2022 Scoping Plan Update
Initial Modeling Results

CALIFORNIA
AIR RESOURCES BOARD

NATURAL AND WORKING LANDS

MARCH 15, 2022

Agenda

- Scoping Plan and NWL
- Modeling Approach
- Scenarios
- Modeling Results
- EJ Advisory Committee Comments/Questions
- Lunch Break (30 minutes)
- Public Comments/Questions

Process on NWL in SP thus far

- June SP kick-off workshops (CARB, CNRA, CDFA, and DOC)
  - Day 1: NWL in the SP, Gov EO, and Climate Smart Lands Strategy
  - Day 2: NWL inventory, potential NWL actions, and key SP policy/technical Qs
- July NWL Technical workshop #1 (CARB and UCM)
  - NWL inventory, modeling approach, target setting and Qs for modeling
- Oct Two NWL tribal specific public workshops
  - How best to define tribal lands within our modeling framework
- Dec NWL Technical workshop #2 (CARB)
  - Modeling approach and draft Scenarios discussion
- Dec 2 – Draft NWL scenarios posted for public comment
- Feb 28 - Final NWL scenarios posted

Lands and the Scoping Plan

- Healthy trees, plants, and soils can support our greenhouse gas reduction goals in two primary ways:
  - Serving as carbon sinks through sequestration.
  - Avoiding releases of emissions from their substantial existing carbon stocks.

- We are not focusing on maximizing carbon across all landscape types.
- We are focusing on supporting carbon management that fosters ecosystem health, resilience and many other ecosystem services.

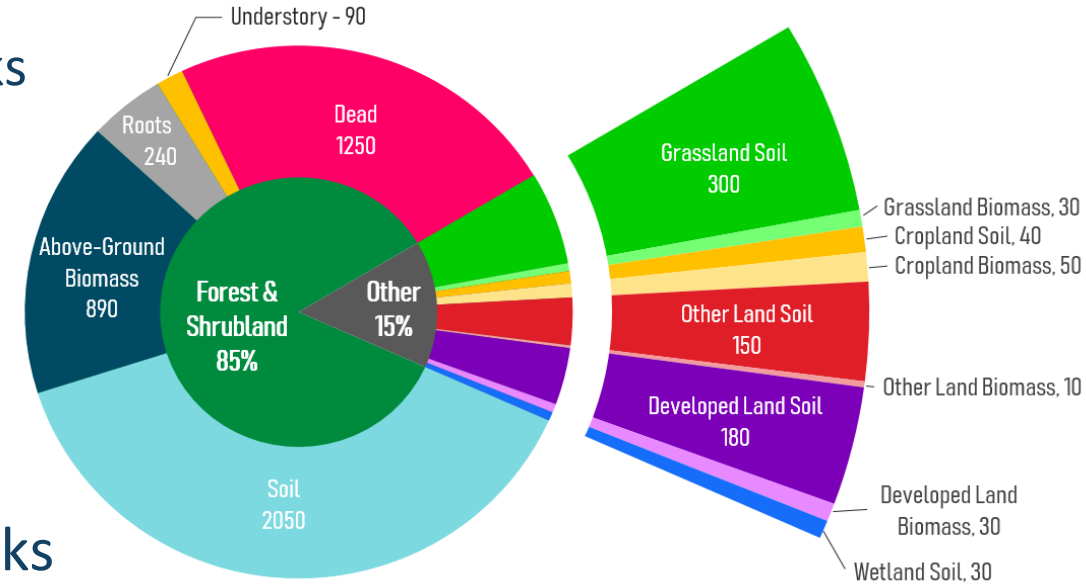
Lands and Their Many Benefits

- Natural and working lands support our basic survival by providing healthy food, clean and abundant water, clean air, and a livable climate.
- They are home to diverse plant, animal, fungal, and microbial species and provide critical economic, recreational and mental health benefits for the people of the State.
- Healthy lands can sequester and store carbon emissions, limit future releases greenhouse gas missions into the atmosphere, and protect people and nature from the impacts of climate change.
- Unhealthy lands have the opposite effect – they release more greenhouse gas emissions, increase climate risks to people and nature, and are more vulnerable to future climate change impacts.
- Our landscapes are living systems and we seek to respect them as such. They have different needs and greenhouse gas emissions occur naturally within them as part of life.

Modeling

- Why Model?
  - Estimate the future trajectory of sources and sinks within the NWL sector
  - Assess how action may change outcomes
  - Cumulative impacts
  - Custom scenarios (climate/policy/management)
- Work is being prioritized by current carbon stocks

2018 CARB NWL Inventory



This is the first time we've conducted modeling for the NWL sector for the SP – what are the dynamics and processes that we wanted to address for this modeling?

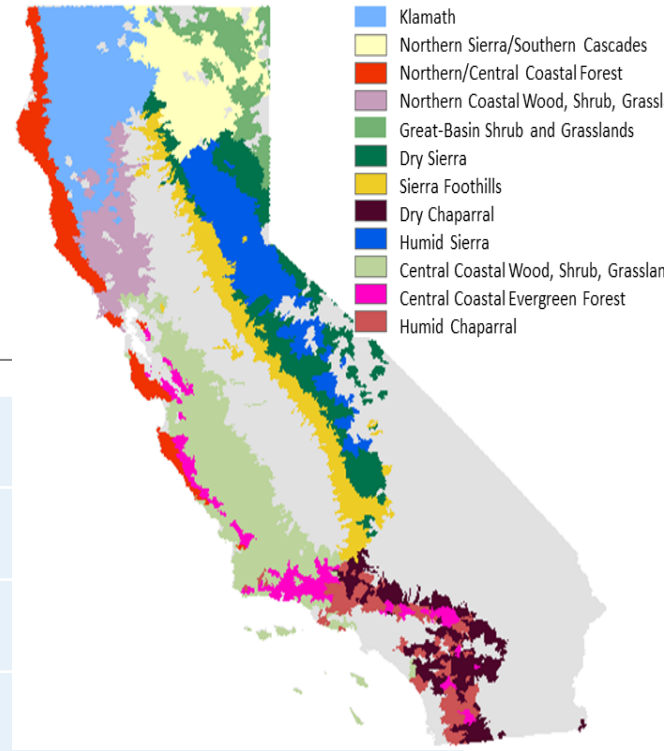
- How will climate change and management interact to influence wildfire emissions?
- How will climate change impact vegetation mortality and drought stress?
- How will various levels of healthy soils action in annual croplands impact statewide soil carbon accumulation under climate change?
- How can we decrease all emissions in delta wetlands given different levels of restoration?
- What will it take to increase urban forest carbon to different levels?
- How much carbon will be lost to ensure 100% compliance for defensible space?
- How will different levels of land use change impact carbon in sparsely vegetated lands?

Modeling Limitations

- Modeling of shrub and grasslands does not include prescribed grazing or compost application or other soil carbon sequestration practices.
- Modeling of riparian zone restoration in forests, shrublands/chaparral, and grasslands, is included but cannot be broken out separately
- Irrigated pasture lands are not included in the modeling
- Developed lands modeling is limited to assessing changes in urban tree and WUI tree and shrub carbon
- Wetlands modeling currently only includes a percentage of Delta wetlands
- Reduction in synthetic fertilizer use under Organic agriculture is not included

CARB Scoping Plan NWL Models

NWL Category	NWL Sub-Category	Model
Forest and Other Natural Lands	Forests	RHESSys
Forest and Other Natural Lands	Shrublands	RHESSys
Forest and Other Natural Lands	Grasslands	RHESSys
Wetlands	Sacramento-San Joaquin Delta	SUBCALC/Literature
Developed Lands	Urban Forests	CARB Urban Forest Carbon Model
Developed Lands	Wildland Urban Interface	California Forest Observatory/CARB NWL Inventory
Croplands	Annual Croplands	Daycent/LUCAS/Literature
Croplands	Perrenial Croplands	CARB Orchard Carbon Model/LUCAS
Sparsely Vegetated Lands	Deserts	CARB NWL Inventory/LUCAS



The Purpose of NWL Scenarios

- Provide a sense of how different levels of action will impact modelled NWLs
- Includes a set of objectives and management strategies
- Scenarios provide guidance for modeling
  - No model can simulate all actions that can be done in real-life
  - Modeling can be updated over time (e.g. CARB first used energy modeling PATHWAYS in 2014).
- Scenario and modeling limitations do not preclude actions from being included in the Scoping Plan recommendations or future implementation

Scenario Descriptions

Business-as-usual: No change in mgmt. from what was being done between 2001-2014

Scenario 1: Prioritize short-term carbon stocks, minimize disturbances.

