Carbon Sequestration as a Climate Mitigation Strategy

May 23, 2023

Tumwater City Council

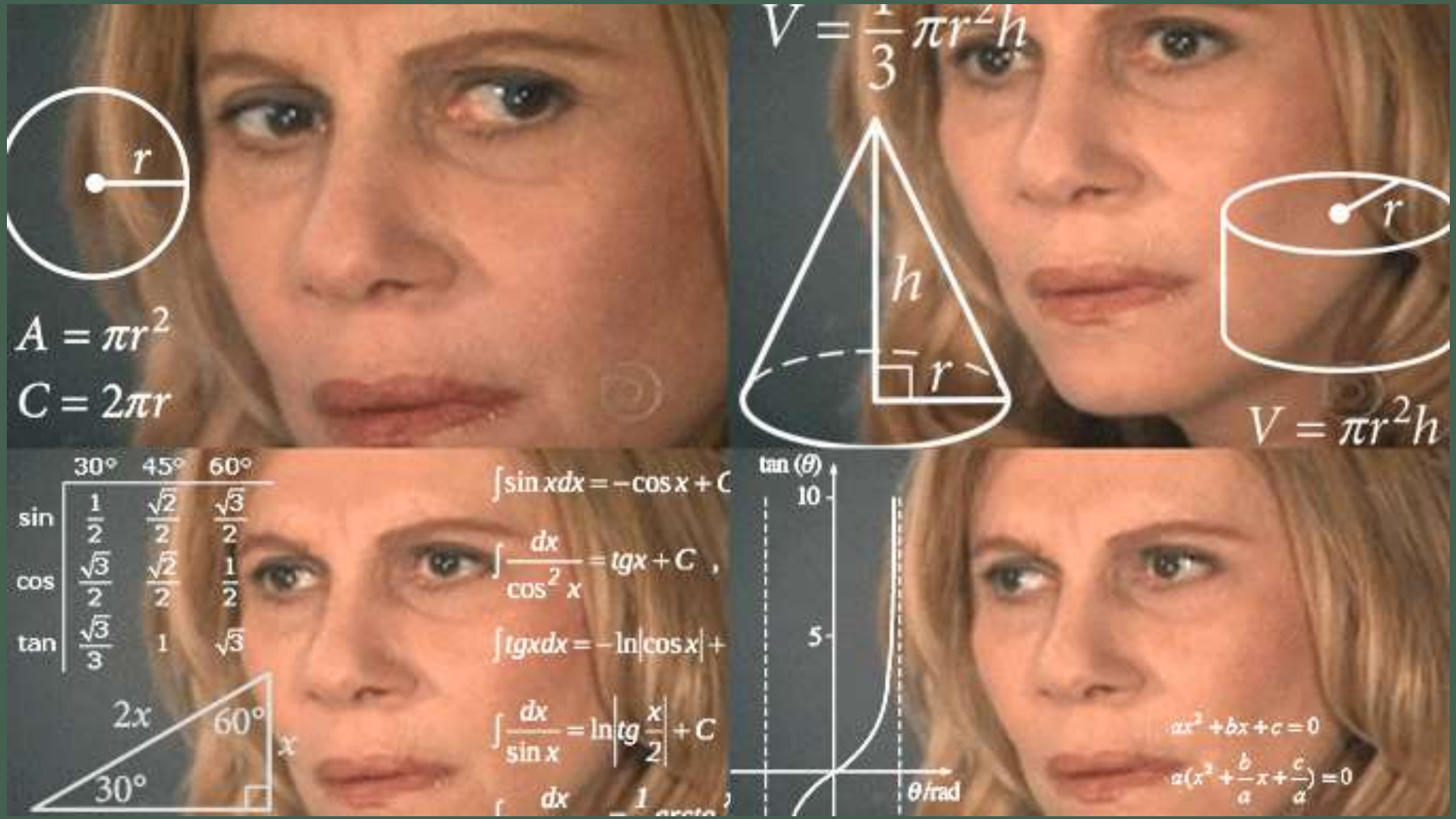
Overview

Background

Thurston Climate Mitigation Plan Context

Sequestration Baseline & Potential

Policy Options & Conclusions


r
$A = \pi r^2$
$C = 2\pi r$
$V = \frac{1}{3}\pi r^2 h$
h
r
r
$V = \pi r^2 h$
30° 45° 60°
sin $\frac{1}{2}$ $\frac{\sqrt{2}}{2}$ $\frac{\sqrt{3}}{2}$
cos $\frac{\sqrt{3}}{2}$ $\frac{\sqrt{2}}{2}$ $\frac{1}{2}$
tan $\frac{\sqrt{3}}{3}$ 1 $\sqrt{3}$
2x
60°
x
30°
$\int \sin x dx = -\cos x + C$
$\int \frac{dx}{\cos^2 x} = tgx + C$,
$\int tgx dx = -\ln|\cos x| +$
$\int \frac{dx}{\sin x} = \ln\left|tg\frac{x}{2}\right| + C$
$\int \frac{dx}{}$
tan (θ)
10
5
θ/rad
$ax^2 + bx + c = 0$
$a(x^2 + \frac{b}{a}x + \frac{c}{a}) = 0$

What is carbon sequestration?

