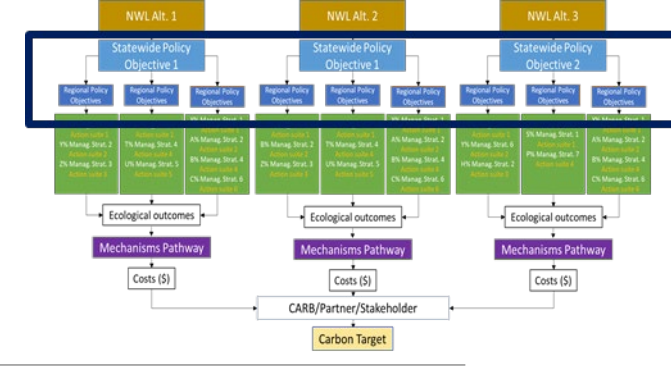
NWL Alternative Scenario: A set of policy objectives, management strategies, and a mechanism pathway

Policy Objectives



- Statewide and regional policy objectives considered
- We want the **objectives** that you are hoping to accomplish through policy
 - NOT the policy itself (this will come in the mechanisms step)
- Action oriented to direct management strategies
- As specific as possible
- Will set how aggressive California will be in addressing climate change
 - Seeking input and building off previous information gathering

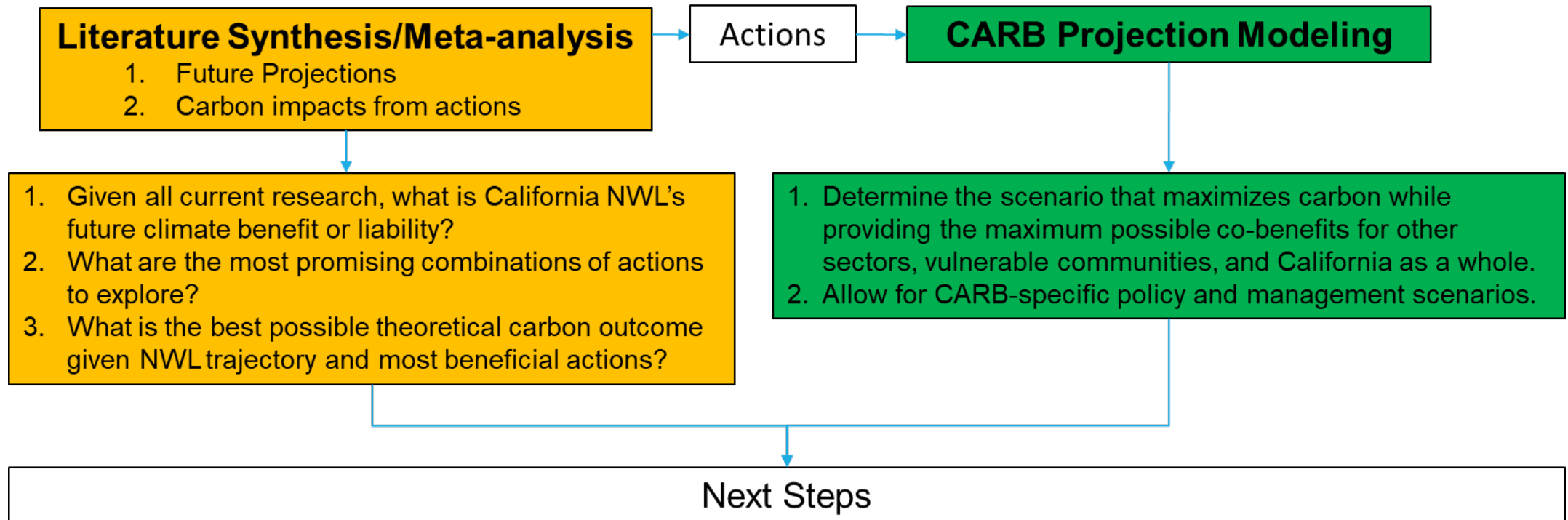
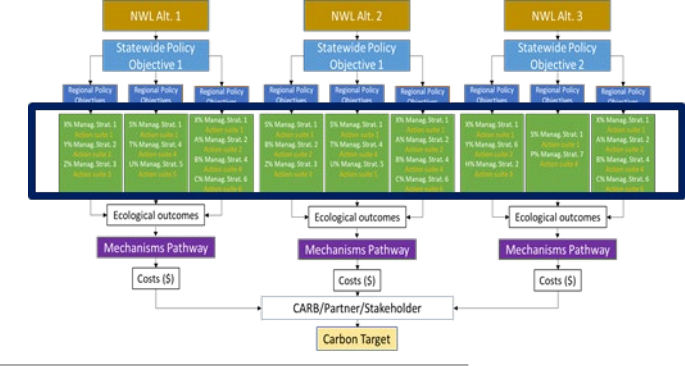
Policy Objectives

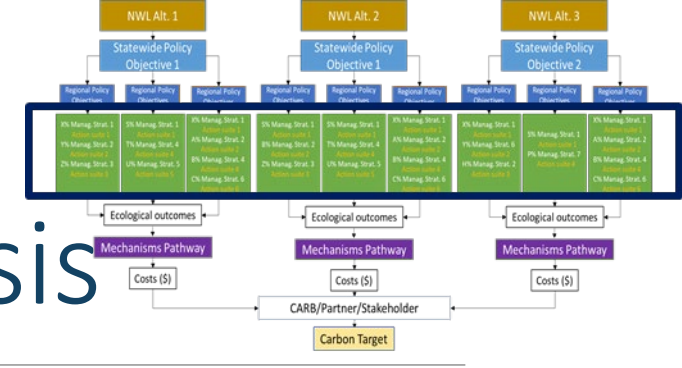


■ Statewide and Regional inputs

- California Natural Resources Agency (CNRA) - Climate Smart Strategy
- California Department of Food and Agriculture (CDFA) – Farmer and Rancher led climate solutions
- Forest Management Task Force - Local and Regional Forest Management Priorities
- Existing Federal, Tribal, and State Agency Land Management Plans
- CalEPA/CARB/CNRA/CDFA/SGC – Draft NWL Climate Change Implementation Plan
- California Air Resources Board – Carbon Neutrality and Scoping Plan workshops
- Environmental Justice Advisory Committee
- Public comment

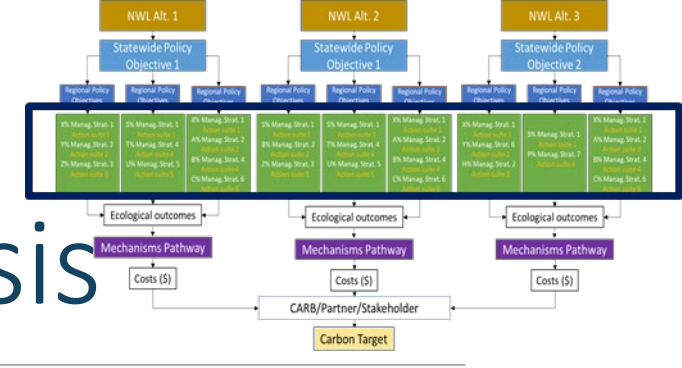
Technical Approach





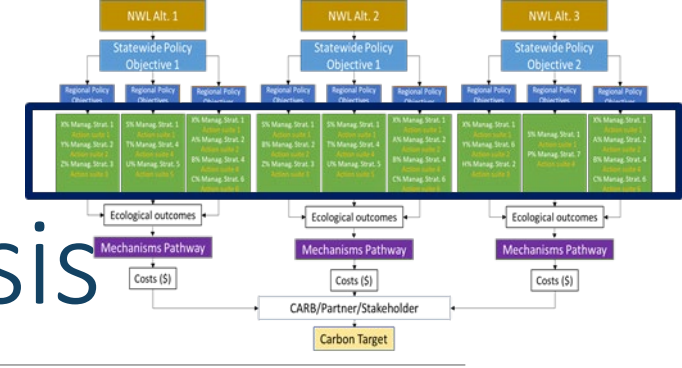
Literature Synthesis/Meta-Analysis

- Due diligence to understand the state of the science surrounding NWL research and incorporate into the Scoping Plan
- Extract and compile quantitative data from existing research to provide a range of estimates
 - Derived estimates will serve as a check for CARB Project Modeling results
 - Land management actions modeled in Management Scenarios informed by synthesis results



Literature Synthesis/Meta-Analysis

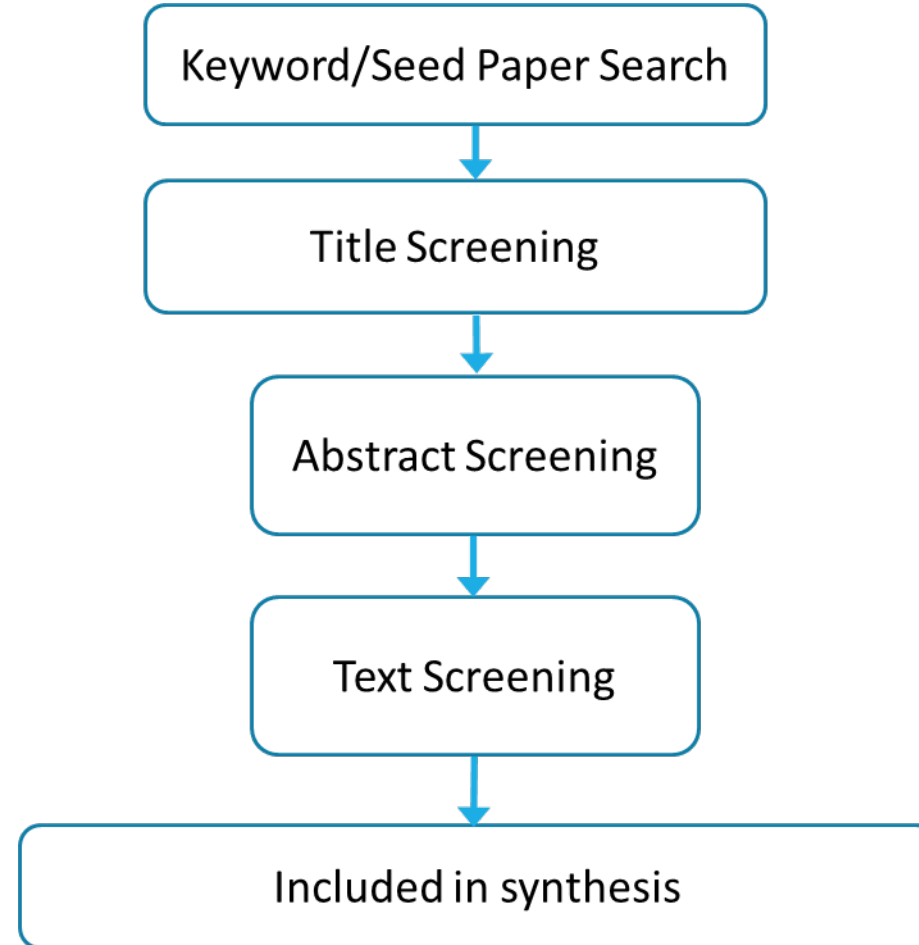
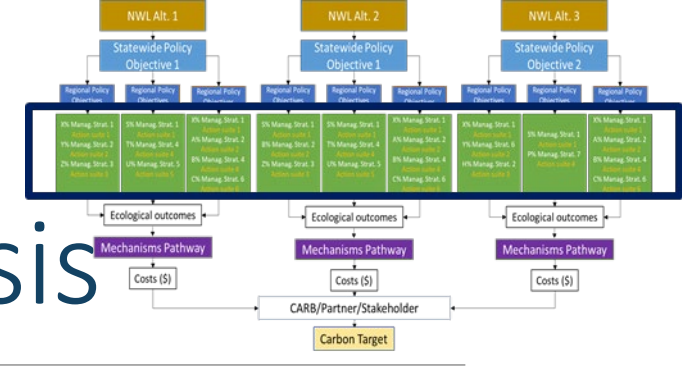
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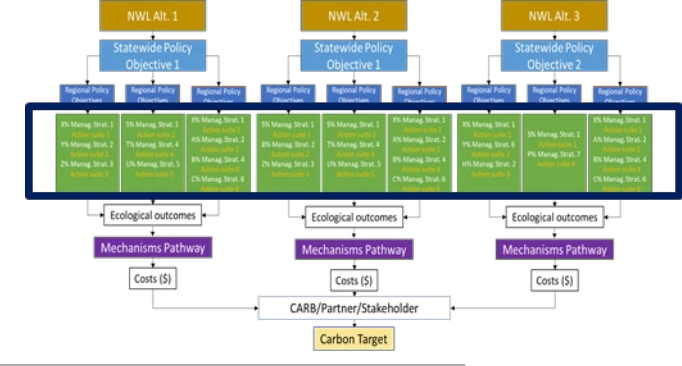
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 2. Carbon Impacts from Actions: *Identify and analyze data from papers that provide quantitative information about the effects of land management actions on future carbon pools and greenhouse gas fluxes in natural and working lands in California.*

