

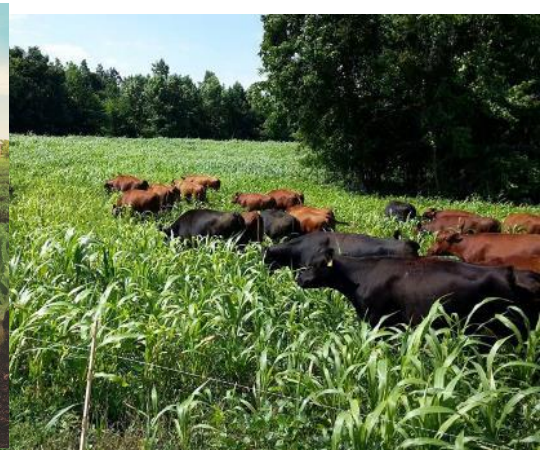

Natural carbon sequestration on working and urban lands:

Benefits for our climate, health, water, food, biodiversity, economy & more

February 15, 2022

The Climate Center

jock@theclimatecenter.org www.theclimatecenter.org

“Code red for humanity….

[UN IPCC 6th Assessment report] must sound a death knell for coal and fossil fuels, before they destroy our planet.”

-UN Secretary General António Guterres, Aug 9 2021,

“No temperature rise is safe”…rapidly warming climate is the "greatest threat" to global public health

-220 medical journals globally, Sept. 7 2021

https://www.reuters.com/business/environment/un-sounds-clarion-call-over-irreversible-climate-impacts-by-humans-2021-08-09/
https://www.theguardian.com/environment/2021/jul/02/canadian-inferno-northern-heat-exceeds-worst-case-climate-models
https://grist.org/science/is-climate-change-happening-faster-than-expected-a-climate-scientist-explains/
https://www.npr.org/2021/09/07/1034670549/climate-change-is-the-greatest-threat-to-public-health-top-medical-journals-warn

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Current global climate goals

UN IPCC 1.5C Report- Oct 2018

- **Cut emissions by 45% by 2030**

AND

- **remove up to 1000 Gt CO2e from atmosphere**

to achieve **net-zero emissions by 2050** and **stay under the 1.5C** dangerous warming threshhold

UN operates by consensus.
Goals are conservative and not enough.
We must do more sooner per new science…

https://www.ipcc.ch/sr15 /
https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers/

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Western US now in global warming-induced severe megadrought; worst in 1200 years

- **Threatens dustbowl & ag economy by as early as 2027 in CA**
- 2015 drought cost ~$2.7 billion and 20k lost ag jobs in California
- Climate impacts likely to worsen by 50% in next few years in California

https://www.motherjones.com/environment/2014/02/california-drought-matters-more-just-california/

https://ramanathan.ucsd.edu/

Williams et al *Nat. Clim. Chang.* (2022). https://doi.org/10.1038/s41558-022-01290-z

https://www.latimes.com/environment/story/2022-02-14/western-megadrought-driest-in-1200-years

https://www.scientificamerican.com/article/drought-takes-2-7-billion-toll-on-california-agriculture/

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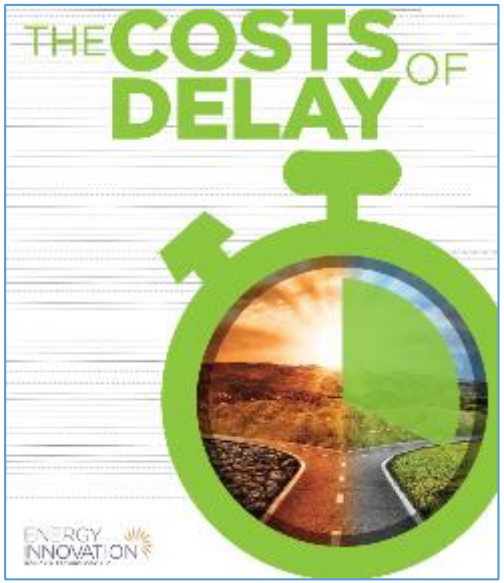
Climate action delay/inaction costs lives and dollars, bankrupting our future