- A process that removes carbon dioxide from the atmosphere and stores it in natural or artificial sinks, such as soil, vegetation, and the ocean.
- Other terms: carbon dioxide removal (CDR), negative emissions technologies (NETs), carbon or emissions offsets
- **IPCC:** carbon sequestration will be necessary to meet all modeled pathways to international climate targets

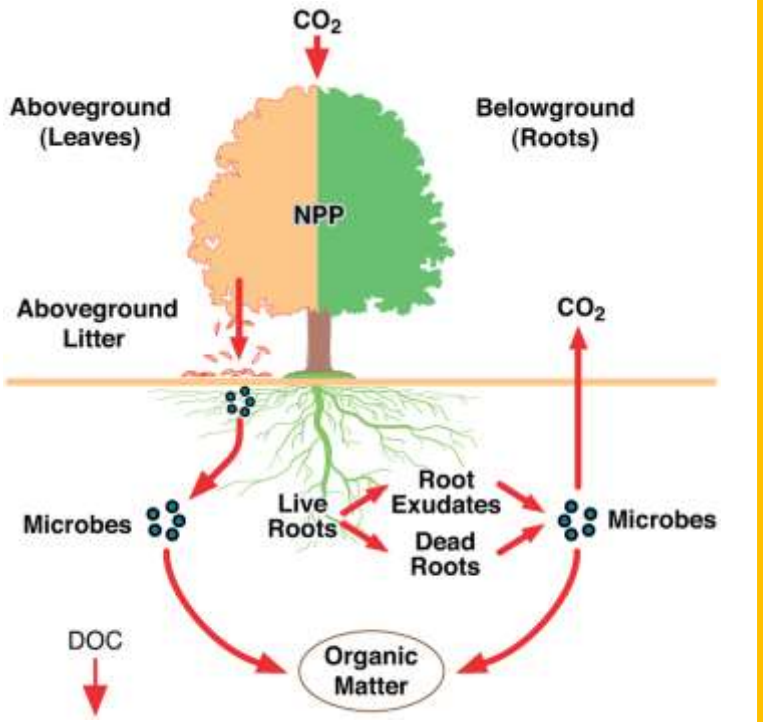
What is carbon sequestration?

Carbon Stock

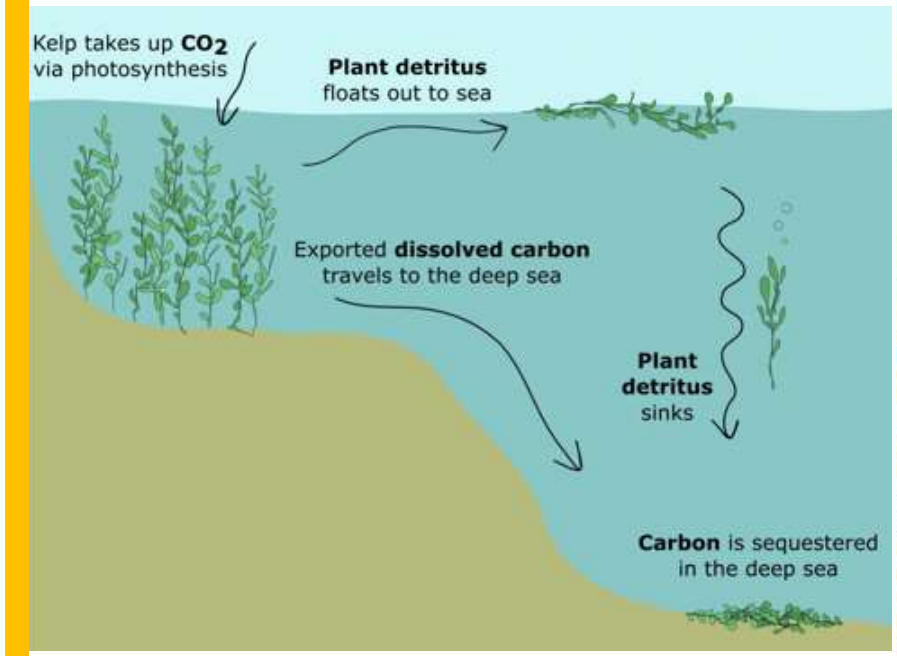
- Stored carbon in vegetation, soil, rocks, gas, liquid, etc
- Tons C