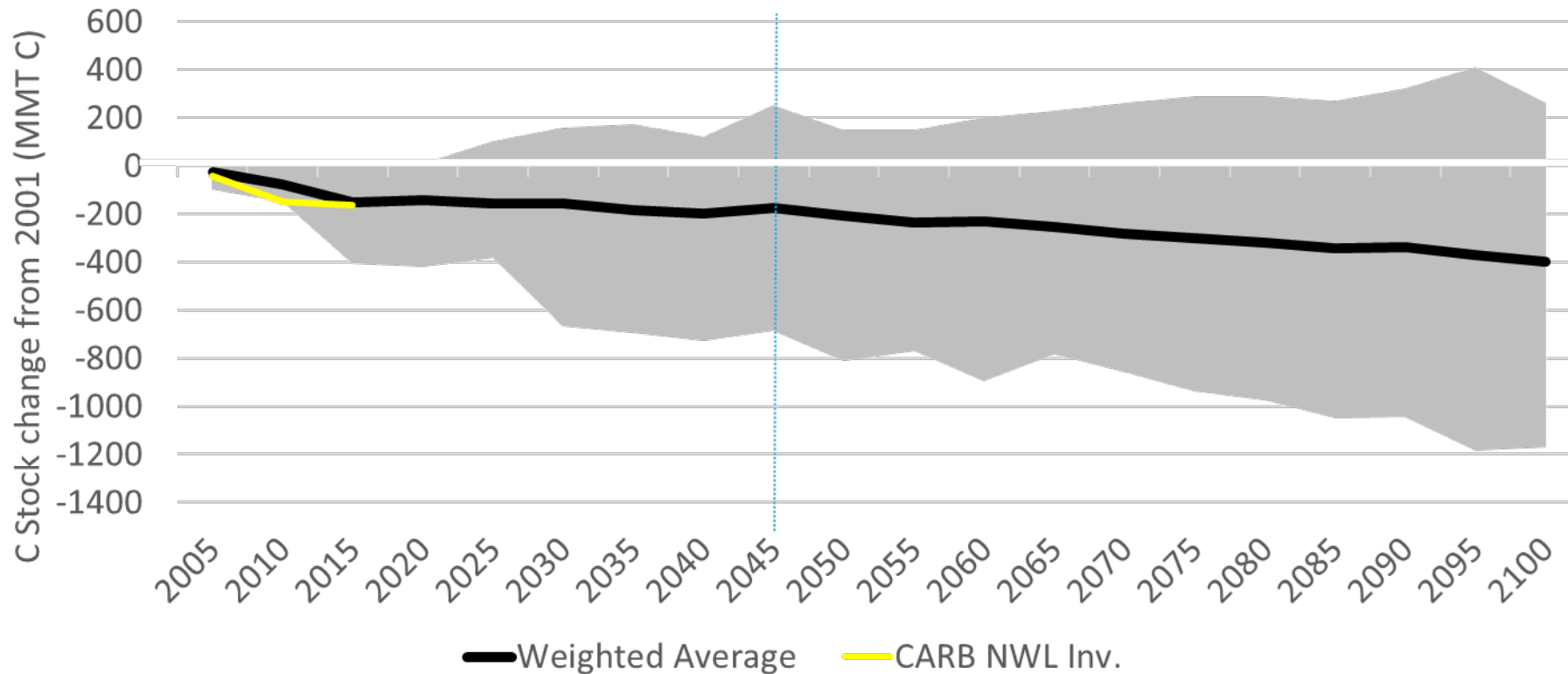
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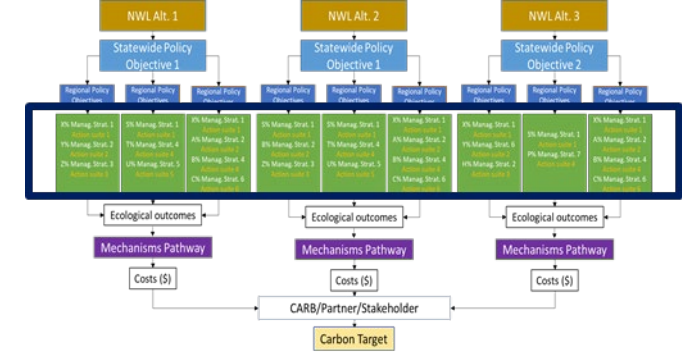
Future Projections (Preliminary)



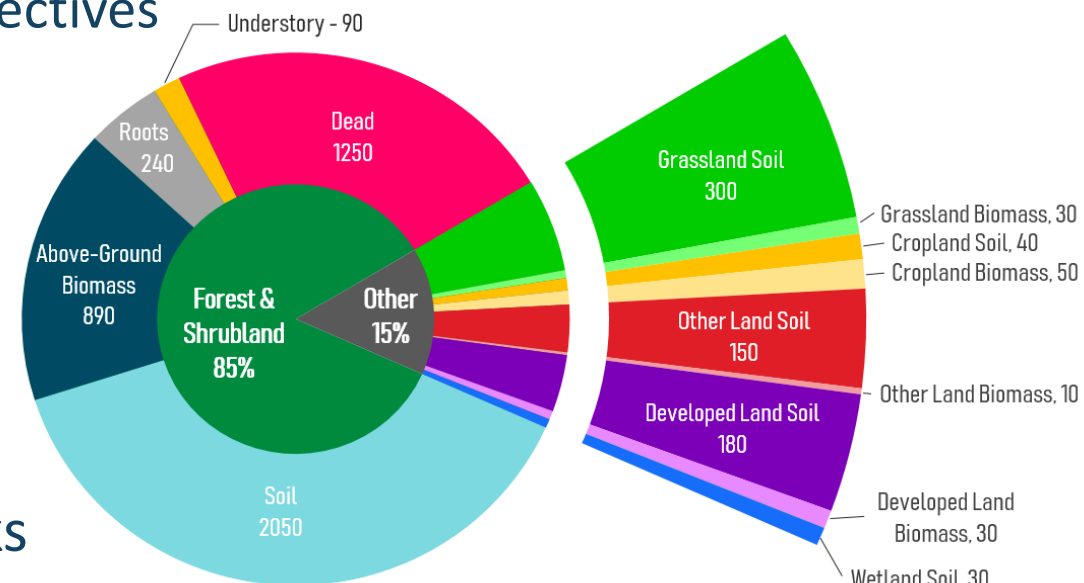
Statewide NWL Preliminary Meta-Analysis Results
(All statewide modeling results)

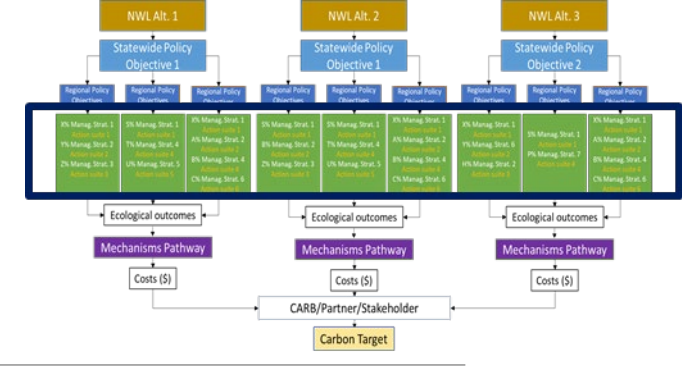


Modeling



- Management strategy portfolios
 - Derived to fulfill the state and regional policy objectives
- Why Model?
 - Quantify ecological outcomes
 - Cumulative impacts
 - Custom scenarios (climate/policy/management)
- Work is being prioritized by current carbon stocks

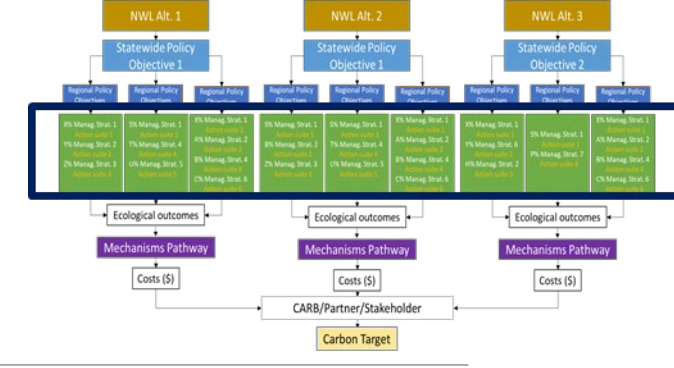




Criteria for Choosing a Model

- Open source or at least publicly accessible
- Dynamic Fire (where applicable)
- Coupled dynamic carbon and water (ideally hydrology)
- Dynamic vegetation mortality
- Scalable
- Ecosystem types that can be modeled
- Existing user-base
- Maturity