Scenario 2: Prioritize implementation of strategies in current commitments/plans

Scenario 3: Prioritize restoration and climate resilient carbon stocks

Scenario 4: Prioritize forest wildfire reduction and other fuel reduction efforts

Find the full revised scenario descriptions by googling "CARB Scoping Plan Workshops." In the workshops page find the "Revised NWL Scenarios" document posted on 2/28/22

Practices Modeled by Landscape

Forests: biological/chemical/herbaceous treatments (e.g. herbicide application), clear cut, various timber harvests (e.g. variable retention, seed tree/shelterwood, selection harvesting), mastication, other mechanical treatments (e.g. piling of dead material, understory thinning), prescribed burning, and thinning. Avoided land conversion. Wildfire, nutrients, and water are modeled and are responsive to management strategies and climate conditions.

Shrublands/Chaparral: biological/chemical/herbaceous treatments, prescribed burning, mechanical treatment, such as mastication, crushing, mowing, piling, etc. Avoided land conversion. Wildfire, nutrients, and water are modeled and are responsive to management strategies and climate conditions.

Grasslands: biological/chemical/herbaceous treatments, prescribed burning. Avoided land conversion. Wildfire, nutrients, and water are modeled and are responsive to management strategies and climate conditions.

Annual Croplands: 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 and shrubs in croplands, and establishing hedgerows .

Practices Modeled By Landscape Continued

Perennial Croplands: Windbreaks/shelterbelts, hedgerows, conversion from annual crops to perennial crops, and avoided conversion to other land-uses.

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.

Delta Wetlands: Restoring wetlands through submerging cultivated land in the Sacramento-San Joaquin Delta and other wetland restoration. Avoided land conversion in the Sacramento-San Joaquin Delta.

Sparsely Vegetated Lands: Avoided conversion of sparsely vegetated lands to another land use.

Scenario 1
Prioritize short-term carbon stocks, minimize disturbances.

- **Forests:** No management or land conversion. Maintain fire suppression at current levels.
- **Shrublands/Chaparral:** No management or land conversion. Maintain fire suppression at current levels.
- **Grasslands:** No management or land conversion. Maintain fire suppression at current levels.
- **Croplands:** Maximize climate smart ag practices (~100k acres/year). Conversion from annual to perennial. No conversion out of agriculture. Achieve ~30% organic agriculture statewide by 2045 (~130k acres/year).
- **Developed Lands:** Maximum possible urban tree cover by 2045 (2000% increase in investment, better water use). Achieve 100% defensible space compliance accounting for property boundaries.
- **Wetlands:** Restore 120,000 acres of Delta wetland
- **Sparsely Vegetated Lands:** No land conversion

Scenario 2

Prioritize implementation of strategies in current commitments/plans

- **Forests:** ~1M acres/year of management. No land conversion. Maintain fire suppression at current levels.
- **Shrublands/Chaparral:** Shrubland specific component of ~1M acres/year of management. No management or land conversion.
- **Grasslands:** Grassland specific component of ~1M acres/year of management. No land conversion. Maintain fire suppression at current levels.
- **Croplands:** Implement climate smart ag practices (~80k acres/year). ~8k acres/year agricultural easements. Achieve ~25% organic agriculture statewide by 2045 (~97k acres/year).
- **Developed Lands:** Increase urban tree cover by 2045 (200% increase in investment, better water use). Achieve 100% defensible space compliance accounting for property boundaries.
- **Wetlands:** Restore 18,000 acres of Delta wetland
- **Sparsely Vegetated Lands:** 25% of BAU land conversion

Scenario 3

Prioritize restoration and climate resilient carbon stocks

- **Forests:** ~2-2.5M acres/year of management. No land conversion. Maintain fire suppression at current levels.
- **Shrublands/Chaparral:** Shrubland specific component of ~2-2.5M acres/year of management. No management or land conversion.
- **Grasslands:** Grassland specific component of ~2-2.5M acres/year of management. No land conversion. Maintain fire suppression at current levels.
- **Croplands:** Implement climate smart ag practices (~50k acres/year). ~6k acres/year agricultural easements. Achieve ~20% organic agriculture statewide by 2045 (~65k acres/year).
- **Developed Lands:** Increase urban tree cover by 2045 (20% increase in investment, better water use). Achieve 100% defensible space compliance accounting for property boundaries.
- **Wetlands:** Restore 60,000 acres of Delta wetland
- **Sparsely Vegetated Lands:** 50% of BAU land conversion

Scenario 4

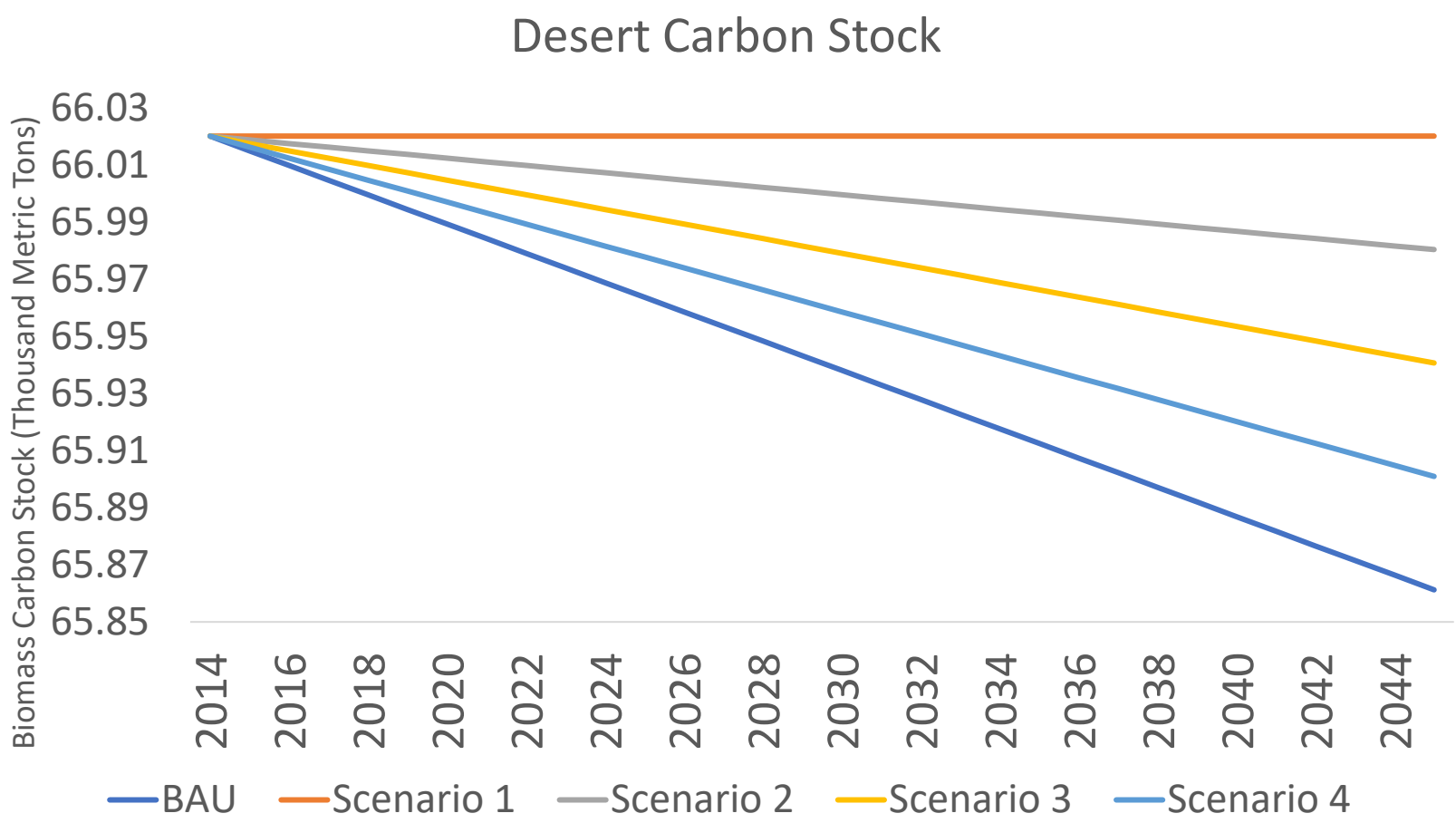
Prioritize forest wildfire reduction and other fuel reduction efforts

