

Natural carbon sequestration on working and urban lands: Benefits for our climate, health, water, food, biodiversity, economy & more

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"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/iul/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-iournals-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



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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/

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://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/



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/wpcontent/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: <u>10.1038/s41893-020-00646-7</u> https://www.accuweather.com/en/weather-news/california-wildfires-will-cost-tens-of-billions-accuweather-estimates/612548 Political Economy Research Institute <u>https://www.peri.umass.edu/images/CA-EconRecProgram-6-12-20_Final.pdf</u> World Resources Institute <u>https://www.wri.org/blog/2020/07/economic-benefits-climate-action-us</u>



"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

PATHWAYS SECTOR SUMMARY AND NET GHG EMISSIONS



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

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



SETTING AN AMBITIOUS SEQUESTRATION GOAL FOR CALIFORNIA'S WORKING LANDS:

ANALYSIS AND RECOMMENDATIONS FOR NET-NEGATIVE EMISSIONS BY 2030 Report quantifies maximum sequestration potential of CA working and urban lands by 2030

Does not include additional sequestration potential from natural lands, forests, montane and coastal wetlands, and nearshore habitat

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)



www.theclimatecenter.org/working-lands

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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

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- ✓ Biodiversity
- ✓ Jobs

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



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

Practice	Annual Acreage (new)*	Rate (MT CO ₂ e/ac/yr)	Annual MT CO ₂ e (new acres)	2030 Acreage Total	Cumulative 2021-2030 (MMT CO ₂ e)	2030 Annual Rate (MMT CO ₂ e)
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)

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

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



Carbon Capture, Utilization and Storage (CCS/CCUS): to remove CO₂ from

power plants and industrial processes, placing the CO₂ 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 CO₂

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



Carbon farming on working & urban lands potential for carbon removal at scale 20+ m acres = ~100 MMT/year CO2e by 2030



Carbon Cycle Institute

CONSERVATION DISTRICT





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

Partners interested in supporting bold NWL sequestration goals

Carbon Cycle Institute





CENTRAL CALIFORNIA ENVIRONMENTAL JUSTICE NETWORK



CALIFORNIA ASSOCIATION OF **RESOURCE** CONSERVATION DISTRICTS













The California Natural and Working Lands Resilience Act of 2022 (or other name?)

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

Asm. C. Garcia, Author; Asm. M. Stone, Co-Author;



Thank you!





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)





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



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



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





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."



Carbon Capture, Utilization and Storage (CCUS or CCS)

to remove CO₂ 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- 1846177778 .lan 2022	closed-
https://foe.scot/wp-content/uploads/2021/01/CCS-Research-Sumr	narv-
Briefing.pdf Jan 2021	
https://iopscience.iop.org/article/10.1088/1748-9326/abd19e/meta	L
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-	
<u>australia-facility</u>	
https://theclimateconnection.org/carbon-capture-and-storage-pros	-cons/
https://www.treehugger.com/carbon-capture-and-storage-ccs-pros	the
<u>cons-5120005</u>	climat
https://www.iea.org/reports/direct-air-capture	cente

Direct Air Capture (DAC)

new technology to extract past CO₂ pollution from the atmosphere



Credit: Climeworks.

- <u>https://www.rechargenews.com/energy-transition/the-amount-ofenergy-required-by-direct-air-carbon-capture-proves-it-is-anexercise-in-futility/2-1-1067588</u>
- https://www.reuters.com/business/cop/global-carbon-emissionsrebound-near-pre-pandemic-levels-2021-11-04/
- <u>https://www.greenbiz.com/article/direct-air-capture-ready-its-closeup</u>
- www.carbon180.org
- Direct Air Capture fact sheet (Carbon 180): https://static1.squarespace.com/static/5b9362d89d5abb8c51d474f8/t /6193e4c60dc10420edc0f5cd/1637698407681/Carbon180+Ed+Pack et+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 <u>2050</u>
- 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