Carbon Flux

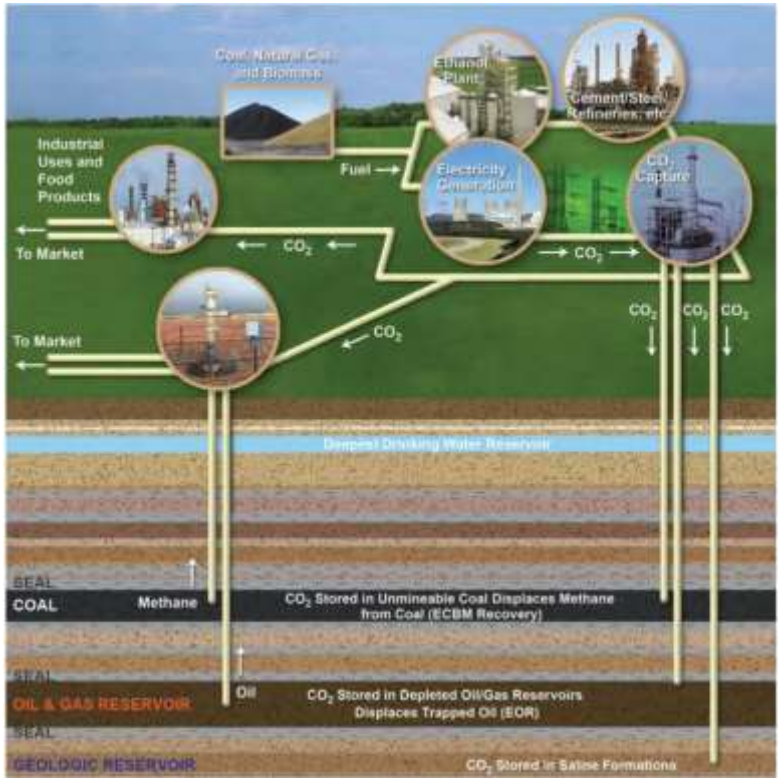
- Movement of carbon from one pool to another
- Carbon emissions, carbon sequestration
- MTCO2e/year



Terrestrial sequestration



Oceanic sequestration/Blue Carbon



Geologic sequestration

What is carbon sequestration?

