

California's Offset Program – Outcomes to Date & the Need for Reform

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California Environmental Justice Advisory Committee

Sacramento, presented over Zoom

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Summary of Presentation – 2 parts

I. California's offset program

- How it works
- Most credits likely do not represent real emissions reductions
- 2025 cap-and-trade extension bills create opportunities for improvements by mandating regulatory action

II. DEBS mandate (Direct Environmental Benefits in the State)

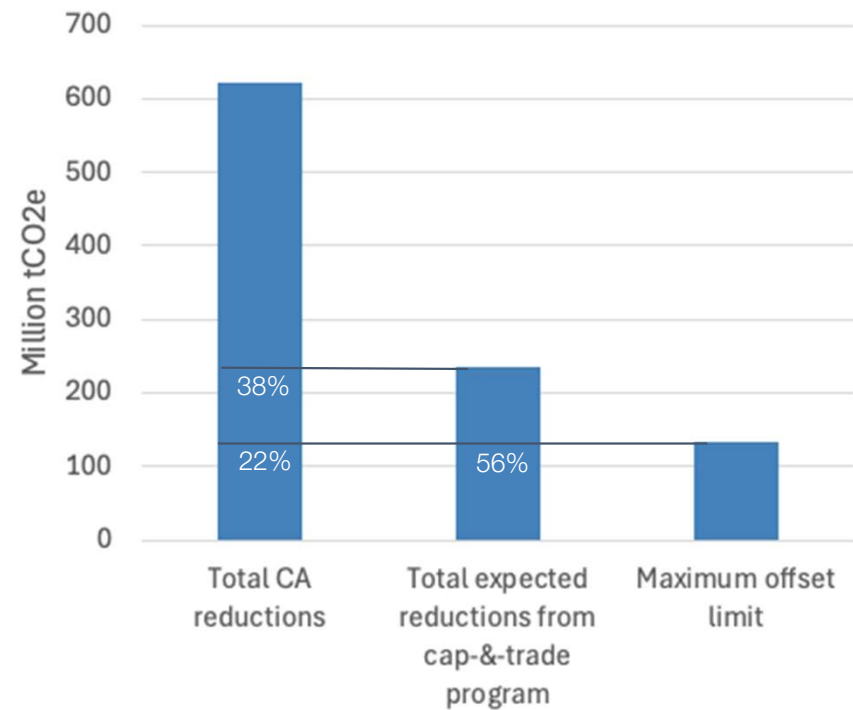
- What are DEBS
- 2/3 of credits use are from out-of-state projects
- 1/3 of DEBS credits used are from out-of-state projects with little in-state benefit

California's offset program

California allows emitters covered under the states cap-and-trade program to purchase offsets instead of reducing their emissions, up to:

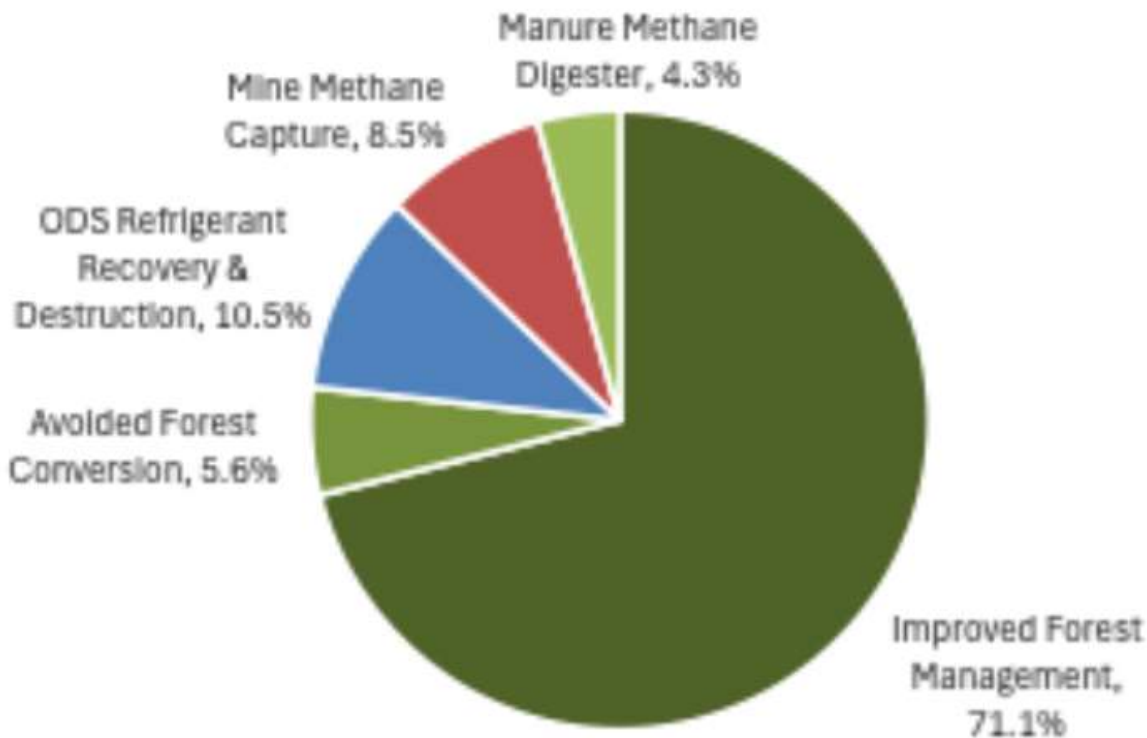
- 4% of their emissions 2021-25
- 6% of their emissions 2026-30