- **Eliminating fossil fuel air pollution in bldgs. & transportation in CA yields $44 billion/year in improved health & avoiding ~5,000 premature deaths**
- **Costs much less investing big today** rather than waiting until 2030 *(For CA: est. $47 billion/year now vs. $110 billion/year starting in 2030 based on CA =14.6% of GDP)*
- $150 Billion in damages from 2018 CA wildfires *but $80 Billion invested in California generate ~725,000 jobs*



https://energyinnovation.org/wp-content/uploads/2021/01/Cost_of_Delay.pdf

https://www.ethree.com/new-e3-reports-quantify-the-health-benefits-of-reducing-fossil-fuel-use-in-california/ Jan 2022
https://www.federalreserve.gov/publications/files/financial-stability-report-20201109.pdf
https://www.nytimes.com/2020/09/08/climate/climate-change-financial-markets.html
Wang, D et al. **Economic footprint of California wildfires in 2018**. *Nature Sustainability*, 2020 DOI: 10.1038/s41893-020-00646-7
https://www.accuweather.com/en/weather-news/california-wildfires-will-cost-tens-of-billions-accuweather-estimates/612548
Political Economy Research Institute https://www.peri.umass.edu/images/CA-EconRecProgram-6-12-20_Final.pdf
World Resources Institute https://www.wri.org/blog/2020/07/economic-benefits-climate-action-us

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“I don’t at all feel that we [in California] are leading the world anymore.”

– Assembly Speaker Anthony Rendon, COP26, Glasgow

https://calmatters.org/newsletters/whatmatters/2021/11/california-climate-change-newsom/

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CLIMATE-SAFE CALIFORNIA

accelerate existing state goals 15 years…

2045 is too late

- **Net-negative emissions by 2030** (remove more climate emissions than we emit) (Brown 2018 EO by 2045)
  - **80% below 1990 GHG levels by 2030** (Schwarzenegger 2005 EO by 2050)
  - **~100 MMT/year CO2e sequestered on natural, working and urban lands by 2030**

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One pathway to Net Negative Emissions by 2030: *by sector*