NWL Modeling Approaches

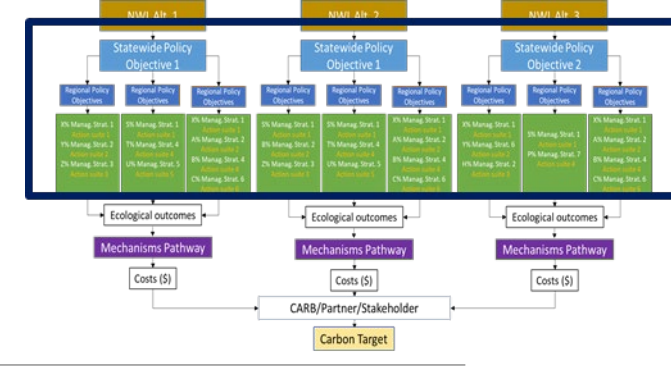
- Forest, Shrublands, riparian zones, mountain meadows
 - Regional Hydro-Ecological Simulation System (RHESys)
 - This can expand into grasslands and settlements
- Agricultural Lands
 - Initially considering: Carbon Reduction Potential Evaluation Tool (CaRPE) – this is comet-planner based
 - Open to other models for consideration
- Wetlands, Settlements (urban, rural, roads, infrastructure), Other lands
 - Considering: Subcalc, National inventory models, IPCC tier-1 methods, in-house derived models
 - Public comment would be appreciated

Equity and Environmental Justice

- AB 32 Environmental Justice Advisory Committee
 - Advise CARB in developing the scoping plan pursuant to Section 38561 and any other pertinent matter in implementing this division
- California Natural Resources Agency 30x30 and Climate Smart Lands Advisory Panel on Using Nature-Based Solutions to Advance Equity
 - Summary Document June 8, 2021 available at www.californianature.ca.gov
- Scoping Plan public workshops and community engagement



Review



- Covered already:
 - What is included in our NWL analysis
 - The general structure of our target making approach along with a few definitions
 - The technical approach, including the synthesis and modeling
 - And the criteria we are using to select models, and the current models **WE** are considering
- Still to come:
 - Our RHESSys modeling for forests and shrublands in detail
 - The mechanism pathways that can be used to achieve our objectives
 - Our proposed baseline
 - Our process for quantifying business as usual
 - Alternative scenarios, and the information that will be used to determine a final carbon target

Environmental Justice Advisory Committee Comments

- EJ Advisory Committee remarks

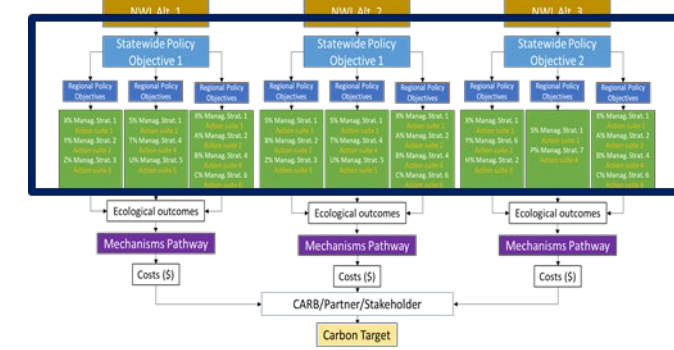


Environmental Justice Advisory Committee Comments

- EJ Advisory Committee remarks
- Key Questions:
 - Are there any other efforts that have gathered regional/local perspectives on nature based climate solution planning/goal setting?
 - Is it clear what we need for policy objectives (put in terms of actions/acre/year)?
 - Are there any models that meet our criteria that you would like us to consider for a specific NWL type (agriculture, wetlands, settlements)?



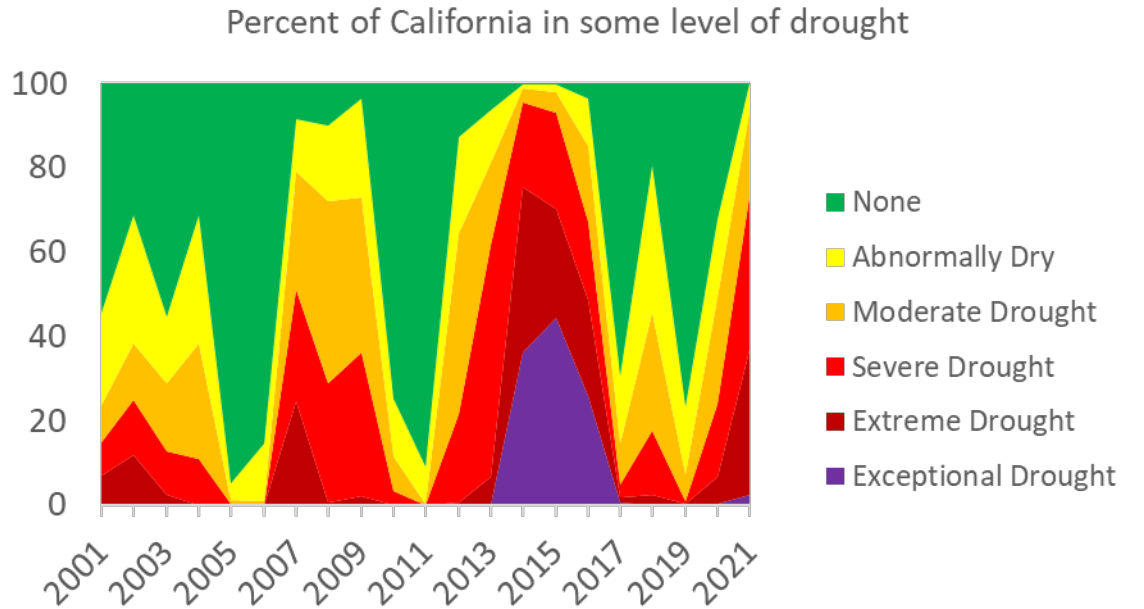
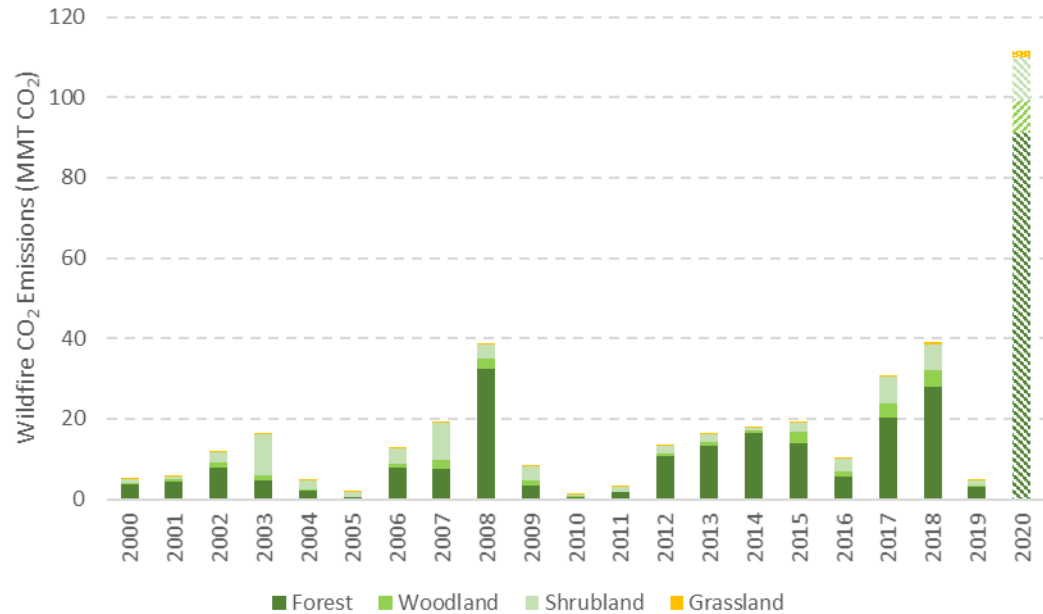
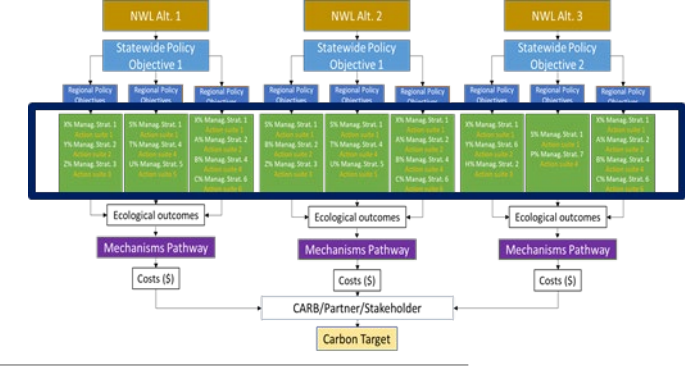
Key Questions



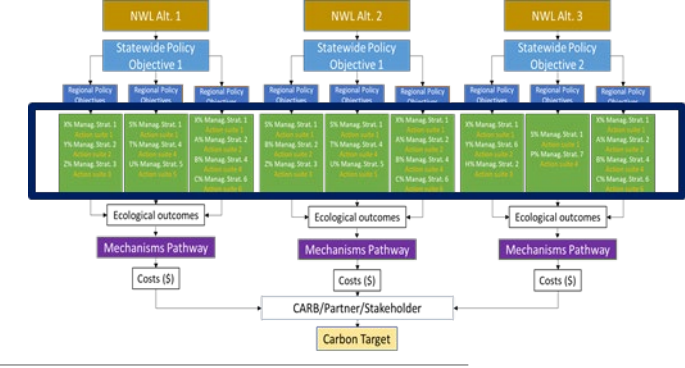
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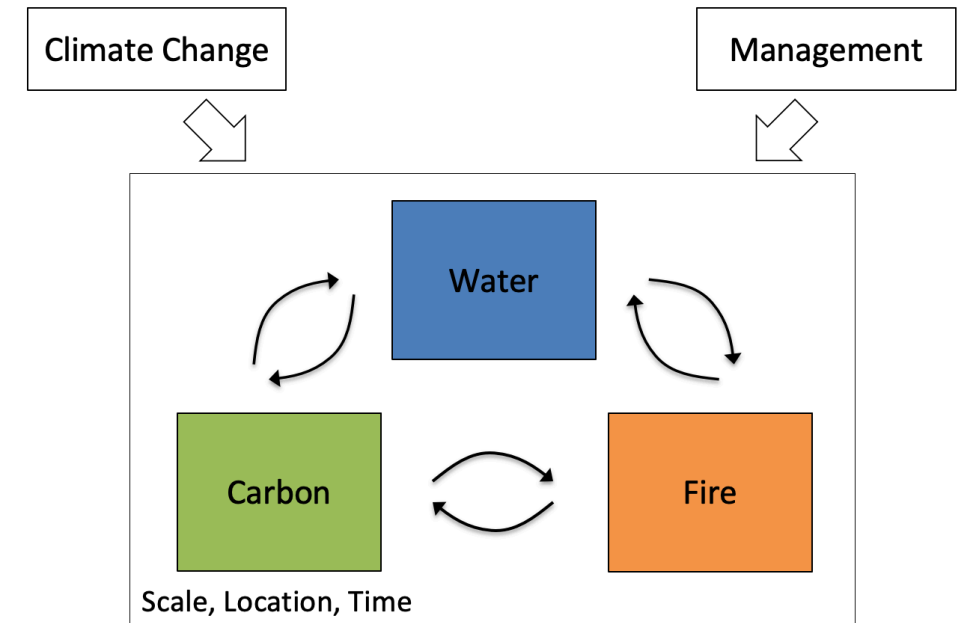
Climate Change is Here