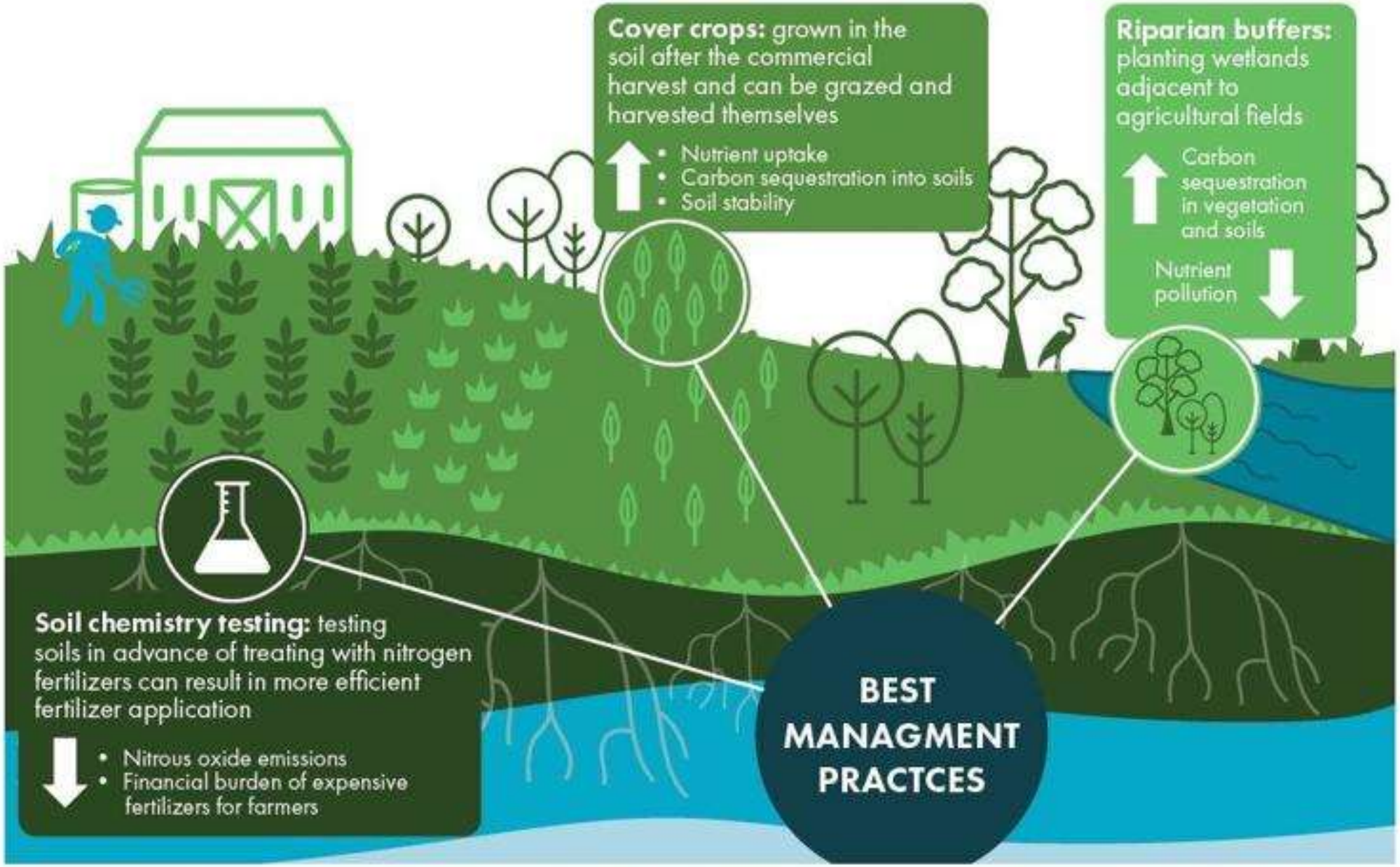
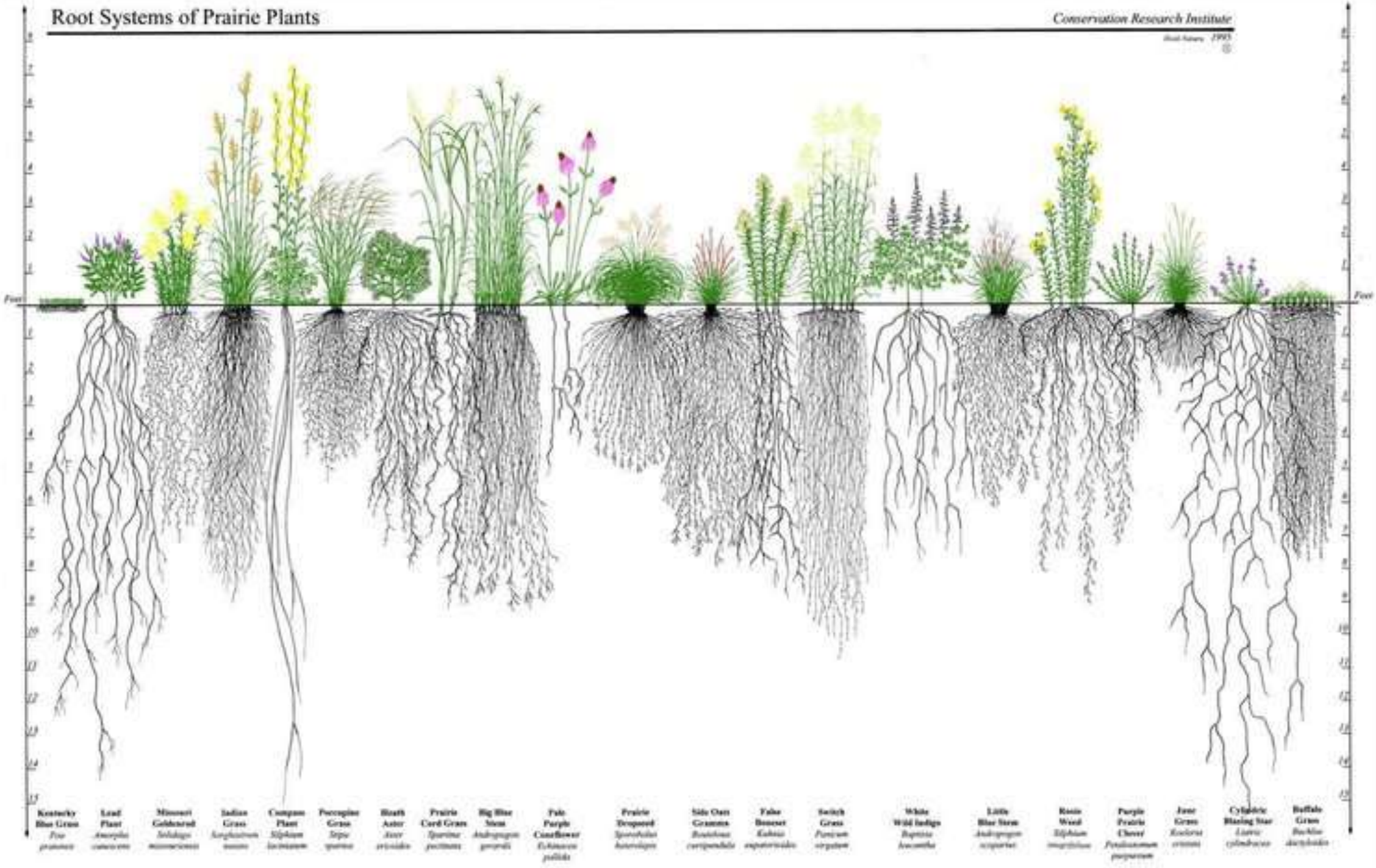


FIGURE 7. ILLUSTRATION OF THREE TYPES OF AGRICULTURAL BEST MANAGEMENT PRACTICES WITH CLIMATE BENEFITS HIGHLIGHTED.