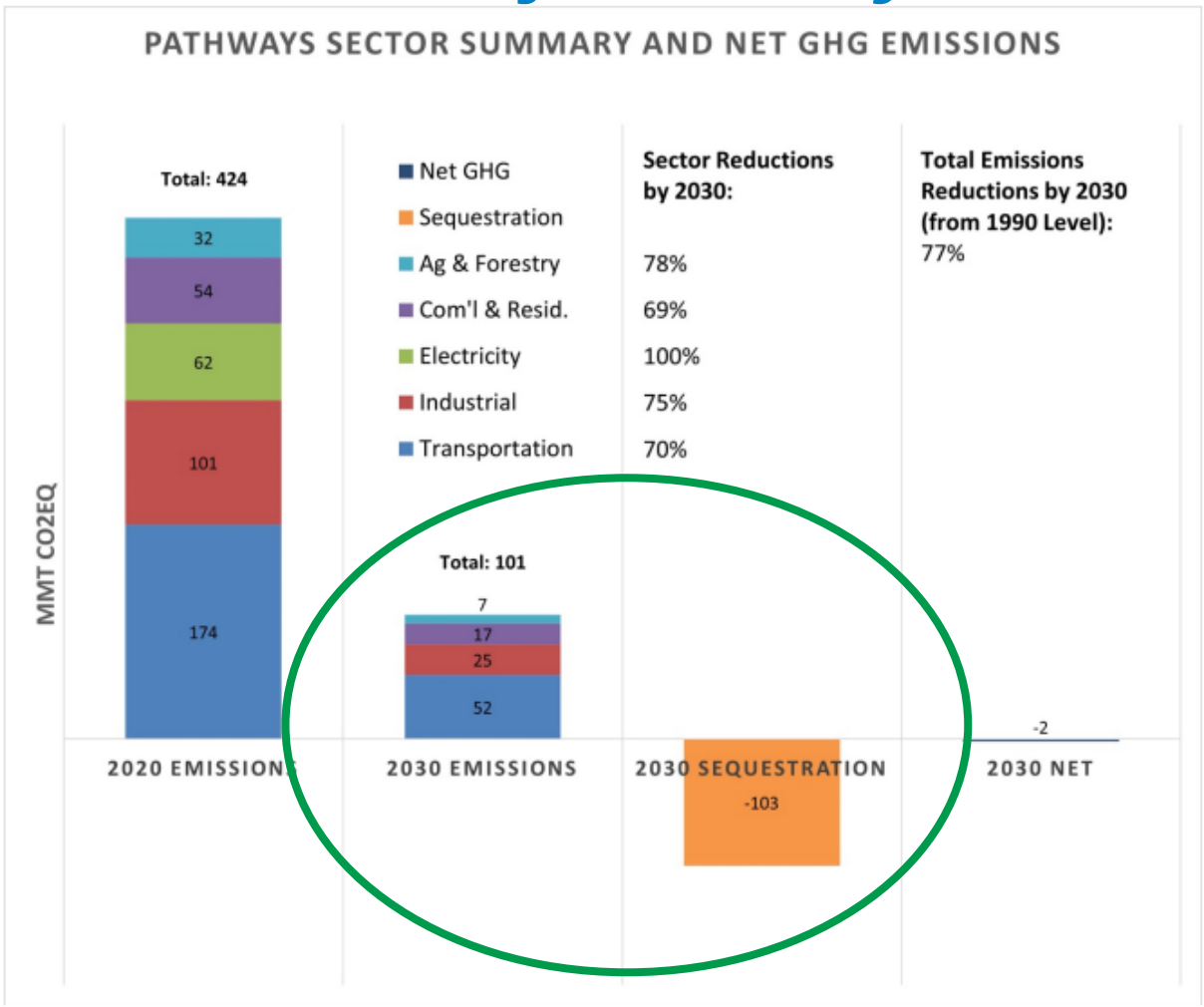

Figure 2. Pathway of emissions reductions by sector that result in net-negative emissions by 2030. Analysis using The Climate Center GHG Accounting Tool.

https://theclimatecenter.org/our-open-source-pathways-model-offers-climate-action-blueprint/
https://arxiv.org/abs/2103.07801

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Bold targets work!
As goes California, goes the world

- AB1493 (2002) **tailpipe emissions cuts**
  - later adopted by 13 other states; basis for 2010 national clean car standards

- SB100 (2017)- **100% carbon-free electricity** by 2045
  - already adopted by 10 other states and Biden Administration with earlier deadlines

- CA launched **Under2 Coalition** (2017); now includes 220 jurisdictions with 1.3 billion people and 43% of the world economy

- Gov. Newsom EO **100% ZEV car sales** by 2035 (Sept 2020) – must be earlier but…
  - GM announces will sell only 100% ZEV cars by 2035 (Jan 2021); Volvo by 2030 (Mar 2021); New York State (Sept 2021)

https://www.researchgate.net/publication/344784830_Sociotechnical_typologies_for_national_energy_transitions
https://www.theclimategroup.org/under2-coalition
https://www.nytimes.com/2021/01/28/business/gm-zero-emission-vehicles.html

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Governor Newsom heard us: ordered Air Resources Board to evaluate pathways to carbon neutral by 2035, 10 years ahead of current policy

July 9, 2021

https://www.gov.ca.gov/2021/07/09/governor-newsom-holds-virtual-discussion-with-leading-climate-scientists-on-states-progress-toward-carbon-neutrality/

Also asked CPUC to establish a more ambitious greenhouse gas emissions target for electricity procurement by 2030