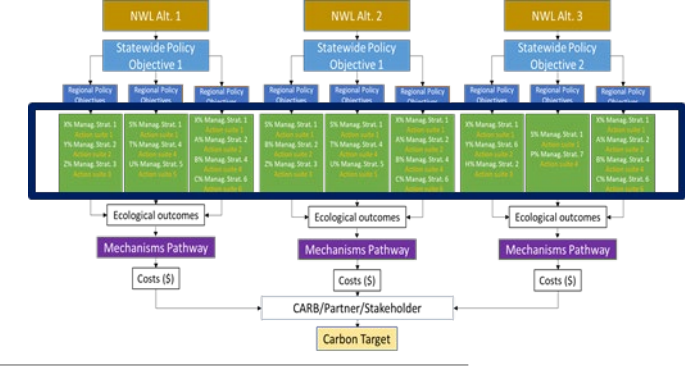
The Ecological System It's All Connected



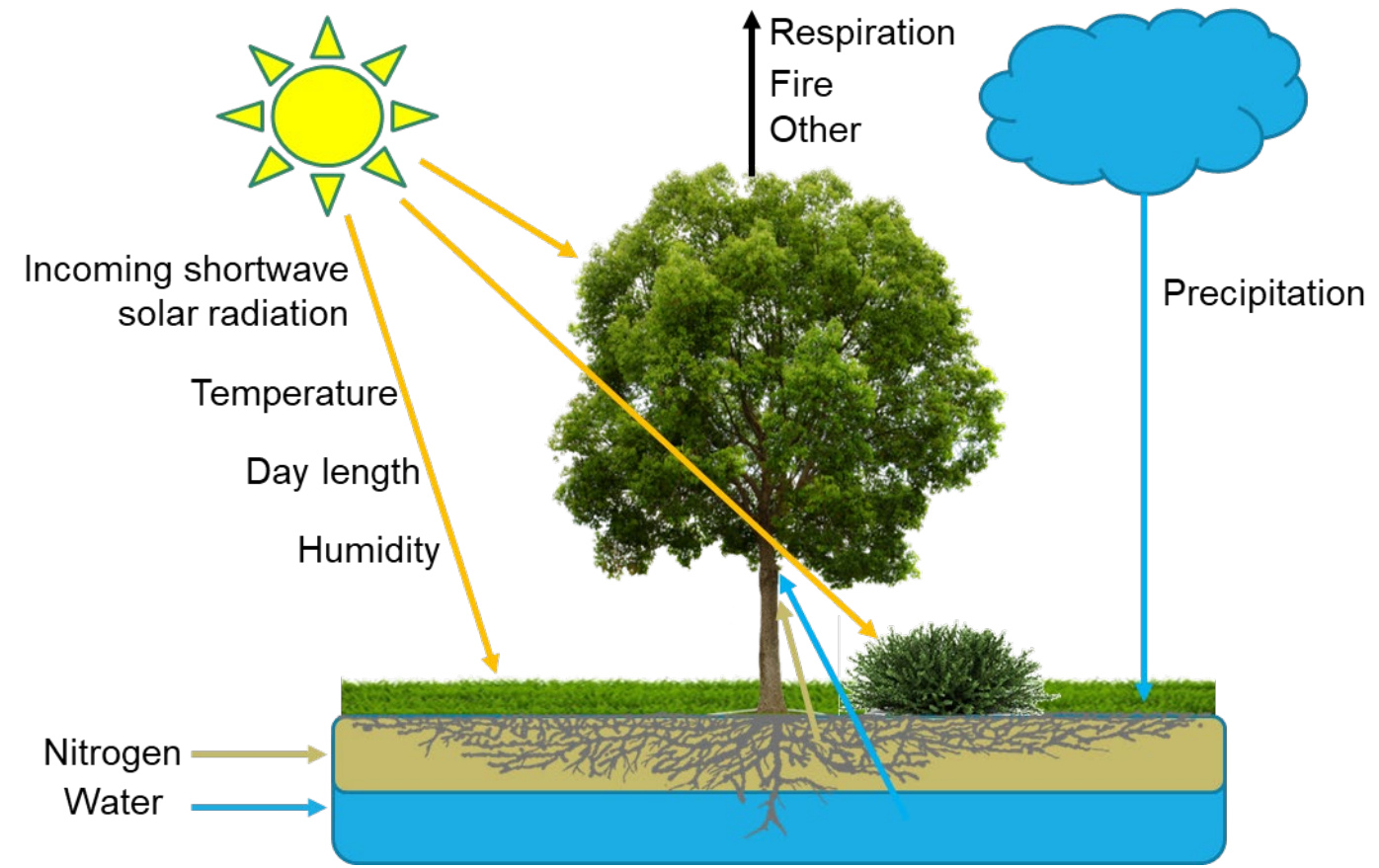
- Carbon is inextricably linked to water and fire
- Integrating carbon, water, and fire are essential to understand impacts from climate and management actions
- We need to be able to model conditions that we have not experienced in the past
- This type of modeling has not been done statewide



Regional Hydrological and Ecological Simulation System (RHESSys)

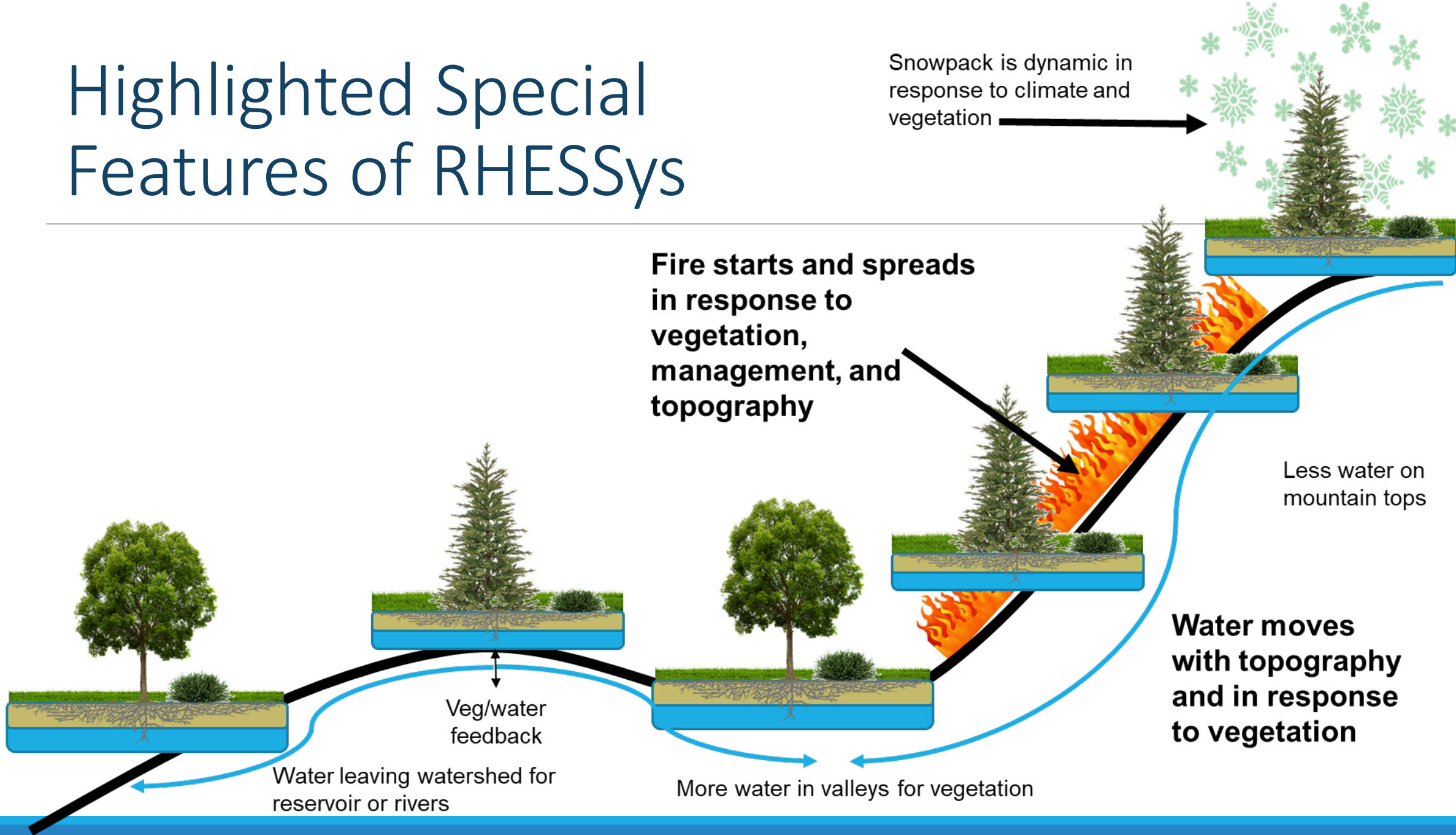


- Process-based watershed-scale model that fully integrated feedbacks between carbon, water, temperature, precipitation, fire, soil nutrients, mortality, and management
- RHESSys can simulate novel conditions
- Quantifies the co-benefit response of management scenarios