Total Expected Reductions in CA 2021-30



Source: CARB 2017 Climate Change Scoping Plan

Eligible project types and issuances to date



Total: 258 million credits

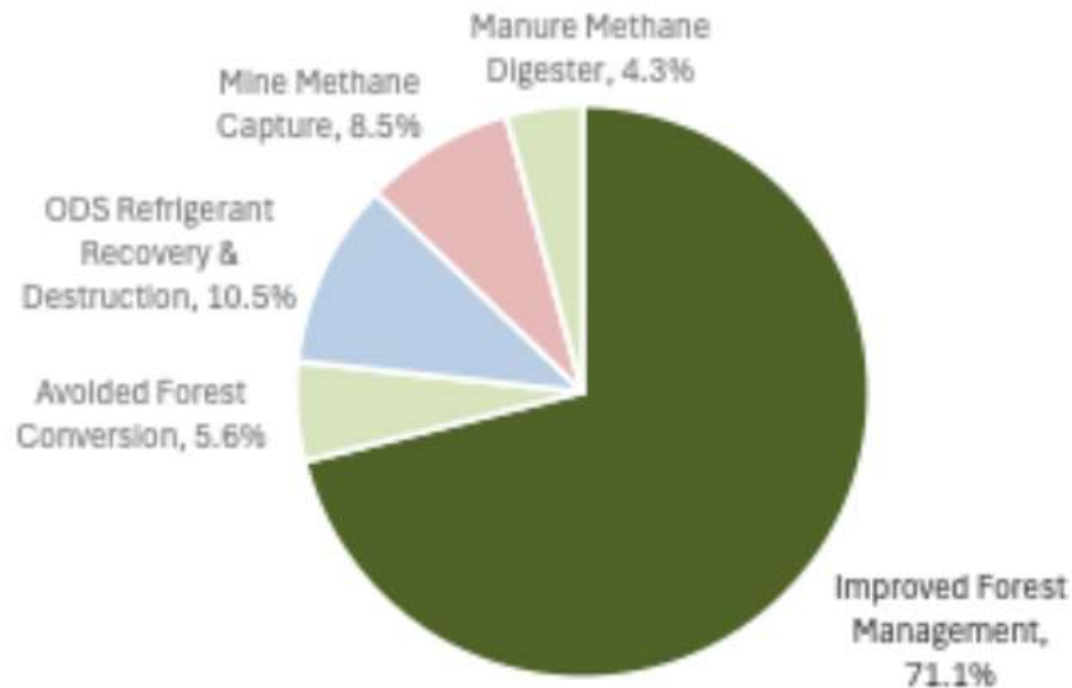
Source: Voluntary Registry Offsets Database, v2025-08
<https://gspp.berkeley.edu/berkeley-carbon-trading-project/offsets-database>

Projects can be anywhere in the United States.

Other eligible project types have had no credits issued:

- Urban forestry
- Rice cultivation
- Reforestation

Improved forest management projects



Total: 258 million credits

Source: Voluntary Registry Offsets Database, v2025-08
<https://gspp.berkeley.edu/berkeley-carbon-trading-project/offsets-database>

Sources of over-crediting from improved forest management projects

- Baselines

Stapp, J... Haya, BK et al. (2023) *Nature Communications Earth & Environment*. <https://www.nature.com/articles/s43247-023-00984-2>

Coffield, SR, et al. (2022) *Global Change Biology*.
<https://doi.org/10.1111/gcb.16380>