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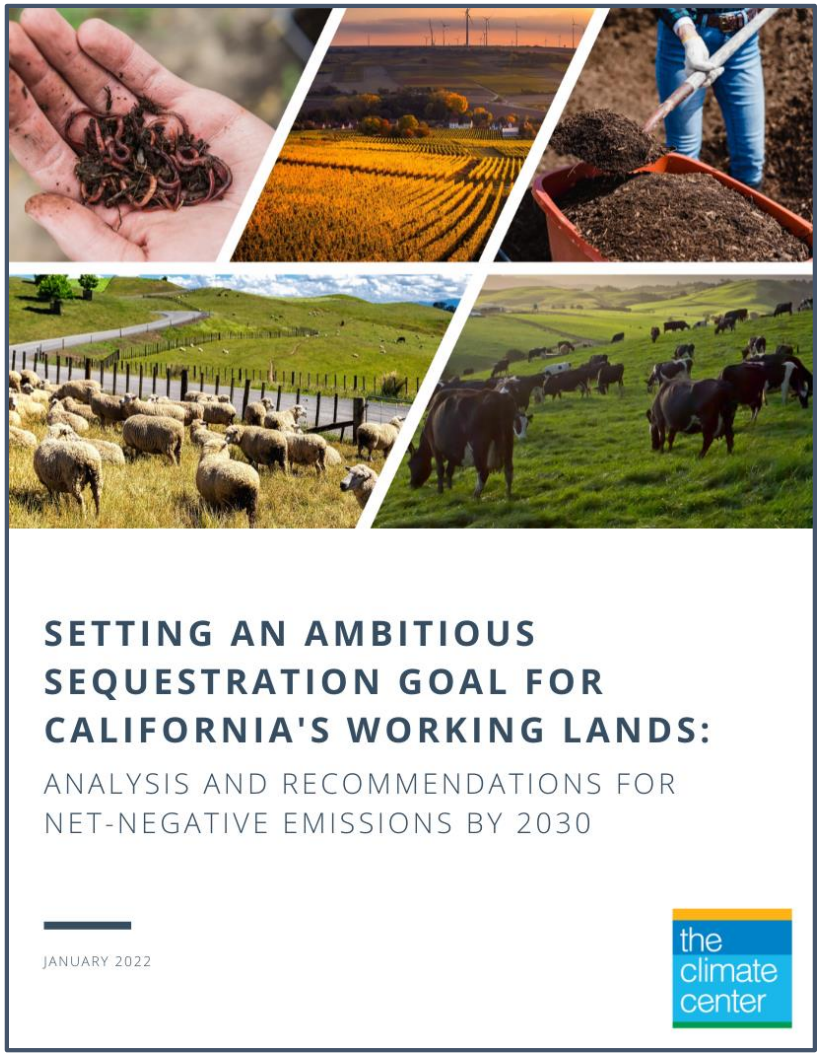
New Report: Sequestration Goals for California's Working Lands by 2030



- ✓ Report quantifies maximum sequestration potential of CA working and urban lands by 2030
- ✓ Builds on partnership with Carbon Cycle Institute (Torri Estrada and Dr. Jeff Creque)
- ✓ Reviewed by expert soil scientists (Dr. Keith Paustian, Dr. Tim Bowles, Dr. Libby Porzig)
- ✓ Does not include additional sequestration potential from natural lands, forests, montane and coastal wetlands, and nearshore habitat

www.theclimatecenter.org/working-lands

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The climate solution in California's compost and crops

These nature-based solutions are cheaper than climate tech

By Justine Calma | @justcalma | Jan 26, 2022, 9:24am EST

SHARE

Rows of composting grape pomace are covered for the winter in Sonoma County's Alexander Valley on December 13, 2015, near Geyserville, California. | Photo by George Rose/Getty Images

"By 2030, that capacity could increase to almost 100 million metric tons of CO2 equivalent sequestered a year. …

The majority of that sequestered carbon would come from composting across the state's croplands and pasturelands. Planting more trees on farms and in cities would also have a significant impact."