Highlighted Special Features of RHESSys

Snowpack is dynamic in response to climate and vegetation

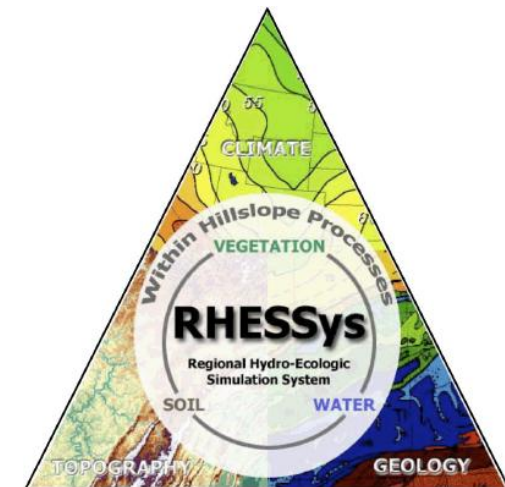
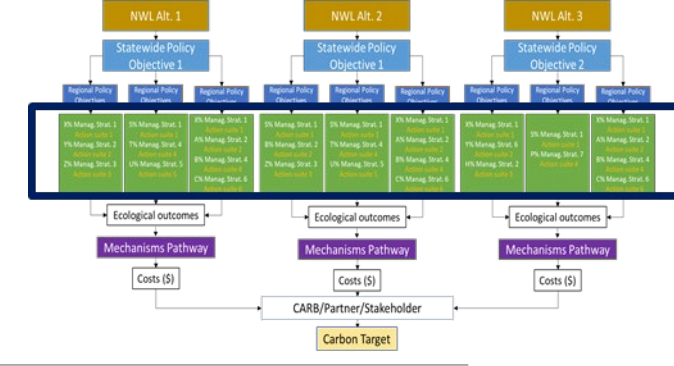


RHESSys Limitations

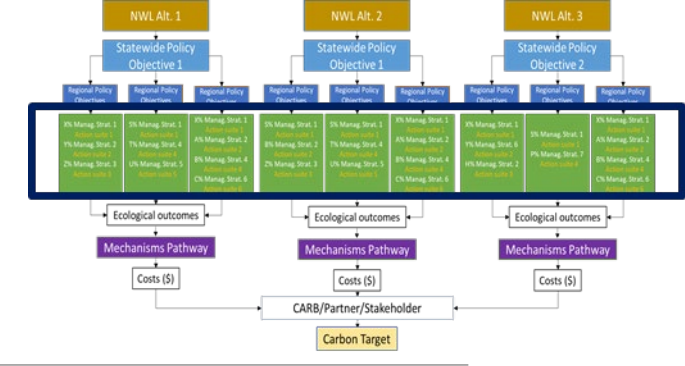
- Complexity (requires time, computational/ technical resources, and skill)
- RHESSys is a watershed-scale model, which will require upscaling for the current Scoping Plan
- RHESSys does not account for type conversion, although it does allow vegetation competition
- Cannot model specific silvicultural treatments

RHESSys is a fully open-source model

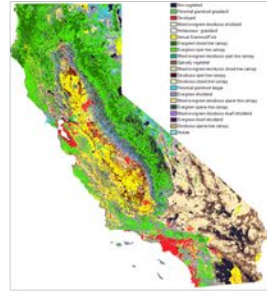
Model code is available at <https://github.com/RHESSys/RHESSys>



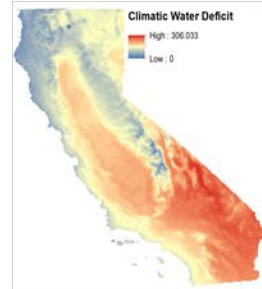
Forest and Shrubland Ecological Units



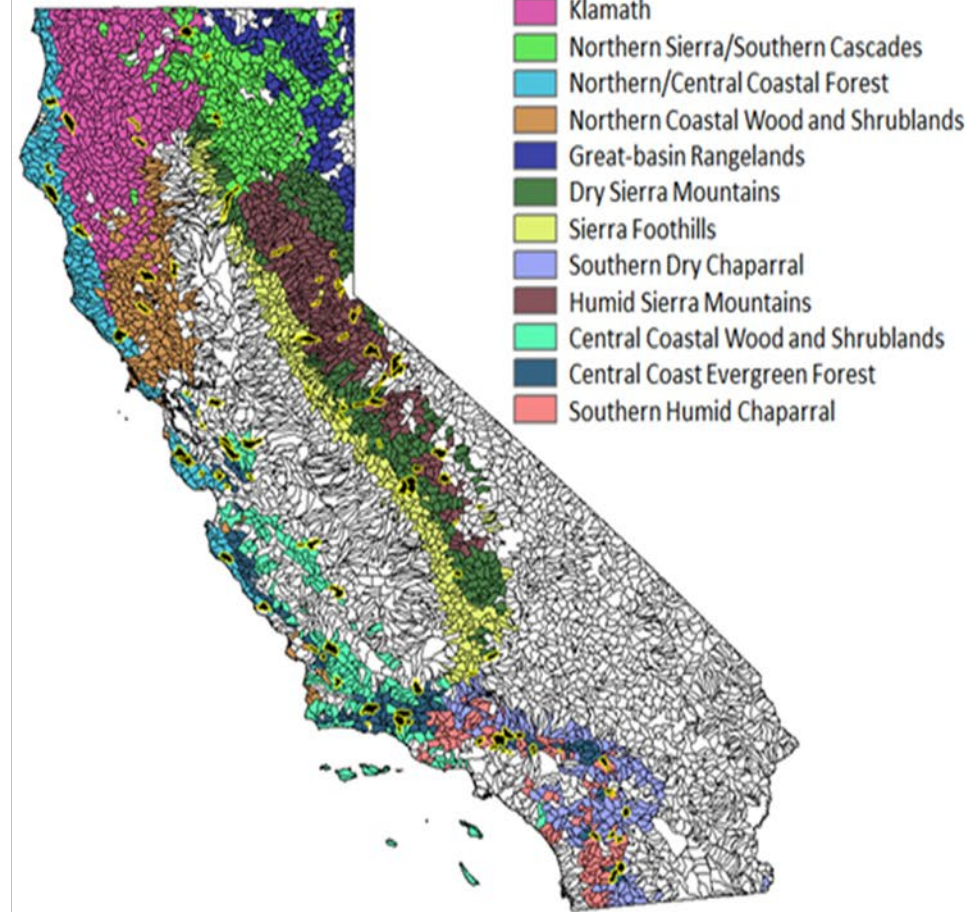
Vegetation Cover



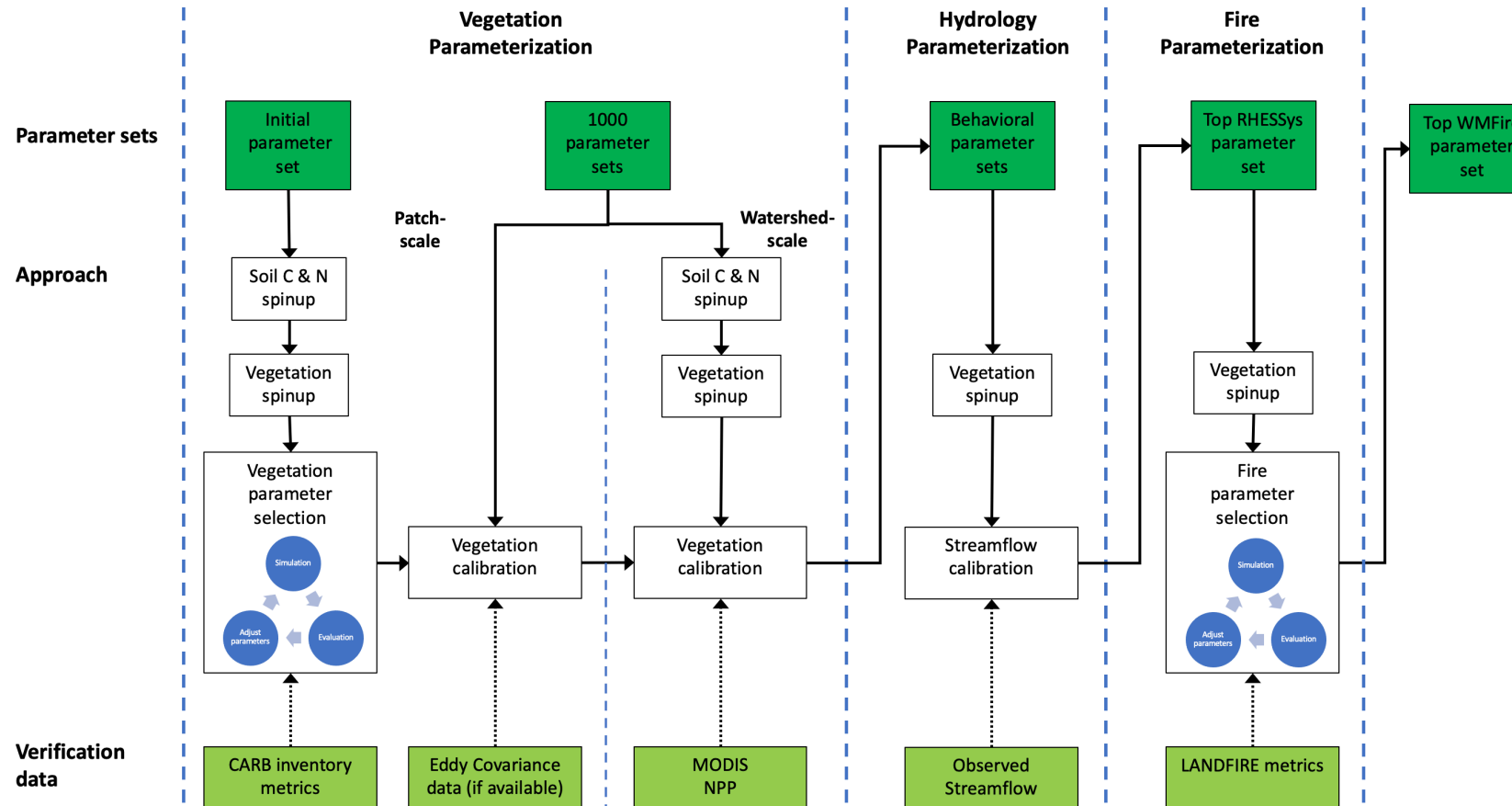
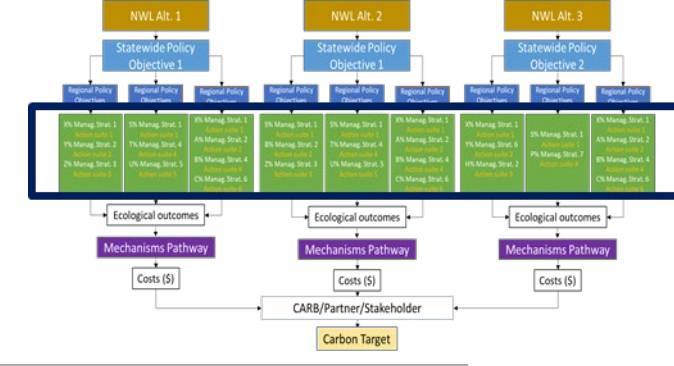
Aridity