Root Systems of Prairie Plants
Conservation Research Institute
Root Nature 1995
Feet
Kentucky Blue Grass Poa pratensis
Lead Plant Amorpha canescens
Missouri Goldenrod Solidago missouriensis
Indian Grass Sorghastrum nutans
Compass Plant Silphium laciniatum
Porcupine Grass Stipa spartea
Heath Aster Aster ericoides
Prairie Cord Grass Spartina pectinata
Big Blue Stem Andropogon gerardi
Pale Purple Coneflower Echinacea pallida
Prairie Dropseed Sporobolus heterolepis
Side Oats Grama Bouteloua curtipendula
False Boneset Kuhnia eupatorioides
Switch Grass Panicum virgatum
White Wild Indigo Baptisia leucantha
Little Blue Stem Andropogon scoparius
Rosin Weed Silphium integrifolium
Purple Prairie Clover Petalostemum purpureum
June Grass Koeleria cristata
Cylindric Blazing Star Liatris cylindracea
Buffalo Grass Buchloe dactyloides

Sequestration Types

- Regenerative Agriculture
- Reforestation/Afforestation
- Prairie Preservation and Restoration

Strategies

- ***Strategy A2***: Support agricultural practices that sequester carbon.
- ***Strategy A5-A7***: Preserve tree canopy and manage forests and prairies to sequester carbon.

Assumptions

- Sequestration will be used to offset countywide emissions
- NOT traded for emissions occurring outside Thurston County

What is the role of carbon sequestration in the TCMP?

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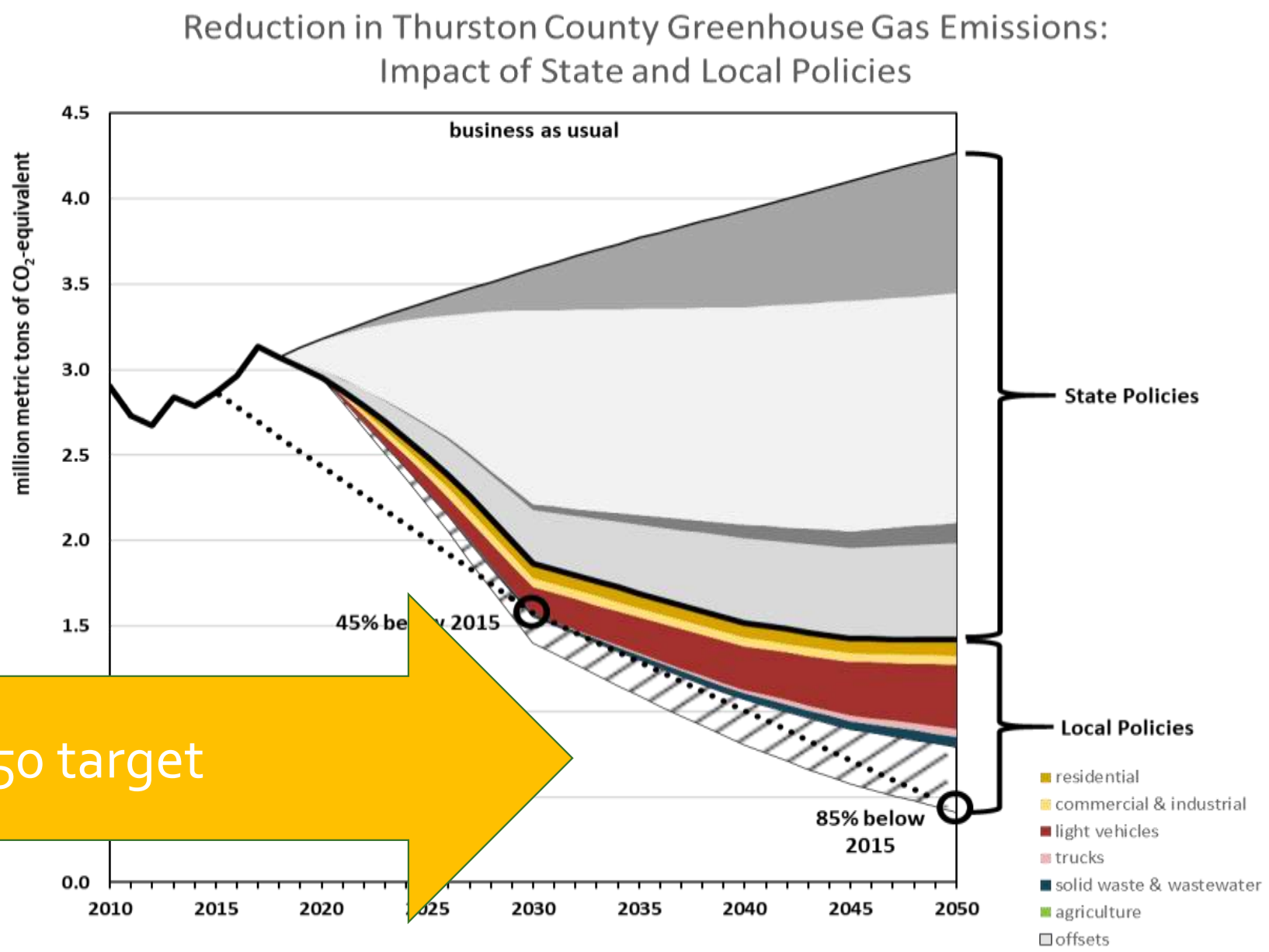
10% of 2050 target