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Benefits of scaling up soil carbon storage on California's working and urban lands

- Sequestration potential of ~100 MMT CO2e per year by 2030

✓ Water security, retention

✓ Drought, heat, wildfire resilience

✓ Cleaner air & water- esp. for frontline communities

✓ Crop yield stability & resilience

✓ Biodiversity

✓ Jobs

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Significant water security and drought resilience benefits from natural sequestration

- Increasing soil health (soil organic matter) 1% stores an extra 20,000 gallons of water per acre

- Increasing soil health (soil organic matter) by just 3% on 47M acres of the state's working lands:
  - Would store an additional 1.5 trillion gallons of water
  - Equivalent to the capacity of Shasta Dam

https://nrcspad.sc.egov.usda.gov/DistributionCenter/pdf.aspx?productID=1027

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Carbon sequestration potential using these proven practices on working and urban lands

Practice	Annual Acreage (new)*	Rate (MT CO_2e/ac/yr)	Annual MT CO_2e (new acres)	2030 Acreage Total	Cumulative 2021-2030 (MMT CO_2e)	2030 Annual Rate (MMT CO_2e)
Rangeland compost	352,000	1	352,000	3,520,000	19.36	**3.52**
Pasture compost	1,155,00	1	1,155,000	11,550,000	63.53	**11.55**
Cropland compost	1,200,000	4.5	5,400,000	12,000,000	54.00	**54.00**
Agroforestry	760,000	2	1,520,000	7,600,000	83.60	**15.20**
Riparian restoration	160,000	1.48	236,800	1,600,000	13.02	**2.37**
Prescribed grazing	436,000	0.05	21,800	4,360,000	1.20	**0.22**
Urban forestry	147,258	4.04	594,922	1,472,580	32.72	**5.95**
Roadside forest buffers	155,152	1.77	274,619	1,551,520	15.10	**2.75**
N fertilizer avoidance	1,600,000	0.44	704,000	16,000,000	7.04	**7.04**
Selected totals					**289.57**	**102.59**

**total acreage not shown because multiple practices can be implemented on same acres*

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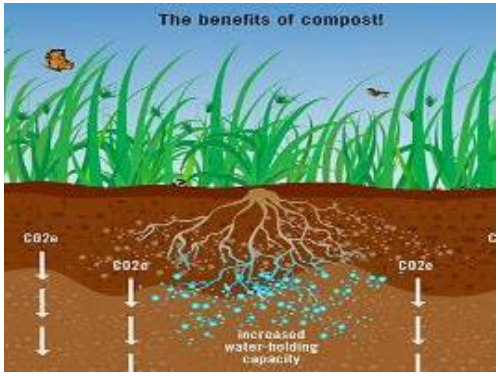
Nature-based sequestration-- *not technological carbon removal*-- by 2030

Carbon Capture, Utilization and Storage (CCS/CCUS): to remove CO_2 from power plants and industrial processes, placing the CO_2 into long-term storage but 81% used for "enhanced oil recovery"

[~26 CCS plants operate globally; $11 Billion+ invested by US; potential use in cement and steel– non oil&gas production]

Direct Air Capture (DAC): extracts CO_2 from the air by pulling air through filters where it reacts with chemicals and is stored or used to make synthetic fuels

[~19 direct air capture (DAC) plants operating worldwide, capturing ~0.01 Mt CO2/year]



Nature-based sequestration (NbS): absorption of CO_2 in natural media like trees, plants, soil, oceans, and other natural or biological settings.

https://foe.scot/wp-content/uploads/2021/01/CCS-Research-Summary-Briefing.pdf
https://crsreports.congress.gov/product/pdf/IF/IF11501/3
https://www.eco-business.com/news/carbon-capture-and-storage-wont-work-critics-say/
https://theclimateconnection.org/carbon-capture-and-storage-pros-cons/
https://www.treehugger.com/carbon-capture-and-storage-ccs-pros-and-cons-5120005
https://www.iea.org/reports/direct-air-capture
www.theclimatecenter.org/working-lands

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Carbon Capture, Utilization and Storage (CCUS or CCS)

to remove CO_2 at the source at power plant and industrial smokestacks and put into long term storage