- **Forests:** ~5-5.5M acres/year of management. No land conversion. Maintain fire suppression at current levels.
- **Shrublands/Chaparral:** Shrubland specific component of ~5-5.5M acres/year of management. No management or land conversion.
- **Grasslands:** Grassland specific component of ~5-5.5M acres/year of management. No land conversion. Maintain fre suppression at current levels.
- **Croplands:** Implement climate smart ag practices (~25k acres/year). ~3k acres/year agricultural easements. Achieve ~15% organic agriculture statewide by 2045 (~32k acres/year).
- **Developed Lands:** Increase urban tree cover by 2045 (2% increase in investment, better water use). Achieve 100% defensible space compliance regardless of property boundaries.
- **Wetlands:** Restore 18,000 acres of Delta wetland (same as Scenario 2)
- **Sparsely Vegetated Lands:** 75% of BAU land conversion

Understanding Modeling Results

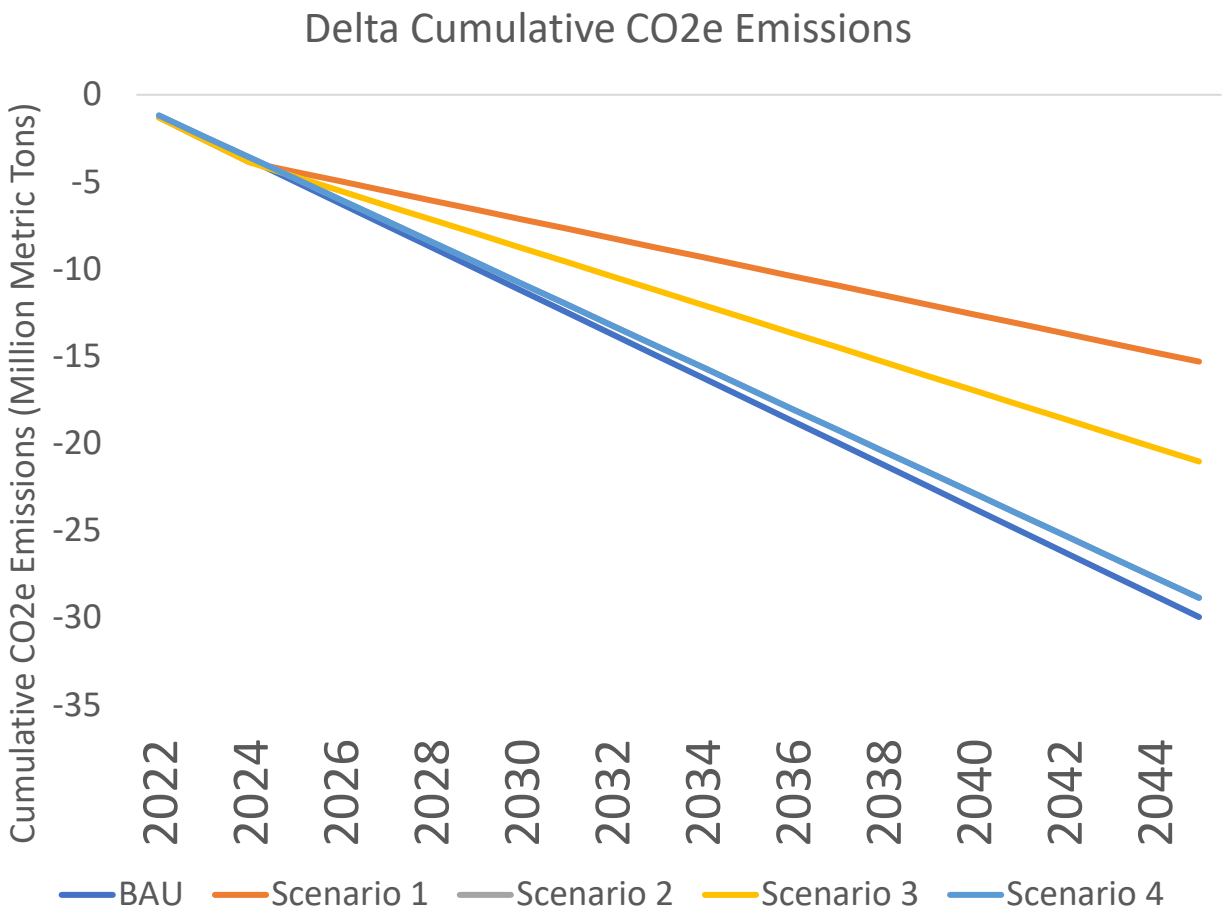
- Results are grouped together by landscape type
- The vertical axis shows carbon impact. Depending on the landscape type, this may be shown in carbon stocks (Carbon) or emissions (CO_2e).
- The horizontal axis shows the modeled timeframe in years.
- For most land types, action for each scenario begins in 2025.
- Graphs are shown from the ecosystem perspective:
  - Negative trends in carbon stock means a loss of carbon from the ecosystem.
  - Negative emissions values means emissions into the atmosphere from the land.
- The Natural and Working Lands Climate Smart Strategy includes additional priority practices that are not included in the modeling effort. Implementing these additional priority practices could result in additional sequestration and emission reduction benefits not captured in these results.