What is the role of carbon sequestration in the TCMP?

- **Target**:
  - Sequester 380,000 $MTCO_2e$/year by 2050
- **Estimated**
  - Agricultural soil carbon: **3,300 $MTCO_2e$/year**
  - Afforestation/Reforestation: **376,300 $MTCO_2e$/year**
- **Not Estimated**
  - Existing trees or other land covers
  - Restored prairies
  - Urban trees
  - Changes in land use

The TCMP left us with some burning questions…

- **How much carbon does land in Thurston County already sequester?**
  - We need a baseline in order to track change.
- **How much more carbon could certain land covers (forest, agriculture lands, prairies) potentially sequester in the future under different climate mitigation strategies?**
- **What can regional partners do to meet the 2050 sequestration target?**
  - Is it even feasible?

Baseline Sequestration

Method:

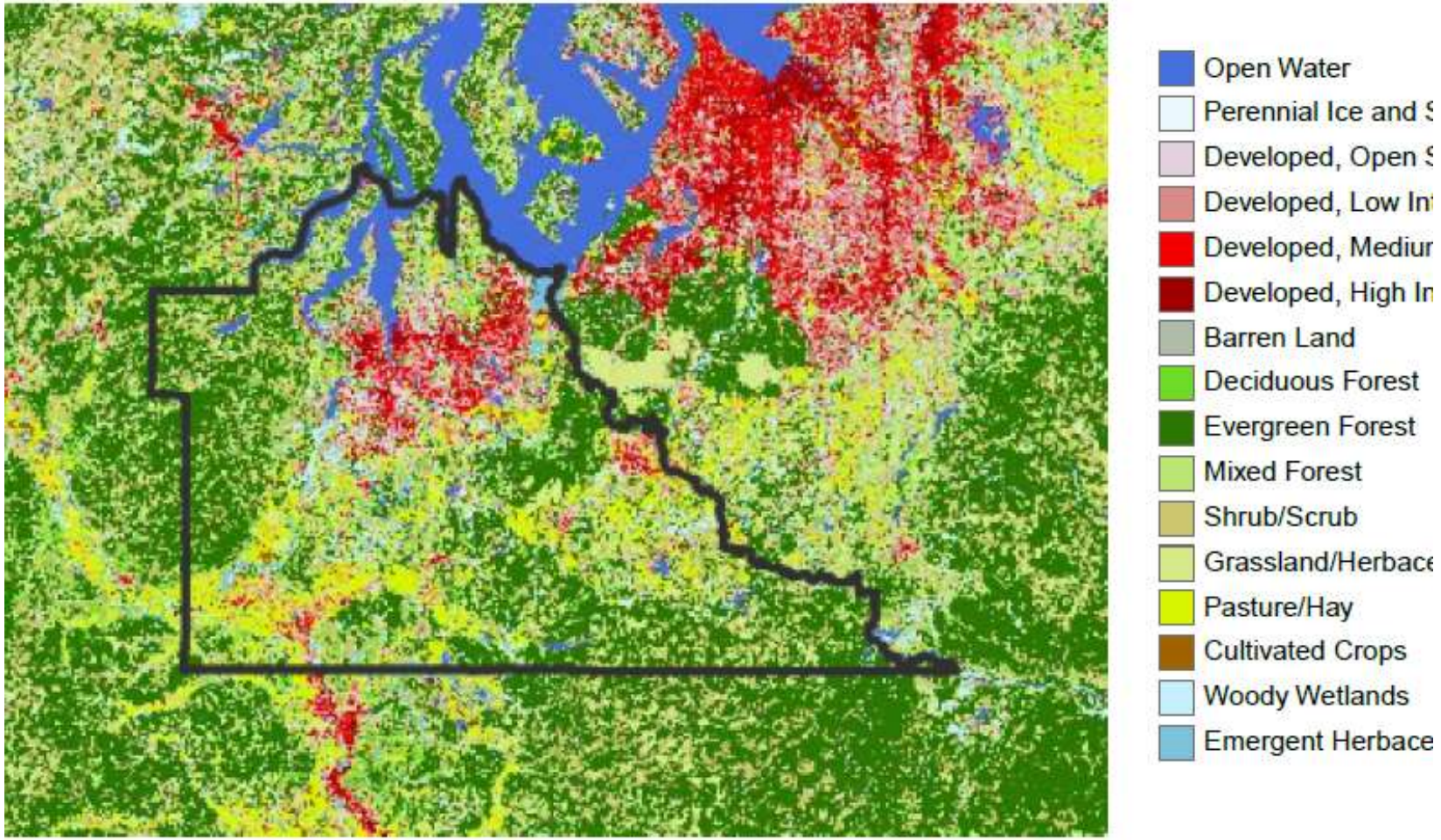
ICLEI LEARN Tool

Uses aerial images to measure change in land use type between two years

Forest → Grassland

Grassland → Settlement

Cropland → Forest



Baseline Sequestration

How much carbon does land in Thurston County already sequester?

- Forests/trees: **926,800 $MTCO_2e$/year**
  - Source: ICLEI LEARN tool, 2006-2016
- Agriculture: ???
- Prairies: ???
- Other land uses: ???

Baseline Sequestration: Forests and Trees

Urban Sequestration Baseline
65,500 $MTCO_2e$/year

Rural Sequestration Baseline
861,300 $MTCO_2e$/year

Total Sequestration Baseline
926,800 $MTCO_2e$/year

Additional Sequestration Needed to Meet TCMP Target
375,000 $MTCO_2e$/year

40% Increase

Sequestration Potential

Literature Review:

Robertson et al. (2021)