Badgley, G... Haya, B, et al. (2021) *Global Change Biology*.
<https://doi.org/10.1111/gcb.15943>

- Leakage

Haya, B (2019) University of California, Berkeley working paper.
https://gspp.berkeley.edu/assets/uploads/research/pdf/Policy_Brief-US_Forest_Projects-Leakage-Haya_4.pdf

- Durability

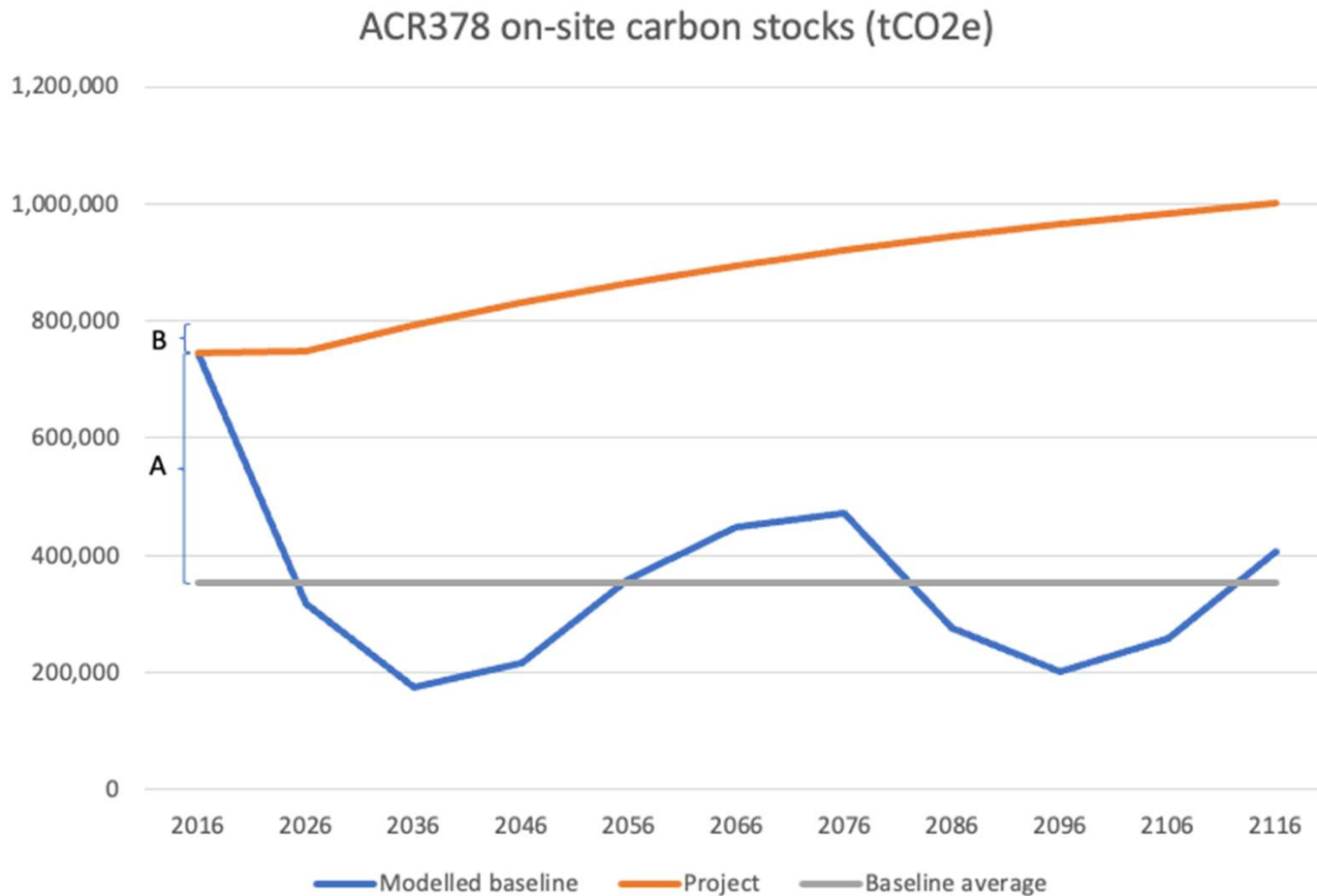
Badgley, G, et al. (2022) *Frontiers in Forests and Global Change*.
<https://doi.org/10.3389/ffgc.2022.930426>

Anderegg, WR, et al. (2020). Climate-driven risks to the climate mitigation potential of forests. *Science*, 368(6497).
<https://www.science.org/doi/10.1126/science.aaz7005>