Results – Sparsely Vegetated Lands



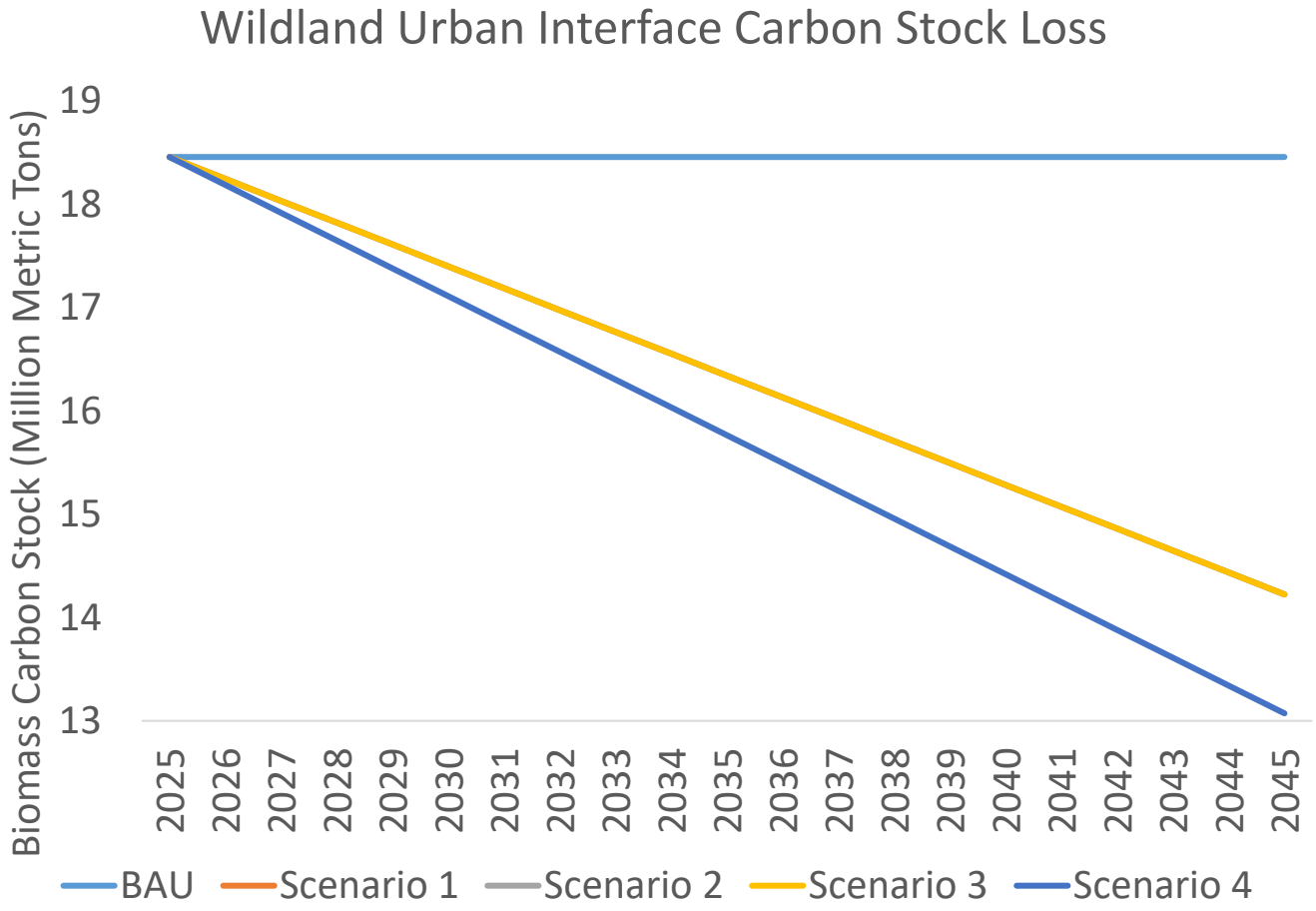
- BAU assumes 0.3% land conversion of the total land type
- Land conversion is modeled
- BAU Land use change loses the most carbon
- Scenario 1 has no carbon loss stemming from no land use change
- Scenarios 2, 3, and 4 have varying levels of land use change
- Scale in thousand metric tons to better display scenario outcomes. Other land types are in million metric tons.

Results – Delta Wetlands



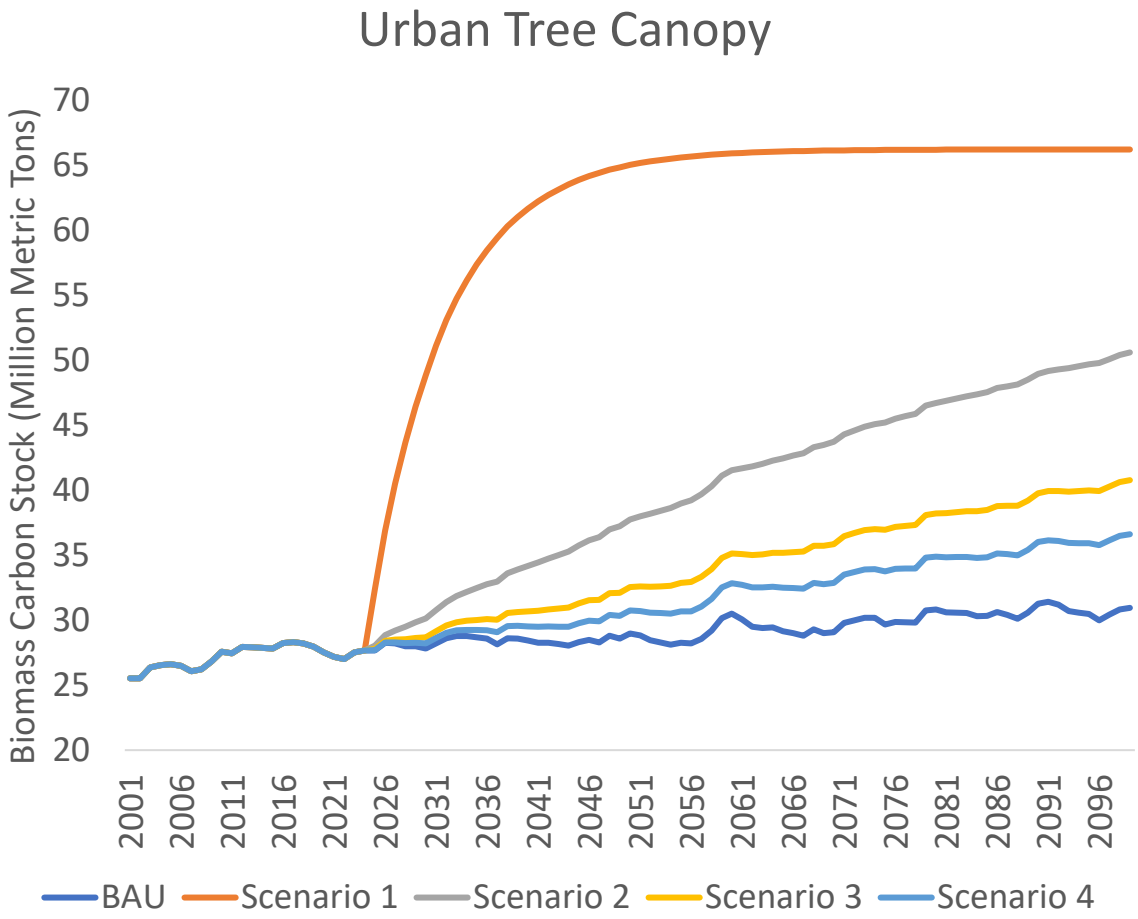
- BAU assumes no action and results in highest emissions.
- Subsidence and land use from drained wetlands produce the most emissions, and when restored, reduce the most emissions.
- Scenario 1 assumes 120k acres of restoration by 2045 and results in the fewest emissions.
- Restoring wetlands into, especially, the Suisun marsh (salty water), results in the greatest emissions reductions.
- Scenarios 2, 3, and 4 assume varying levels of action between BAU and Scenario 1.

Results – Developed Lands



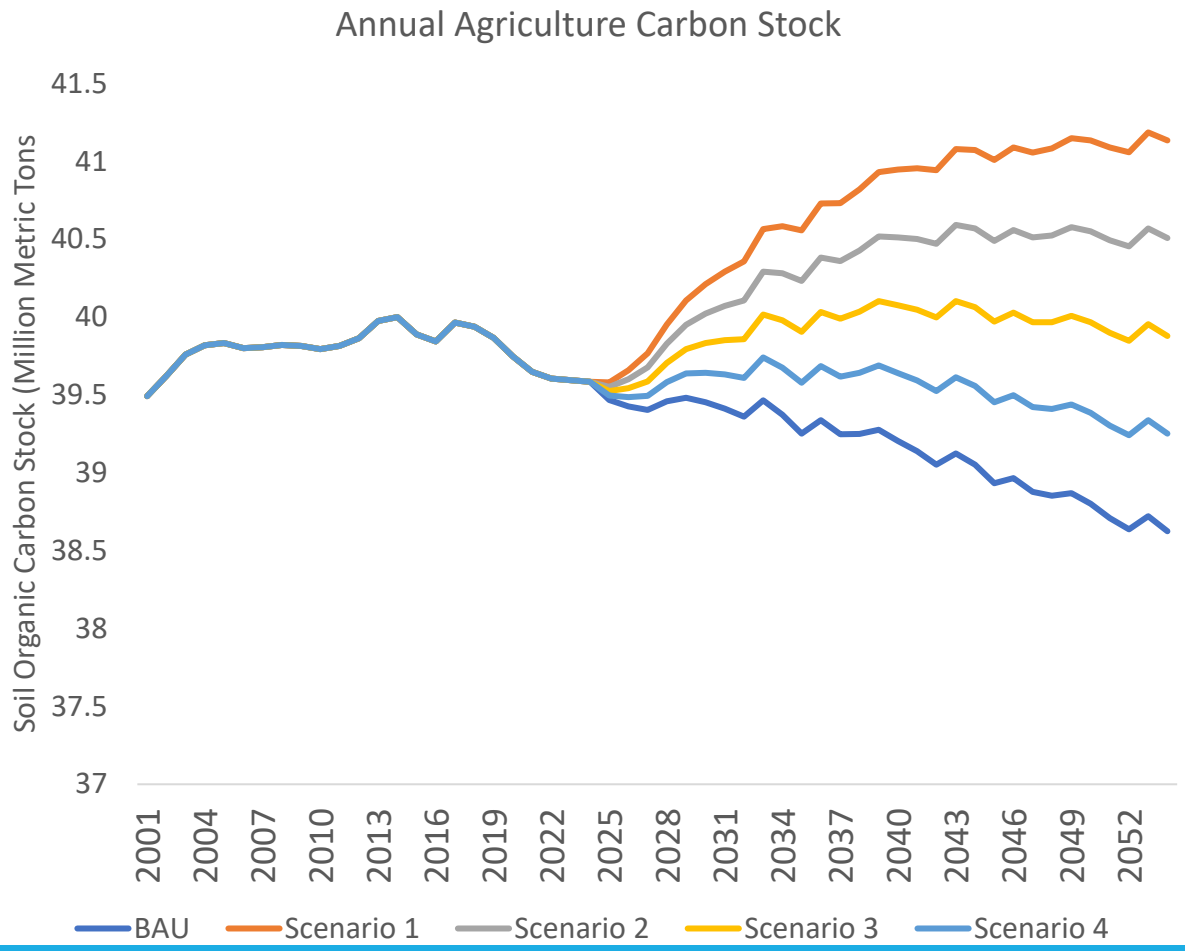
- BAU assumes no improvement on defensible space from baseline, so carbon stocks remain the same.
- Only 46.7% of parcels statewide currently have sufficient defensible space in our assessment.
- Around 900k property parcels need some level of work.
- Scenarios 1, 2, and 3 show the carbon loss assuming to 100% compliance with current regulation
- Scenario 4 is 100% compliance with regulation, plus additional loss to ensure every structure in the state has full defensible space