Reforestation Hub

NRCS COMET-PLANNER,

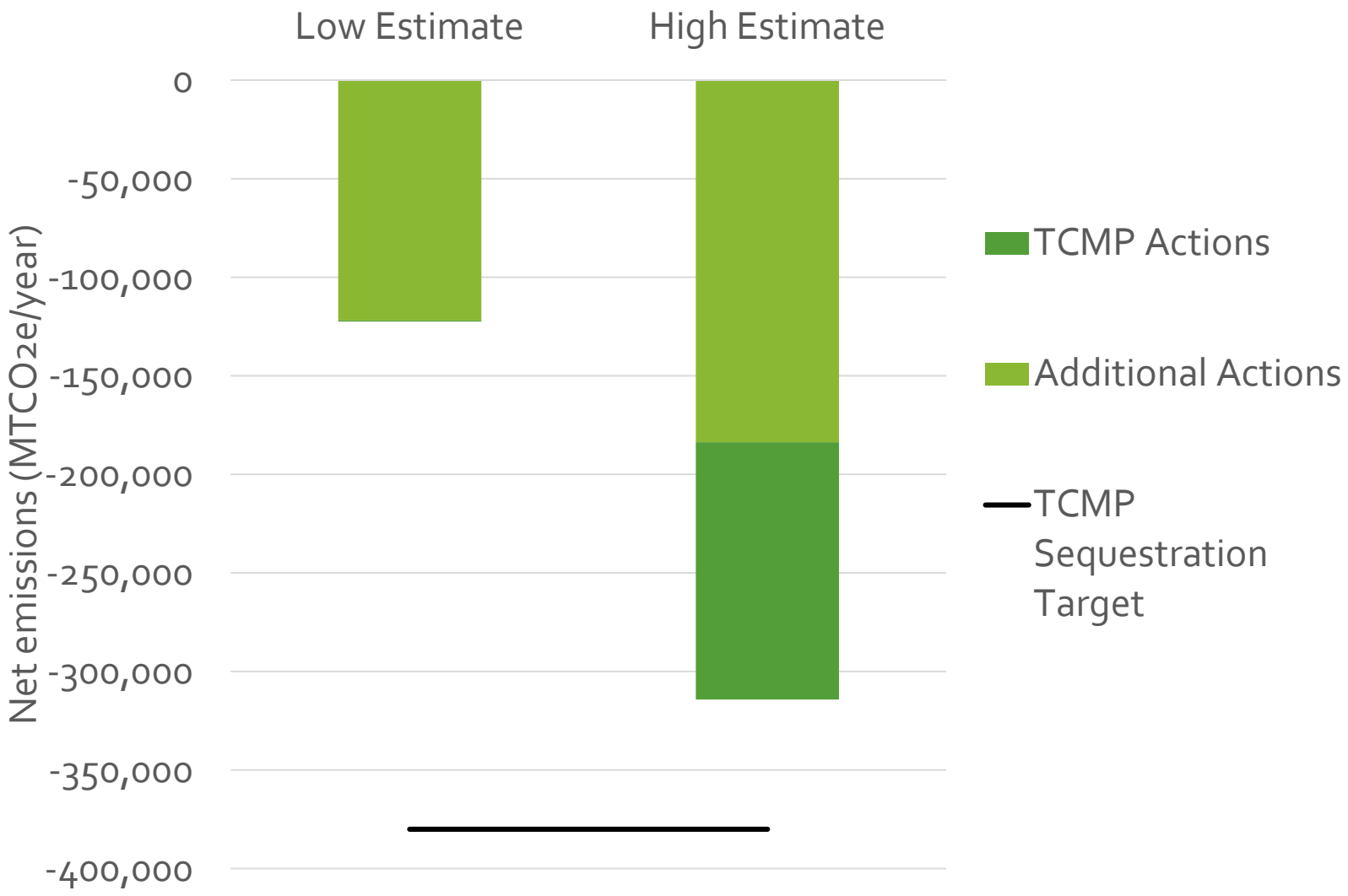
Washington Climate Smart Estimator

CARB Land Restoration Benefit Calculator Tool

What strategies could increase carbon sequestration?

- TCMP Actions
  - Regenerative agriculture (A2.1)
  - Reforestation/afforestation (A5.1)
  - Prairie preservation (A7.3)
- Other Actions
  - Extended timber harvest
  - Avoided conversion of forests
  - Tidal wetland restoration

Sequestration Potential



Policy Options

What actions could regional partners take?

- Report outlines 30 potential actions
  - Cost – initial and ongoing
  - Staff requirements
  - Carbon sequestration potential
- Options
  - Technical assistance/outreach
  - Regulatory
  - Financial incentives
  - Data/Enabling

Policy Options

Support rural forest conservation and incentive programs

- State program advocacy
- Feasibility of regional incentive programs

Align existing programs with sequestration goals

- Comprehensive Plans
- HCP implementation
- TCMP target update

Fill priority data gaps

- Land use change emissions inventory
- Regional tree canopy update
- Prairie soil analysis
- Regenerative agriculture tracking

Build relationships with community partners and track state/federal programs

- Sequestration working group

Sequestration Questions

- What actions should be taken to achieve carbon sequestration targets?
- What role should carbon sequestration play in achieving our emissions targets?
  - Should we adjust our assumptions/targets?
  - Focus on offsets? Focus on co-benefits?
  - Keep within county boundary? Consider expanded markets?
- What should be the relative role of different sequestration strategies?
- What are the costs relative to the benefits of different strategies?

Who else is working on this?

State

- **Department of Natural Resources**
  - Climate Resilience Plan (2020) and Forest Action Plan (2020)
  - Small Forest Landowner and Stewardship Program
  - Urban and Community Forest Program
  - Carbon Project – includes land in Thurston County
- **Washington State Conservation Commission**
  - Voluntary Stewardship Program
  - Sustainable Farms and Fields Program
- **Climate Commitment Act (Ecology)**
  - Includes carbon offsets for reforestation, avoided forest conversion, improved forest management, urban forestry, livestock management

➢ Offset projects located in Thurston County sold through carbon registries (including state and private programs) will not necessarily offset Thurston County emissions.

Conclusions

- Existing forests and trees sequester ~927,000 $MTCO_2e$/year
  - Additional info needed to get a complete baseline
- TCMP sequestration target highly ambitious, likely infeasible
- Partners have a menu of options for next steps

Thank You!

Staff Contact

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Rural Forests

- **Half** of Thurston County is forested
- **93%** of forested land is in the rural county
- **60%** of rural forested land is managed for timber harvest
  - Largely in private timber companies
  - Some state managed lands
- **37%** is private, non forestry
- 3% in a designated park of preserve

Sequestration Potential

Sequestration Strategies	Estimated Sequestration Potential ($MTCO_2e$/year) Low	High
Sequestration actions included in the TCMP		
Regenerative agriculture (A2.1)	340	6,990
Reforestation/afforestation (A5.1)	170	118,820
Prairie preservation (A7.3)	1	4,760
Other sequestration actions		
Extended timber harvest	117,600	171,180
Tidal wetland restoration	4,300	12,540
SUBTOTAL	122,411	314,290
Actions that maintain sequestration capacity		
Avoided conversion of forests°	11,310	56,490

° Avoiding forest conversion will not increase total sequestration. It will only reduce future net emissions.