- BUT 81% used for "enhanced oil recovery" –> injecting underground for more fossil fuel production
- ~26 CCS plants operating globally
  - In Australia: Chevron's Gorgon Liquefied Natural Gas Plant– captured half of 80% goal in first few years (by July 2021)
- $11 Billion to date invested by US [$6 Billion+ (as of 2020) & $5.1 Billion more in Biden's Infrastructure Bill (2021)]
- >80% of 39 CCS projects attempted in the U.S. failed
  - Latest in US: NRG Energy's Petra Nova coal-fired plant in Texas closed permanently in Jan. 2022
- Limited potential use in non oil & gas production, e.g., cement & steel

https://gizmodo.com/the-only-carbon-capture-plant-in-the-u-s-just-closed-1846177778 Jan 2022
https://foe.scot/wp-content/uploads/2021/01/CCS-Research-Summary-Briefing.pdf Jan 2021
https://iopscience.iop.org/article/10.1088/1748-9326/abd19e/meta
https://crsreports.congress.gov/product/pdf/IF/IF11501/3
https://www.eco-business.com/news/carbon-capture-and-storage-wont-work-critics-say/
https://www.canarymedia.com/articles/carbon-capture/the-carbon-capture-project-that-couldnt-chevron-misses-targets-for-its-huge-australia-facility
https://theclimateconnection.org/carbon-capture-and-storage-pros-cons/
https://www.treehugger.com/carbon-capture-and-storage-ccs-pros-cons-5120005
https://www.iea.org/reports/direct-air-capture

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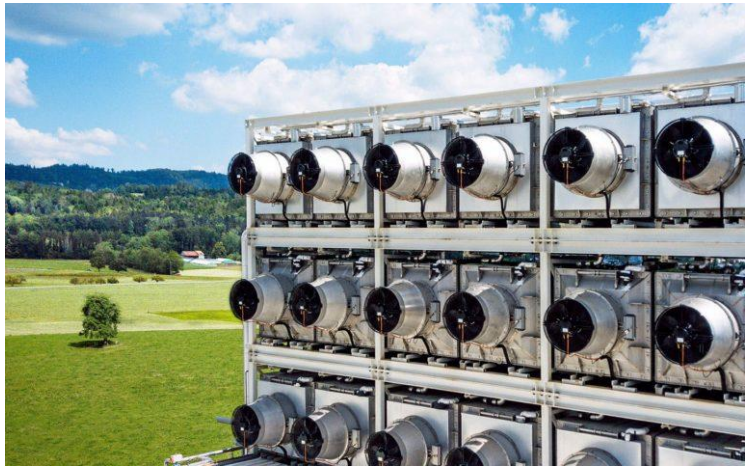
Direct Air Capture (DAC)

new technology to extract past CO_2 pollution from the atmosphere



Credit: Climeworks.

- https://www.rechargenews.com/energy-transition/the-amount-of-energy-required-by-direct-air-carbon-capture-proves-it-is-an-exercise-in-futility/2-1-1067588
- https://www.reuters.com/business/cop/global-carbon-emissions-rebound-near-pre-pandemic-levels-2021-11-04/
- https://www.greenbiz.com/article/direct-air-capture-ready-its-closeup
- www.carbon180.org
- Direct Air Capture fact sheet (Carbon 180): https://static1.squarespace.com/static/5b9362d89d5abb8c51d474f8/t/6193e4c60dc10420edc0f5cd/1637698407681/Carbon180+Ed+Packet+DAC.pdf

- Pulls air through filters where it reacts with chemicals and is stored or used to make synthetic fuels
- ~19 Direct Air Capture (DAC) plants operating worldwide
- Only captures ~0.01 Mt CO2/year, tiny fraction of the 34 Gigatons of fossil emissions in 2021
- Estimated to remove ~5 Gigatons by 2050
- Very energy intensive (requires almost same energy as in the fossil fuels that produce the CO2)
- $3.5 Billion for 4 regional DAC facilities in Biden's 2021 Infrastructure Bill