- Perverse incentives to increase carbon on over-stocked lands

Herbert, C, Haya, BK, et al. (2022) *Frontiers in Forests and Global Change*. <https://doi.org/10.3389/ffgc.2022.957189>

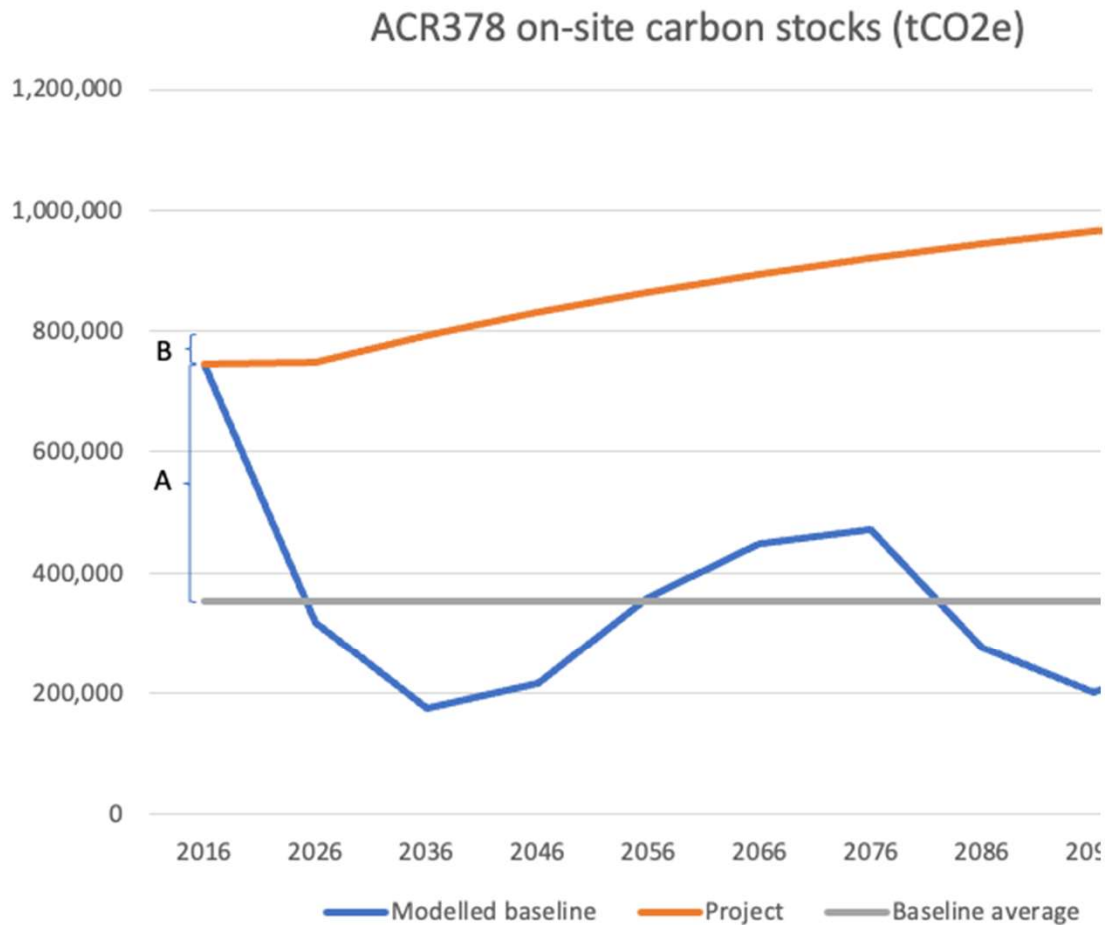
Baselines: What would likely have happened without offsets?



The baseline set by ACR378 is typical:

substantially below initial carbon stocks, and close to the minimum allowed, maximizing credits generated

Baselines: What would likely have happened without offsets?



Received: 4 June 2021 | Accepted: 7 October 2021
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Global Change Biology WILEY

PRIMARY RESEARCH ARTICLE

Systematic over-crediting in California's forest carbon offsets program

Grayson Badgley^{1,2} | Jeremy Freeman³ | Joseph J. Hamman^{3,4} | Barbara Haya⁵ | Anna T. Trugman⁶ | William R. L. Anderegg⁷ | Danny Cullenward^{3,8}

Received: 20 January 2022 | Revised: 6 June 2022 | Accepted: 20 July 2022
DOI: 10.1111/gcb.16380

Global Change Biology WILEY

RESEARCH ARTICLE

Using remote sensing to quantify the additional climate benefits of California forest carbon offset projects