Eco-region

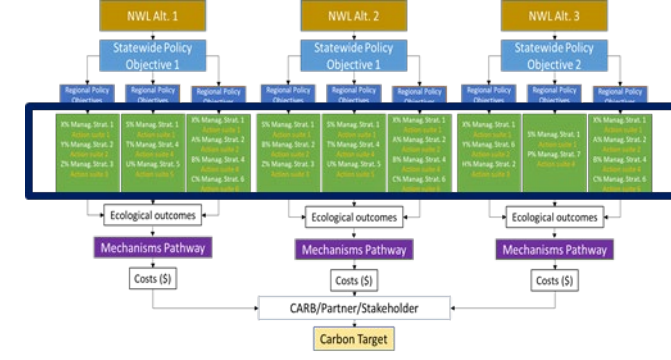


RHESSys Parameterization

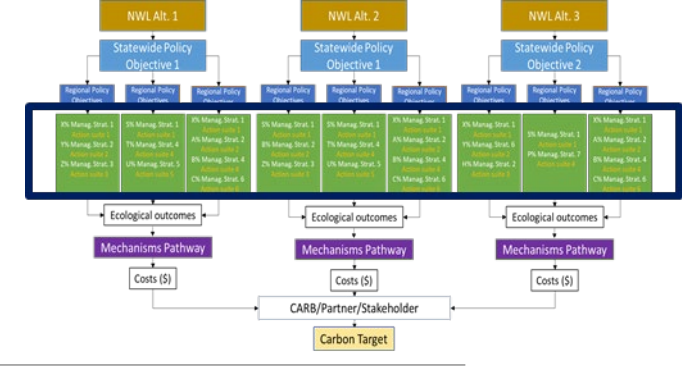


Modeling Scenarios

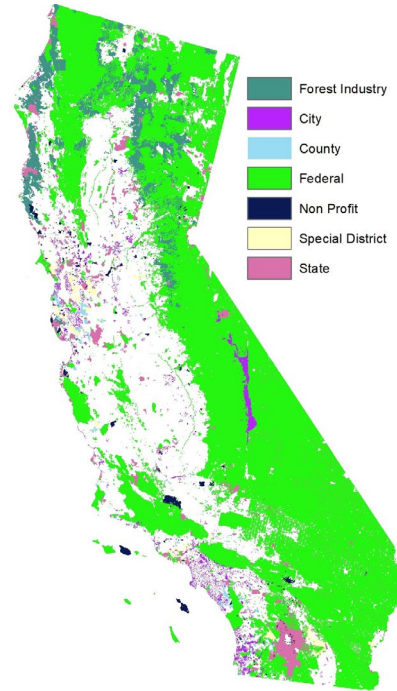
- Management (hypothetical management strategies as examples)
 - No management without natural disturbance
 - No management with natural disturbance
 - Business-as-usual (BAU)
 - Aggressive management
 - Realistic management ramp up
- Climate change from 4 climate models
 - Chosen by the 4th Climate Assessment
- 3 climate scenarios
 - Historical
 - Representative Concentration Pathway (RCP) 4.5
 - RCP 8.5



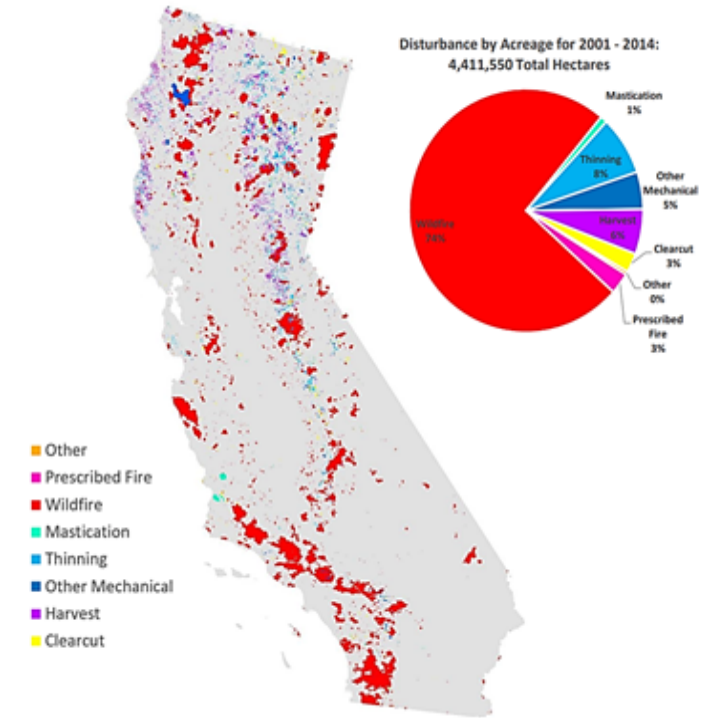
Modeling Scenarios



Eco Unit



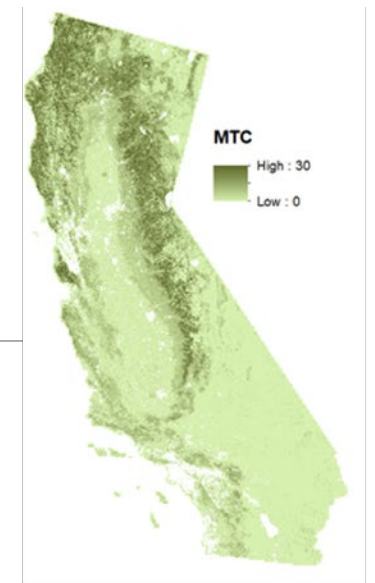
Ownership



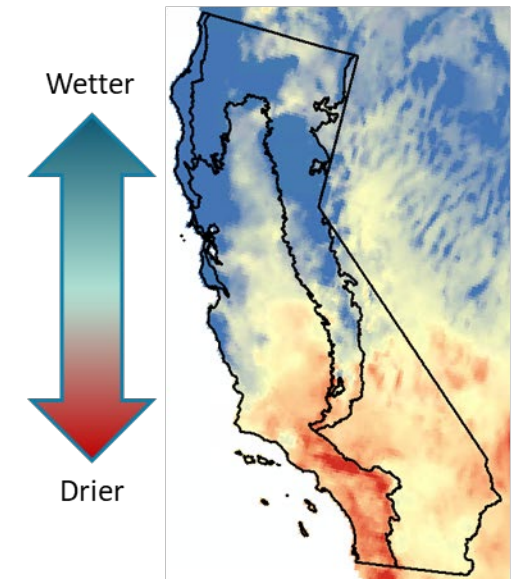
Treatments/Disturbances

NWL Modeling Challenges

- Every region of California's forests and shrublands have unique conditions and dynamics
- Climate change will affect regions differently
- Unknown outcomes to management action at scale
- Policy objectives to management strategies

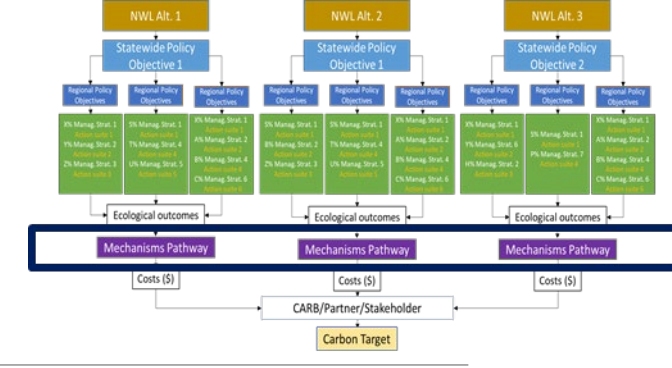


2014 Carbon Stocks



Projected change in Precipitation by 2050

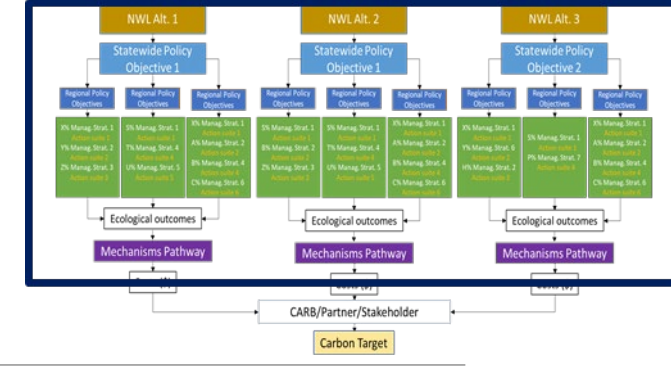
Mechanisms Pathways



- Policy levers California can implement to elicit the desired changes in management
 - Integration into existing programs and policies
 - Market-based
 - Innovative financing
 - Land-use policies
 - Ecosystem services valuation
 - Regulatory



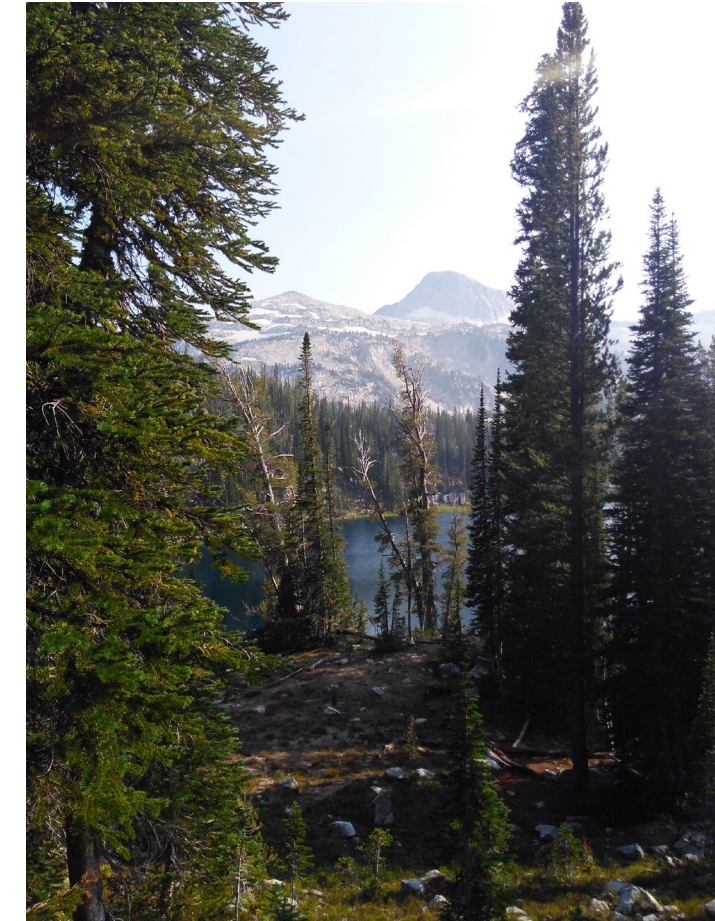
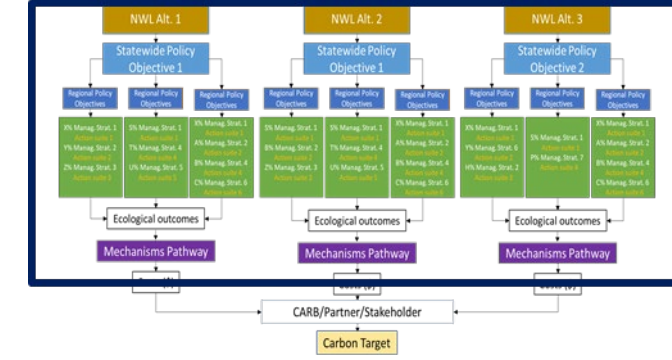
Baseline and Scenarios



- Baseline vs. Business-as-usual
 - Baseline – A quantifiable carbon stock/sequestration rate at some moment in the past that will be used to measure progress towards a future carbon target
 - For example, in the previous Scoping Plan, fossil emissions have a target of 40% below 1990 emissions levels by 2030. In this example, 1990 emissions are the baseline off of which the target is defined
 - Business-as-usual (BAU) – A scenario of the future with no changes to land management compared to your baseline time-period. What is the outcome with no action?