Results – Developed Lands



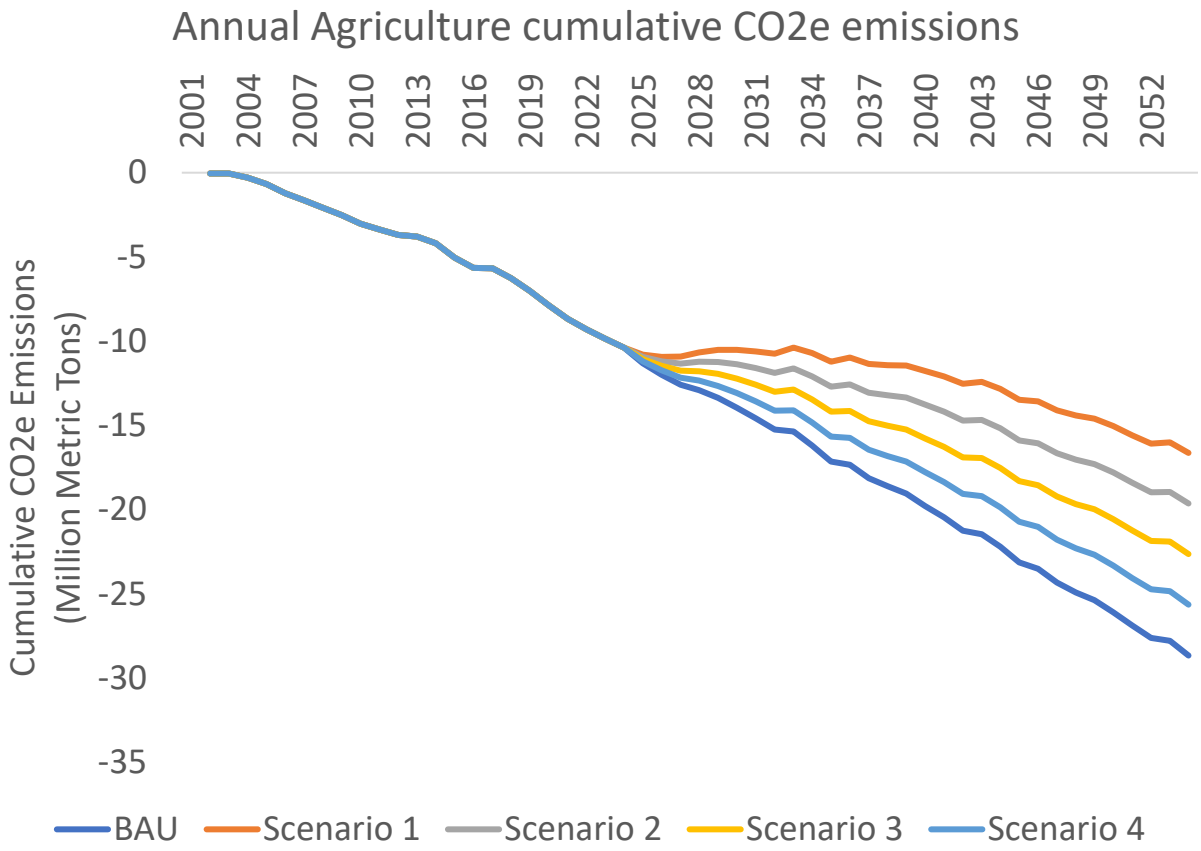
- BAU assumes urban area expansion and the rate of tree canopy increase from 2001-2010
- BAU shows moderate to no gain in tree canopy carbon stock at 2045
- Scenario 1 attempts to reach the theoretical maximum for urban tree canopy based on published literature.
- Scenario 4 shows greatest gain per unit investment assuming improved water use
- Carbon stock increases depend on availability of arable land

Results – Annual Croplands



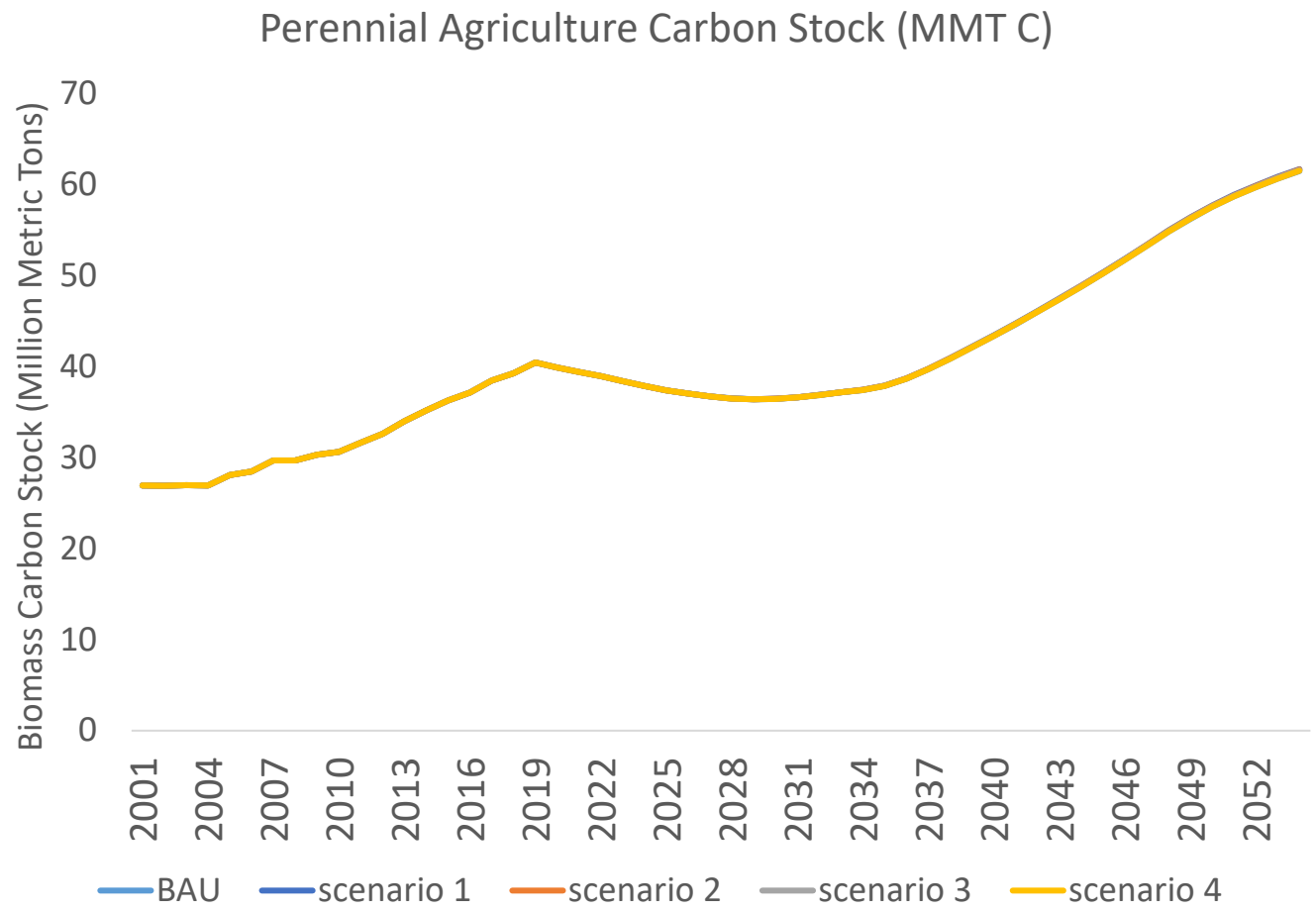
- BAU reflects management from 2001-2010 and does not include healthly soil or organic practices and a loss of annual croplands to non-agricultural uses of 11,119 acres/year.
- BAU results in a loss of soil organic carbon stocks
- Scenario 1 results in the greatest increase in carbon stocks and assumes 30% of annual croplands to organic, expansion of healthy soils practices, and no land conversion.
- Scenarios 2, 3, and 4 assume varying levels of action between BAU and Scenario 1.