Shane R. Coffield¹ | Cassandra D. Vo¹ | Jonathan A. Wang¹ | Grayson Badgley^{2,3} | Michael L. Goulden^{1,4} | Danny Cullenward^{3,5} | William R. L. Anderegg⁶ | James T. Randerson¹

communications
earth & environment

ARTICLE

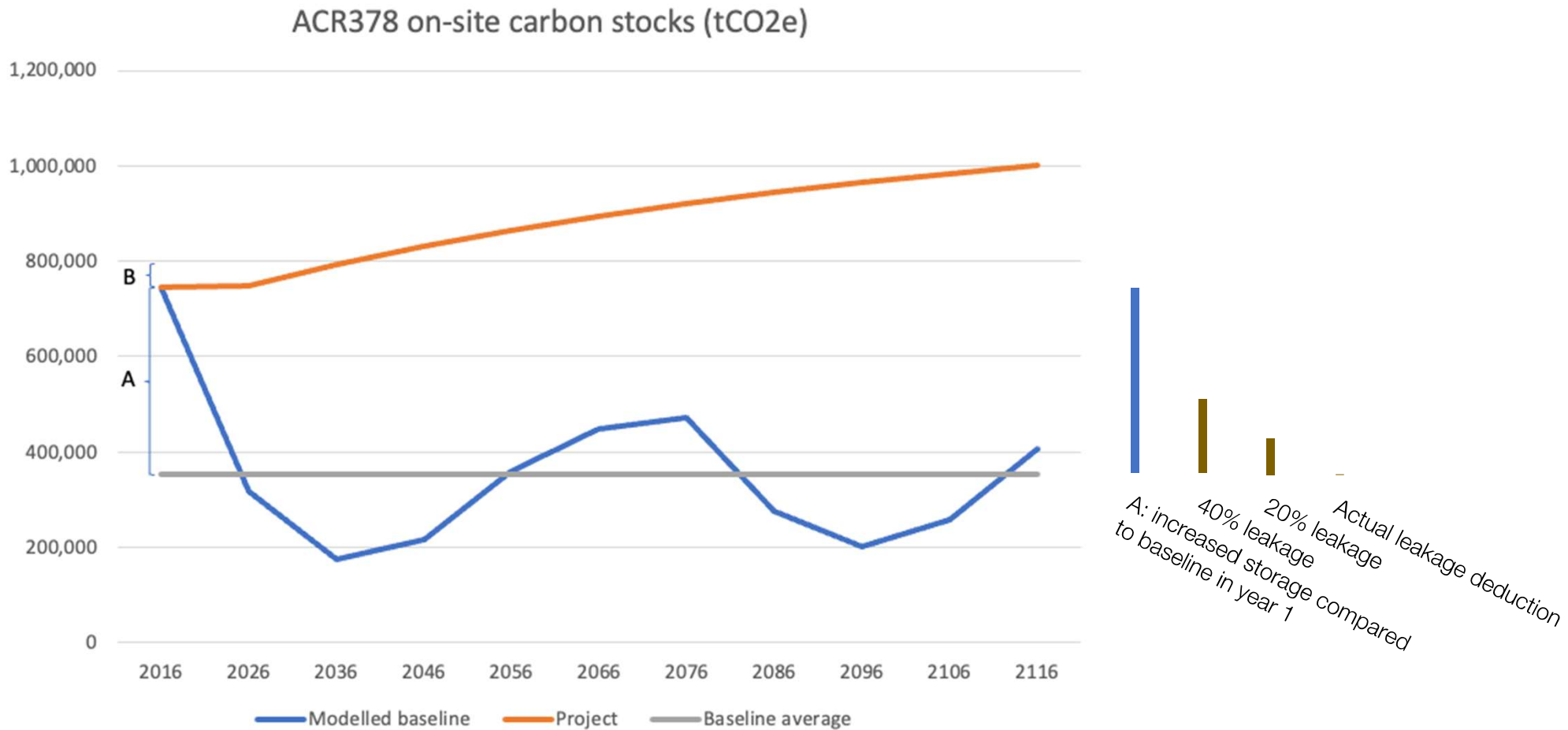
<https://doi.org/10.1038/s43247-023-00984-2> OPEN

Check for updates

Little evidence of management change in California's forest offset program

Jared Stapp^{1,2*}, Christoph Nolte², Matthew Potts¹, Matthias Baumann³, Barbara K. Haya⁴ & Van Butsic¹

Leakage: Emissions from displacing harvesting to meet demand



Leakage: Emissions from displacing harvesting to meet demand

POLICY BRIEF: The California Air Resources Board's U.S. Forest offset protocol underestimates leakage