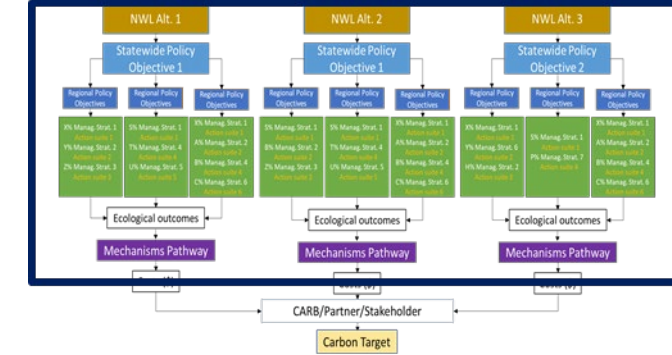
Baseline Recommendation

- Two parts to a baseline
 - Carbon stocks during a particular year
 - Carbon stock change between two years
- Baseline time-period recommendation
 - Carbon stocks in 2014
 - Carbon stock change from 2001-2014
- Reasoning
 - Highest quality published data during this period

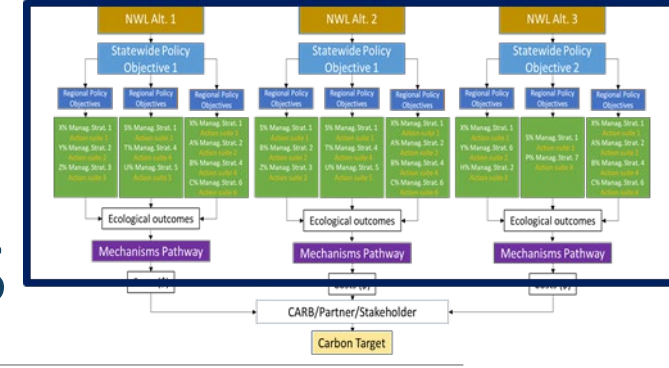


Business-as-usual Scenario

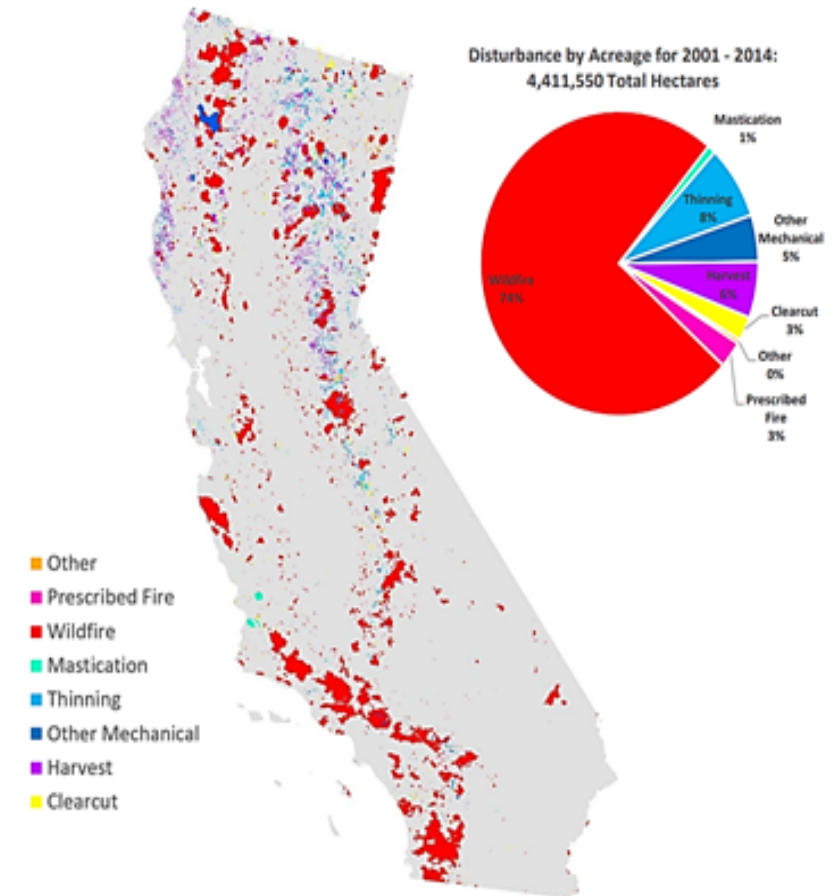
- Quantifiable land management from 2001-2014
- Information needed:
 - Who is doing the management
 - Where are treatments happening
 - What type of actions are happening (thinning, prescribed burning, clearcutting, etc.)
 - How big are their treatments
 - How frequently are treatments happening
 - How much of their land is being treated
- This will be used to model BAU management under climate change



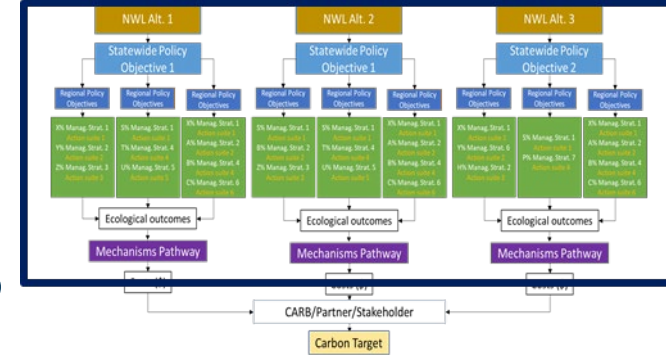
Business-as-usual Example: Forest and Shrub-lands



- Maps of treatments from 2001-2013
 - After this point, data quality diminishes
 - LANDFIRE disturbance data
 - All ownerships
 - Harmonized treatment information
 - Statewide, wall-to-wall



Business-as-usual Example: Forest and Shrub-lands



Humid Sierra



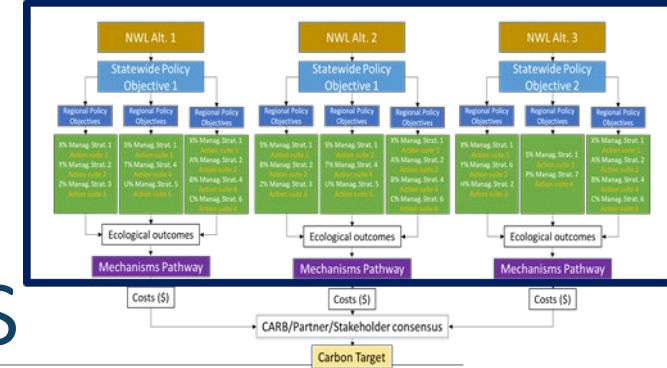
For each dominant ownership of a watershed within this eco-unit by treatment type

How many acres get treated per year?

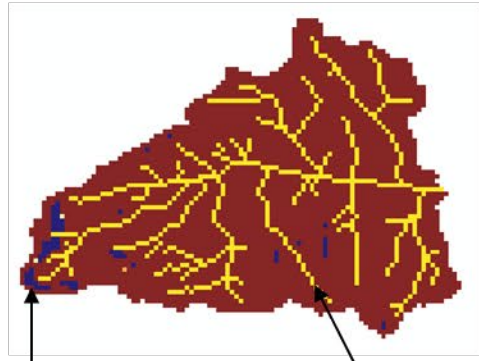
How often do treatments occur?

How big are treatments when they occur?

Business-as-usual Example: Forest and Shrub-lands



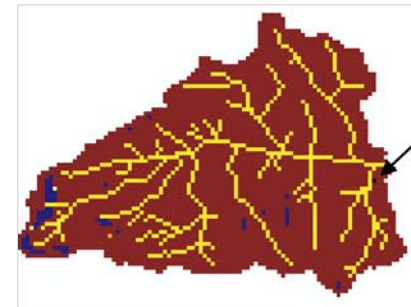
Sagehen



Areas too steep for treatments

Streams

Sagehen as if the Federal Government managed this watershed



Thinning on Oct 4, 1904

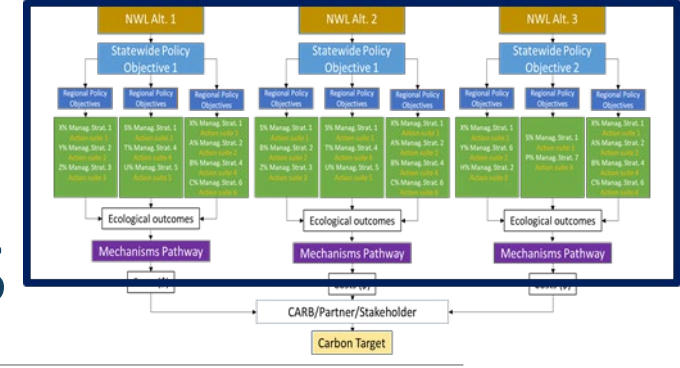
All Thinning in 1904



Frequency of all treatments 1900-1950 (0-5 treatments)