Results – Annual Croplands



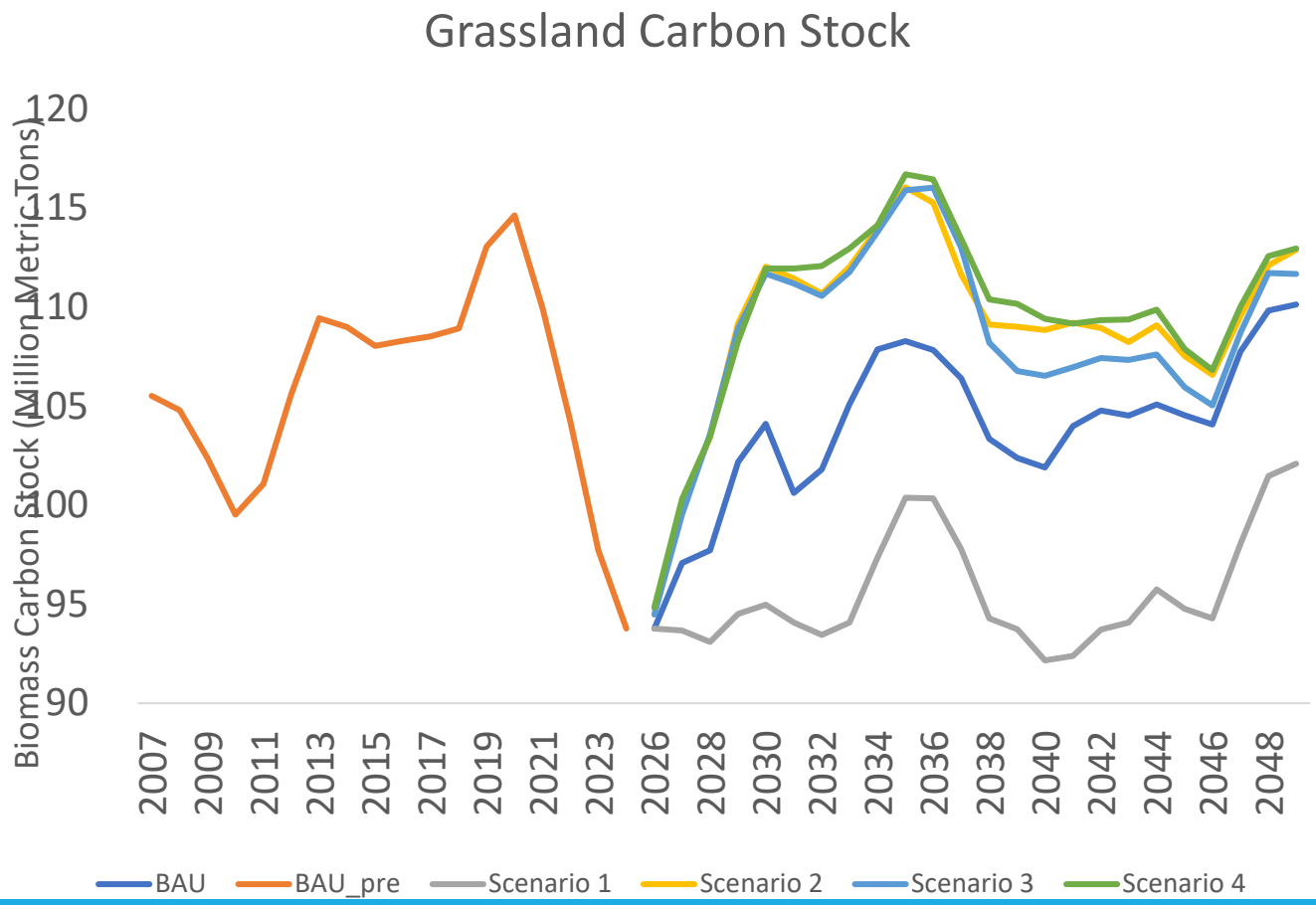
- In the graph, negative values are emissions.
- Some scenarios sequester C stock, but because of N2O emissions, all scenarios are net emitters.
- Reduction in synthetic fertilizer use and the associated potential reduction in emissions with the expansion of Organic practices are not modeled.