May 7, 2019
 Barbara Haya, PhD, Research Fellow, Center for Environmental Public Policy, University of California, Berkeley,
 bhaya@berkeley.edu

SUMMARY

Analysis of projects Board's (ARB) U.S. true emissions redu Forest protocol has total quantity of em tons of CO₂, which during 2021 to 203

Leakage, in the con causes an increase accounts for leakaj

First, the protocol studies of leakage Wear & Murray 21

Second and more site carbon storag improved forest r the first year of tl physically incons

of giving credit but assumes harvesting would be sp... reducing credits to account for leakage. As a result, most forest offset projects begin in greenhouse gas debt; project landowners generate offset credits that allow emitters in California to emit more than the state's emissions cap today, in exchange for promises that their lands will continue to increase their storage of carbon over 100 years.

... whether the protocol requires forestland owners to increase carbon stocks to ... forestland owners are

Actual emissions reductions by U.S. Forest offset projects as percent of credits issued to date

| | | Expected over 100 years (ARB's current approach) | Achieved to date (Recommended approach) |
|------------------------------|-----|---|--|
| | 20% | 100% | 65% |
| If the true leakage rate is: | 40% | 99% | 49% |
| | 60% | 97% | 33% |
| | 80% | 96% | 18% |

<https://gspp.berkeley.edu/faculty-and-impact/working-papers/policy-brief-arbas-us-forest-projects-offset-protocol-underestimates-leaka>

California's forest offset protocol

Four quality issues:

- Baselines / additionality
- Leakage accounting
- Durability
- Perverse incentives

RESEARCH

REVIEW SUMMARY

FOREST AND CLIMATE

Climate-driven risks to the climate mitigation potential of forests

William R. L. Anderegg*, Anna T. Trugman, Grayson Badgley, Christa M. Anderson, Ann Bartuska, Philippe Gais, Danny Cullenward, Christopher B. Field, Jeremy Freeman, Scott J. Goetz, Jeffrey A. Hicke, Deborah Huntzinger, Robert B. Jackson, John Nickerson, Stephen Pacala, James T. Randerson

BACKGROUND: Forests have considerable potential to help mitigate human-caused climate change and provide society with a broad range of cobenefits. Local, national, and international efforts have developed policies and economic incentives to protect and enhance forest carbon sinks—ranging from the Bonn Challenge to restore deforested areas to the development of forest carbon offset projects around the world. However, these policies do not always account for important ecological and climate-related risks and limits to forest stability (i.e., permanence). Widespread climate-induced forest die-off has been observed in forests globally and creates a dangerous carbon cycle feedback, both by releasing large amounts of carbon stored in forest ecosystems to the atmosphere and by reducing the size of the future forest carbon sink. Climate-driven risks may fundamentally compromise forest carbon stocks and sinks in the 21st century. Understanding and quantifying climate-driven risks to forest stability are crucial components needed to forecast the integrity of forest carbon sinks and the extent to which they can contribute toward the Paris Agreement goal to limit warming well below 2°C. Thus, rigorous scientific assessment of the risks and limitations to widespread deployment of forests as natural climate solutions is urgently needed.

ADVANCES: Many forest-based natural climate solutions do not yet rely on the best available scientific information and ecological tools to assess the risks to

undermine the effectiveness of climate solutions. Here, we synthesize current understanding of the climate risks to forest carbon sinks and highlight key findings that may compromise the effectiveness of climate solutions. We lay out

OUTLOOK: The scientific community agrees that forests can contribute to global efforts to mitigate human-caused climate change. The com-

frontiers | Frontiers in Forests and Global Change

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California's forest carbon offsets buffer pool is severely undercapitalized

Grayson Badgley^{1*}, Freya Chay¹, Oriana S. Chegwidzen¹, Joseph J. Hamman^{1,2}, Jeremy Freeman¹ and Danny Cullenward^{1,3*}

¹CarbonPlan, San Francisco, CA, United States, ²National Center for Atmospheric Research, Boulder, CO, United States, ³Institute for Carbon Removal Law and Policy, American University, Washington, DC, United States

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Forests as natural climate solutions and underappreciated

Climate stress

Human disturbance

Effective use of forests as natural climate solutions on accounting for climate-driven drought. Leveraging cutting-edge climate solutions, both in estimating and in estimating the risks to forest

California's forest offset protocol

Four quality issues:

- Baselines / additionality
- Leakage accounting
- Durability
- Perverse incentives