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Carbon farming on working & urban lands

potential for carbon removal at scale

20+ m acres = ~100 MMT/year CO2e by 2030

CARBON FARM PLANNING in Marin

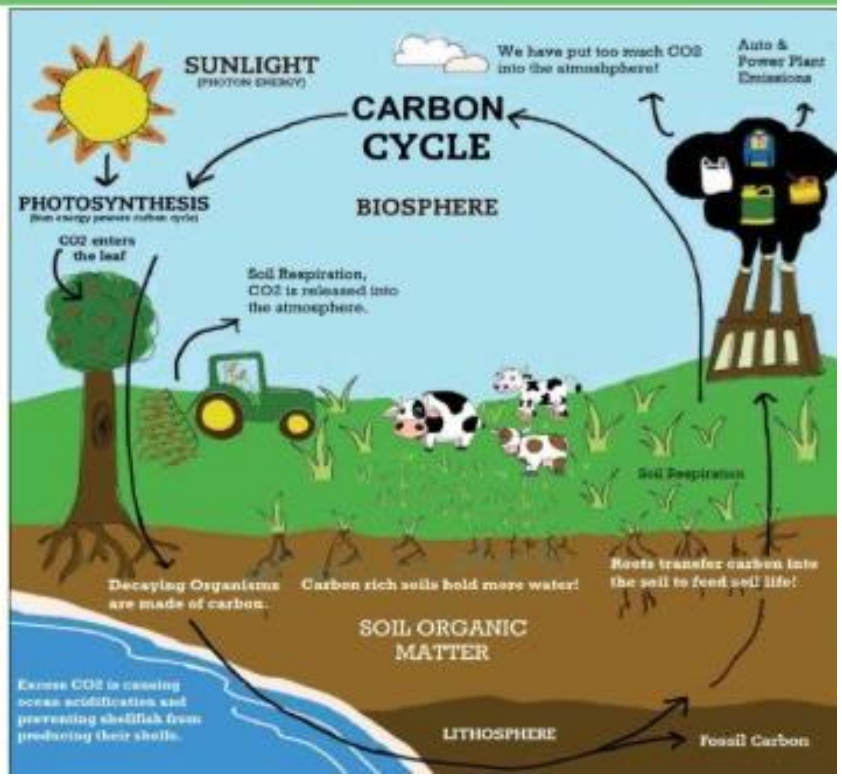
Assistance is available for farmers and ranchers!

Plan for carbon sequestration and climate adaptation conservation practices with Marin RCD!

Potential List of Conservation Practice(s)* in a Carbon Farm Plan:

- Compost Application • Anaerobic Digester
- Silvopasture/ Shrub & Tree Establishment
- Windbreak/ Shelterbelt/ Hedgerow
- Riparian and Wetland Restoration
- Filter Strips • Grassed Waterways
- Forage & Biomass Planting
- Rangeland Management
- Prescribed Grazing and Range Planting
- Nutrient Management
- Residue & Tillage Management, No-Till
- Cover Crops

*NRCS Standard Conservation Practices



MARIN RESOURCE CONSERVATION DISTRICT

Carbon Cycle Institute

MARIN CARBON PROJECT

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NWL Carbon Sequestration: Priority policy recommendations

- Establish bold statewide short- and mid-term targets
- Scale up technical assistance for land managers
- Scale up compost production (food waste) and application
- Increase state funding for NWL carbon sequestration programs
  - Total estimated public/private funds needed: ~$29 Billion over 10 yrs

https://www.usda.gov/media/press-releases/2022/02/07/usda-invest-1-billion-climate-smart-commodities-expanding-markets

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Partners interested in supporting bold NWL sequestration goals

Carbon Cycle Institute

CALIFORNIA ENVIRONMENTAL VOTERS
FORMERLY CLCV

The Nature Conservancy

CIVICWELL

CALIFORNIA ASSOCIATION OF RESOURCE CONSERVATION DISTRICTS

ENVIRONMENT CALIFORNIA
ENVIRONMENT CALIFORNIA
Clean air. Clean water. Open spaces.

SEQUOIA Riverlands Trust
SERVING LAND and PEOPLE

Point Blue Conservation Science

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The California Natural and Working Lands Resilience Act of 2022

Natural carbon removal on rural and urban lands => benefits our climate, health, water, food, environment and economy

Thank you!

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