Results – Perennial Croplands



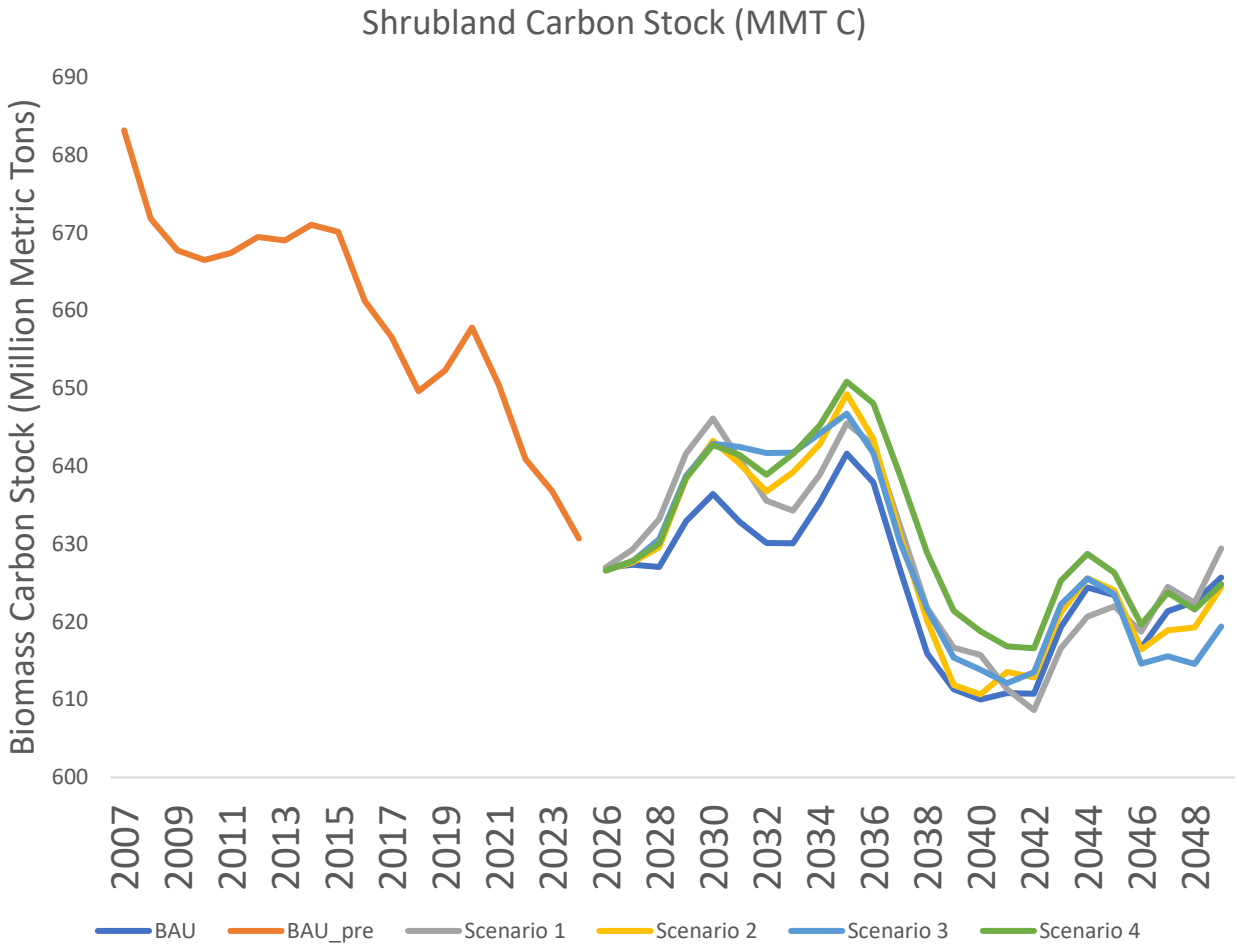
- BAU assumes an average replacement and expansion planting rate of 145k acres/year
- Only Windbreaks/shelterbelts, hedgerows practices separate scenarios.
- The expansion of perennial agriculture was modeled for the 4th climate assessment and then adjusted to account for climate and other limitations.
- Potential above ground carbon stock increases from growth of orchard trees are significant in the cropland category.
- Water will be a limiting factor for perennial crops.

Results - Grasslands



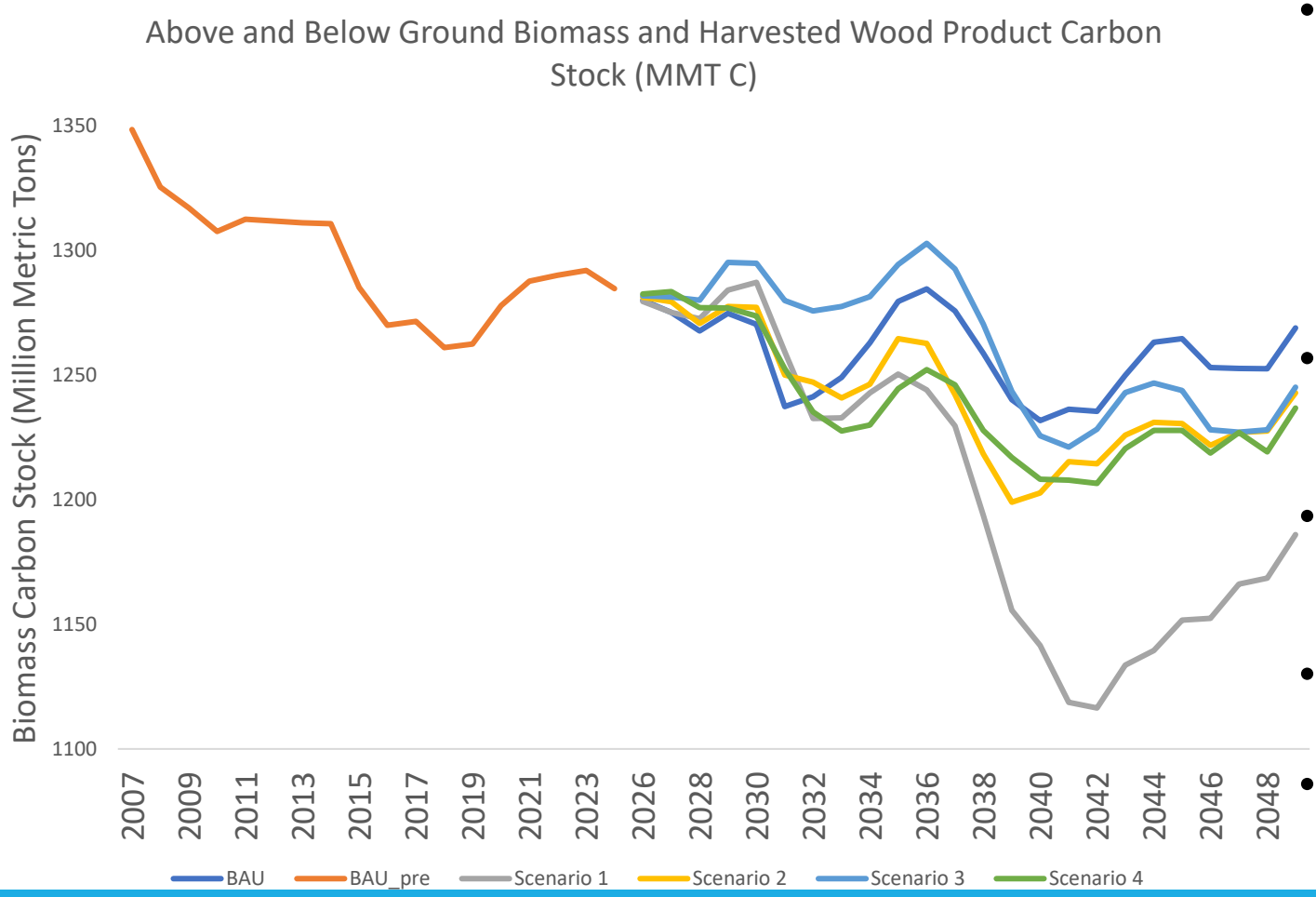
- For this sector the BAU represents the management that could be quantified between 2001-2014, this includes prescribed burning, and herbicide treatments, and not land conversion.
- Grassland biomass is sensitive to change; recovers quickly.
- Scenario 1 results in the lowest carbon stocks by 2045.
- Scenarios with increased management result in the greatest carbon stocks by 2045.
- The difference in scenarios is primarily driven by fire risk reduction, and increased water yield, in forests and shrublands.