 Frontiers | Frontiers in Forests and Global Change

TYPE Original Research
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Managing nature-based solutions in fire-prone ecosystems: Competing management objectives in California forests evaluated at a landscape scale

Claudia Herbert^{1*}, Barbara K. Haya², Scott L. Stephens¹ and Van Butsic¹

¹Department of Environmental Science, Policy, and Management, University of California, Berkeley, Berkeley, CA, United States, ²Goldman School of Public Policy, University of California, Berkeley, Berkeley, CA, United States

California's cap-and-trade compliance offset market incentivizes forest managers to maintain elevated carbon stocks. It provides these incentives without enforcing standardized fire mitigation practices despite many projects being located in fire prone regions. Here, we evaluated the difference between management actions in California forests that participated in the carbon offset market versus those that engaged with state programs to reduce wildfire risk via fuel reduction treatments. Using remotely sensed data from the California Forest Observatory and the Moderate Resolution Imaging Spectroradiometer, we compared the vertical forest structure and vegetation canopy trends on forest offsets with forests that are receiving fuel treatment. We found California forests managed for carbon under the Improved Forest Management (IFM) program by the California Air Resources Board had higher levels of biomass than forests managed for fire risk reduction as indicated by 2016 lidar-estimated fuel loads. In addition, IFM-participating forests did not reduce their fuel loads between 2016 and 2020, whereas lands receiving grants for fuel management did, indicating that on average, the IFM projects were not engaging in fuel reduction efforts. However, despite the differences in fuel management between IFM projects and active fuel treatments, we found that both types of management saw a declining trend in vegetation greenness between 2015 and 2021. While declining greenness is expected of active fuel treatments associated with vegetation removal, such a trend in the case of IFM indicates additional wildfire risk. Managing forests for both

Why has offset quality been so poor across all major offset programs to date?

- Ensuring offset quality is challenging, due to:
 - high levels of uncertainty & complexity
 - asymmetric information
 - aligned interest (credit buyers and sellers both benefit financially from excess credits)
 - adverse selection

Cap-and-trade extension bill – AB 1207

- Offset limit of 6% of emissions extended to 2045
- 50% DEBS requirement extended to 2045
- Offsets will be under the cap starting in 2031 (like they are in Washington state)
 - Poor offset quality will no longer weaken the cap (but it will waste money)
 - Offsets will play a much smaller role in cost containment
- CARB shall develop approaches to increase offset projects in the state
- CARB shall consider developing additional compliance offset protocols to address sectors not covered by the cap-and-trade program

Cap-and-trade extension bill – SB 840

- By December 31, 2026 CARB shall conduct a study on:
 - The contribution of offset project to progress towards California’s climate goal
 - Evaluation of the potential for changes to the definition of “direct environmental benefits in the state”
 - Recommendations on how instate offset projects could be more attractive for development
 - Recommendations for alternative valuation methodologies or criteria for instate offset projects, particularly regarding natural and working lands
- No later than January 1, 2029, the state board shall update all existing compliance offset protocols to ensure that they reflect best available science
- Thereafter evaluations every 5 years against best available science

Cap-and-trade extension bill – SB 840

- By December 31, 2026 CARB shall conduct a study on:
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 - **Recommendations for alternative valuation methodologies or criteria for in-state offset projects, particularly regarding natural and working lands**
- **No later than January 1, 2029, the state board shall update all existing compliance offset protocols to ensure that they reflect best available science**
- Evaluation repeated every five years thereafter

Summary of Presentation – 2 parts

I. California's offset program

- How it works
- Most credits likely do not represent real emissions reductions
- 2025 cap-and-trade extension bills create opportunities for improvements by mandating regulatory action

II. DEBS mandate (Direct Environmental Benefits in the State)

- What are DEBS
- 2/3 of credits use are from out-of-state projects
- 1/3 of DEBS credits used are from out-of-state projects with little in-state benefit

DEBS – Direct Environmental Benefits in the State

AB398, 2017 cap-and-trade extension bill, starting in 2021:

- At least half of all offset credits surrendered must have DEBS.