Business-as-usual

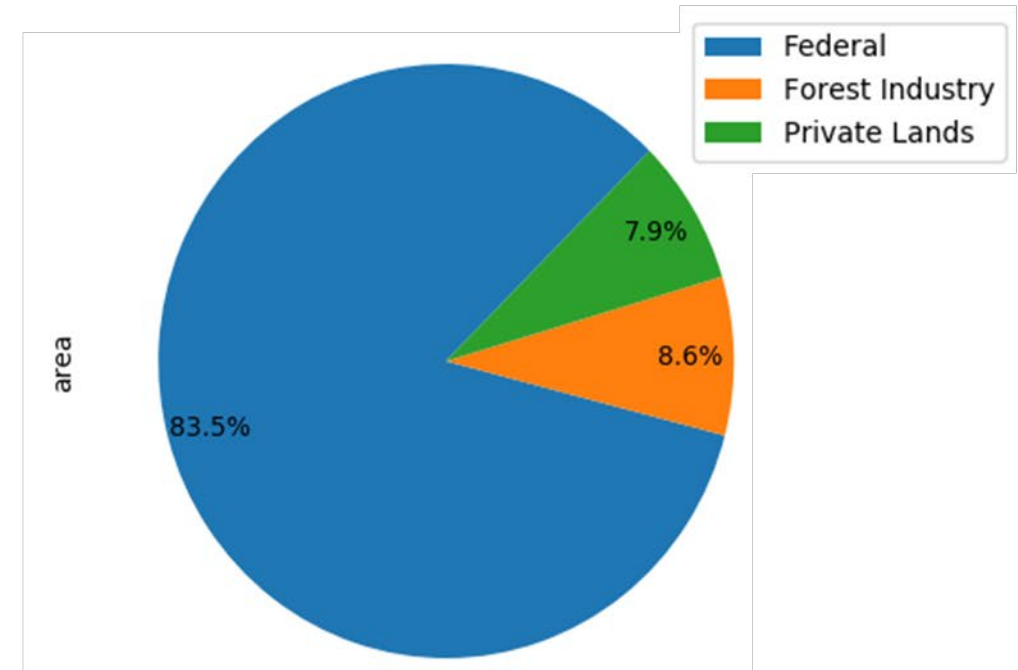
Example: Forest and Shrub-lands



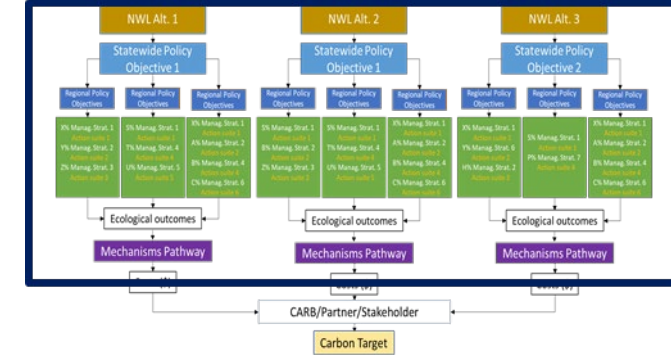
- Outputs from daily management and modeling
 - Scaled up by dominant ownership share of eco-unit area
 - Annual (1850-2100)
 - Carbon/water/fire



Humid Sierra

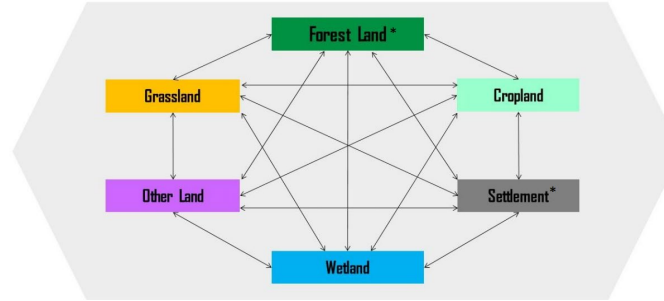
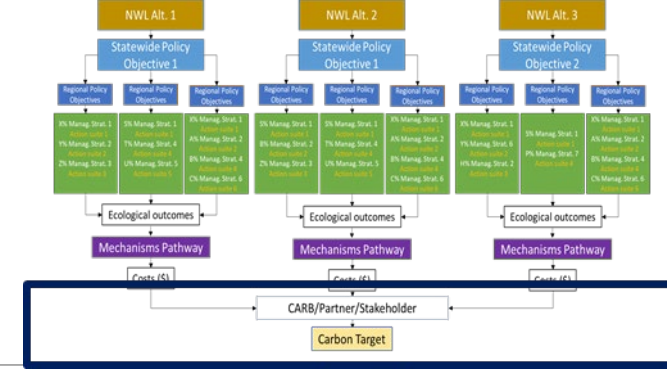


Alternative Scenarios



- For each NWL type, an alternative scenario includes:
 - Statewide and regional objectives
 - A suite of regional management strategies to meet those objective
 - A mechanisms pathway portfolio to pay for the change in management strategies
 - Ecological outcomes and costs
- Scenarios are determined by stakeholder objectives, priorities, and aspirations
- CARB is NOT predetermining a carbon target, and then figuring out how to achieve it
- CARB is NOT quantifying the “optimal” scenario to maximize ecosystem benefits

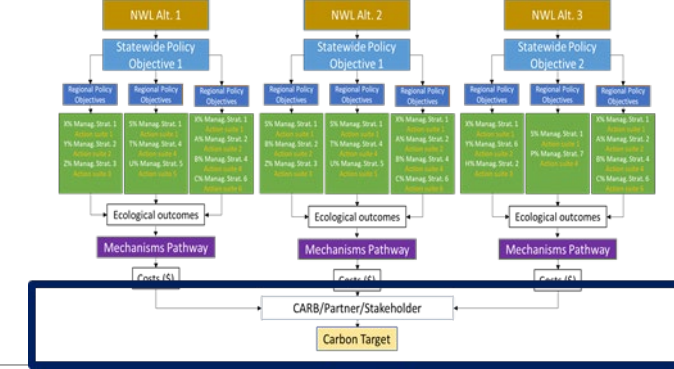
Alternative Scenarios



Outcomes (vs. baseline)	BAU	NWL Alt. #1	NWL Alt. #2	NWL Alt. #3	NWL Alt. #4	NWL Alt. #5
Carbon stock change (MMT C)	Red Down Arrow	Red Down Arrow	Blue Circle	Red Down Arrow	Green Up Arrow	Green Up Arrow
Carbon sequestration (MMT C/year)	Red Down Arrow	Blue Circle	Green Up Arrow	Green Up Arrow	Green Up Arrow	Green Up Arrow
Water Quantity (m ³ /year)	Green Up Arrow	Green Up Arrow	Blue Circle	Red Down Arrow	Red Down Arrow	Red Down Arrow
Fire emissions (CO ₂ /year)	Green Up Arrow	Blue Circle	Red Down Arrow	Red Down Arrow	Green Up Arrow	Green Up Arrow
Cost (\$ Billions)	Blue Circle	Green Up Arrow	Green Up Arrow	Green Up Arrow	Green Up Arrow	Green Up Arrow

Determining a carbon target

- Between now and mid-century
- Two components:
 - A carbon stock change vs. baseline
 - A carbon sequestration rate based on a moving average around 2045
- Bottom-up approach
- Stakeholder input on the desired scenario will inform the CARB board
- CARB board will vote on the carbon target as part of the overall Scoping Plan
- Based on the scenarios outcome, information from the synthesis, and stakeholder engagement
- Provides a metric to measure progress and for accountability
- Scoping Plan is an actionable blueprint for State and local agencies to use to address climate change.





5-minute Break

Key Questions

- What are we missing?
- What do you especially like in any part of our process?
- What are some policy objectives you would like to see in a scenario (in terms of actions on the ground)?
- Are there specific actions that you would like to see incorporated into a management strategy that will be modeled?
- What are the biggest threats to your NWL type of concern that must be included in modeling?
- What are some mechanisms that you would like to see considered, and how do you think those mechanisms will affect management? (if you recommend a mechanism, we will ask a follow up about how you anticipate that affecting specific on-the-ground action)

Key Questions

- Are there any other efforts that has gathered regional/local perspectives on nature based climate solution planning/goal setting?
- Is it clear what we need for policy objectives (put in terms of actions/acre/year)?
- Are there any models that meet our criteria that you would like us to consider for a specific NWL type?



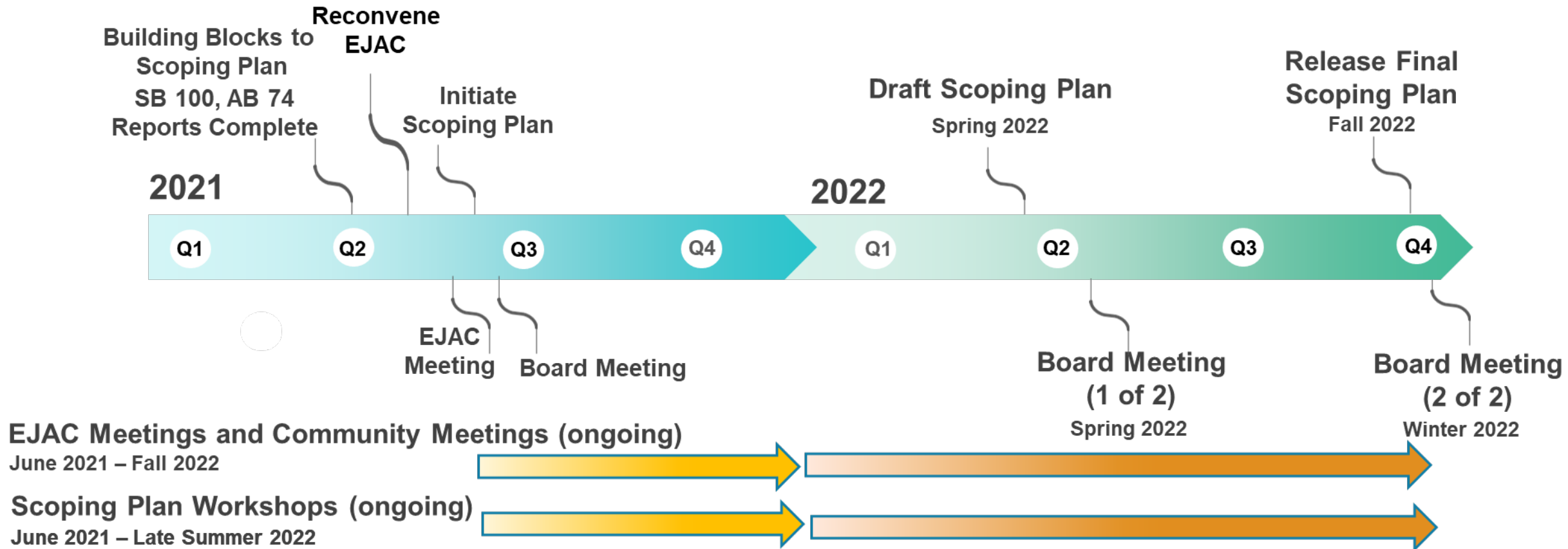
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Submitting written comments

- Written comments
 - https://www.arb.ca.gov/lispub/comm2/bcsubform.php?listname=nwl-2021-tech-ws&comm_period=1
 - You can search: California Air Resources Board Scoping Plan workshops
 - Comment closing date August 3, 2021 (11:59 pm)

2022 Scoping Plan Update Schedule



Staying Engaged

Scoping Plan Workshops	Environmental Justice Advisory Committee Meetings
Supporting Material and Information	Board Meetings
www.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan	

Closing Remarks