Results – Shrublands/Chapparal



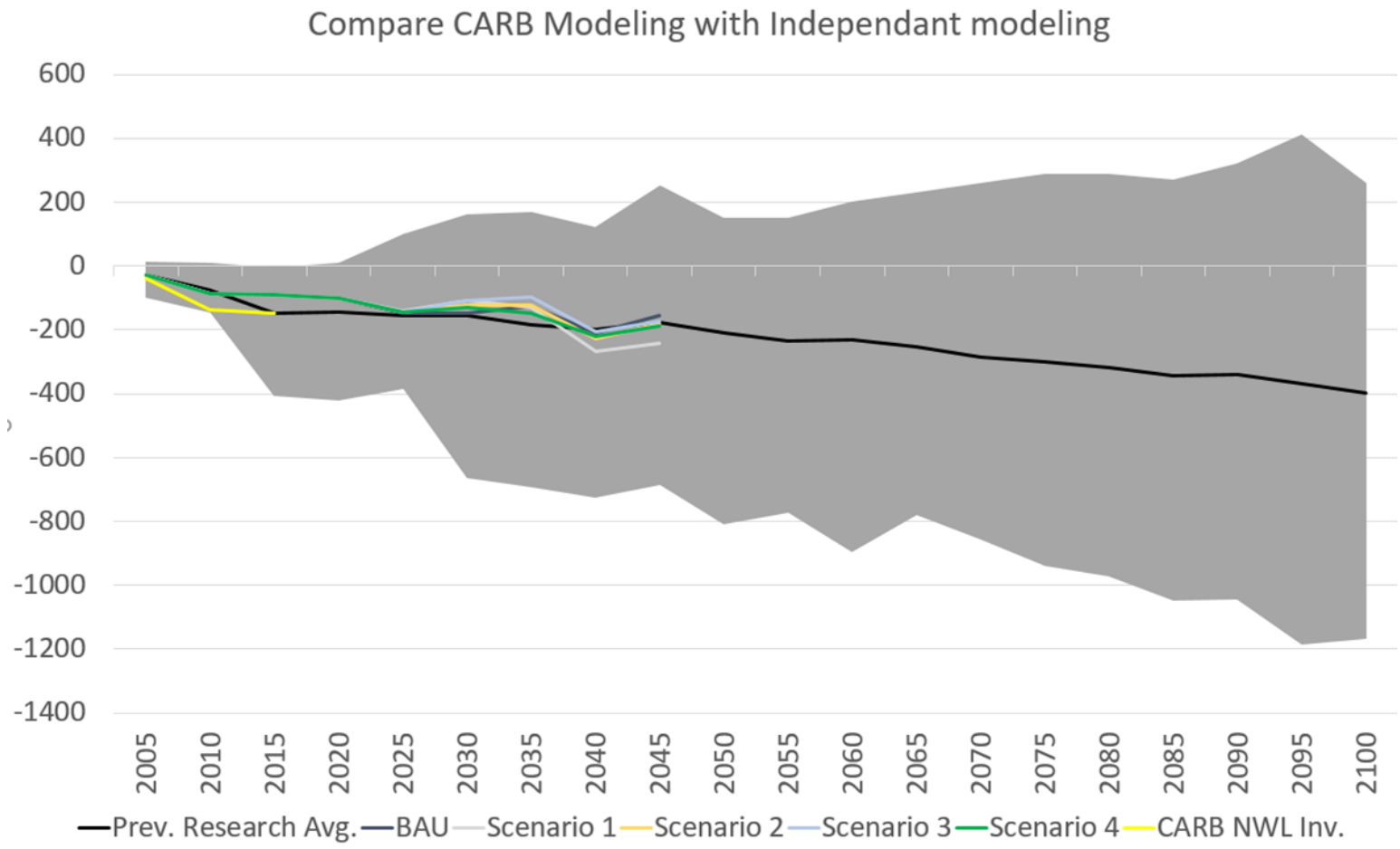
- For this sector the BAU again represents the management that could be quantified between 2001-2014, and this includes mechanical treatments, mastication, prescribed burning, and herbicide treatments, and not land conversion.
- Little difference between scenarios
- Climate change is driving desertification of shrublands in various parts of the state

Results - Forests



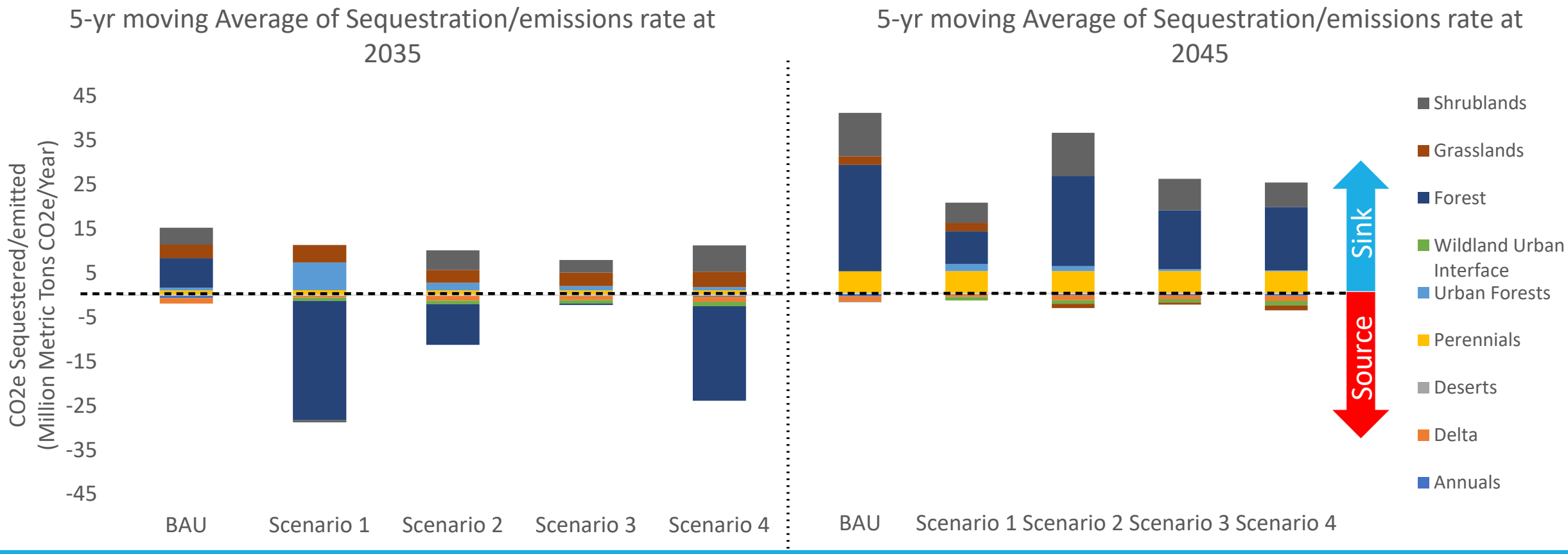
- For this sector the BAU again represents the management that could be quantified between 2001-2014, this includes clearcuts, harvesting, thinning, mechanical treatments, mastication, prescribed burning, and herbicide treatments and not land conversion. All of the treatments in the forest, shrubland, and grassland sector total about 250k acres of combined treatment per year.
- Scenario 1 shows lowest carbon stocks by 2045 primarily because of fire, a reduction in recovery, and no carbon in harvested wood products.
- Scenario 3 management levels work to decrease severity of early fires, while not negatively impacting overall forest carbon stock.
- Early behavior in the modeling is not as indicative of the impact of management as the overall trajectory
- Too short of a time frame to see true benefit of increased management

CARB NWL Modeling compared with Previous Research



- CARB's modeling is in line with previous research
- Grey shadow represents various modeled outcomes of California's NWL carbon stock change relative to 2001 from previous independent research

All NWL sequestration/emissions rate at a given year



Additional Analysis

- Co-benefits for NWL actions are important, additional assessments include:
  - Wildfire emissions from forest, shrublands, and grasslands
  - Water availability from forests, shrublands, and grasslands watersheds
  - Health benefits/outcomes from reduced wildfire emissions
  - Costs of management strategies and cost-savings from health benefits.

Key Takeaways from Modeling

- Results shows the size of carbon flux from carbon stocks modelled by 2045, underscoring the need for ongoing management to reduce loss.
- Healthy living systems will always be cycling carbon and nitrogen. The extent to which that cycling results in net sequestration and improvements of water use depends on active stewardship and management.
- Forests, shrublands, chaparral, and grasslands see benefits in reduced fire emissions from increased management.
- Investments in healthy soil practices in annual croplands increase soil carbon.
- Expanding deployment of urban tree canopy, wetland restoration, healthy soils practices, and Organic farming deliver carbon sequestration and reduced emissions.
- As we move into an uncertain future, it is important to enhance our ecosystem health and diversify our management across the landscape to reduce risk of unknowable/unforeseeable future events

Other Considerations (outside of current modeling scope)

- Reductions possible from decreased N application under Organic agriculture and other soil health practices.
- Additional sequestration possible from more actions on irrigated pasture, grasslands, shrublands, chaparral, and forests
- Non-modelled landscapes, i.e. sea grasses/weeds, coastal wetlands, and other lands provide additional opportunities
- Accelerating pace of climate change calls for new/expanded monitoring approaches to assess risks and benefits of NWL

Comments

- Environmental Justice Advisory Committee Comments
- Public Comments
  - Use the "**Raise Hand**" function in the GoToWebinar toolbar located to the right of your screen as shown by the hand icon
  - When staff call your name, please "**Unmute**" yourself by clicking the red microphone button, and proceed to introduce yourself