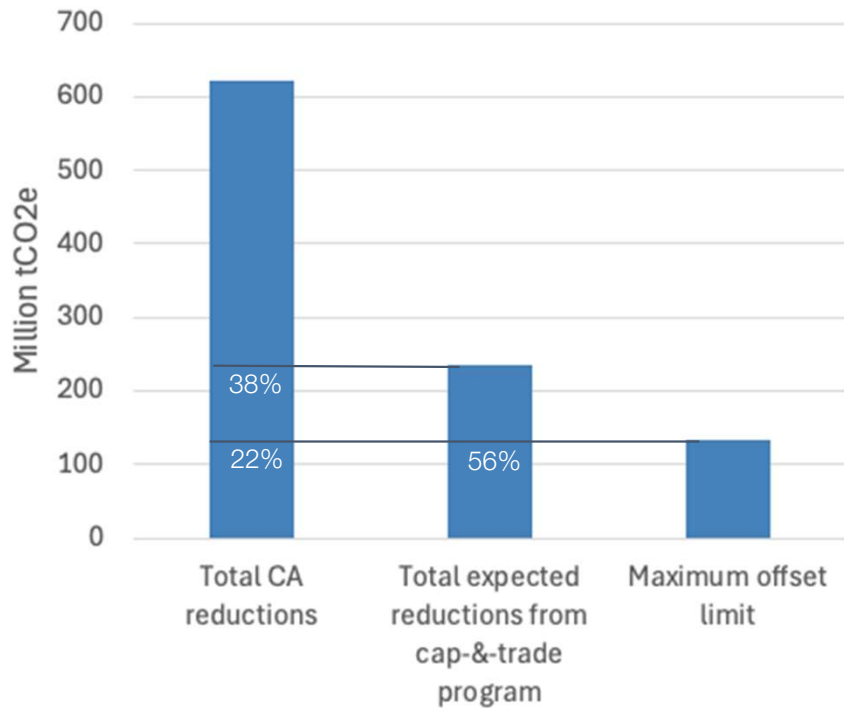
“direct environmental benefits in the state” are the reduction or avoidance of emissions of any air pollutant in the state or the reduction or avoidance of any pollutant that could have an adverse impact on waters of the state.”

Section 95989 of the cap-and-trade regulation:

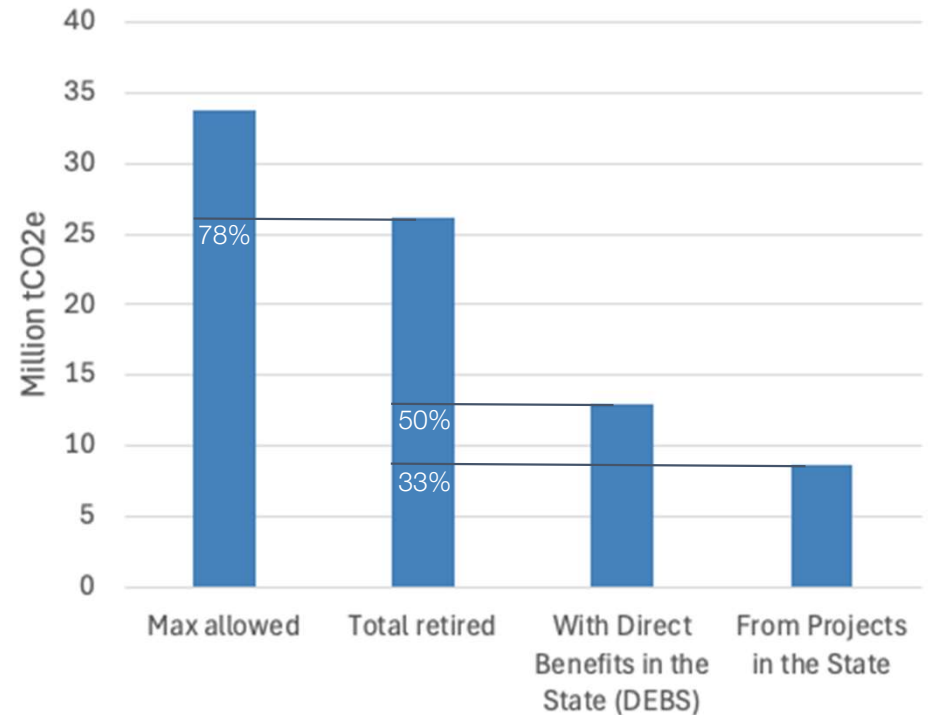
“offset projects that are located within, or that avoid GHG emissions within, the State of California are automatically considered to provide direct environmental benefits in the State.”

California's offset program is large

Total Expected Reductions in CA 2021-30



Total CARB Offset Credits Used 2021-23



Source: CARB 2017 Climate Change Scoping Plan

Source: The Fourth Compliance Period (CP4) Compliance Detail Report for CARB's Cap-and-Trade Program

Out of state refrigerant (ODS) offsets

- All are considered to have DEBS, because all have some refrigerants sourced from in the state
- On average, only 1 in 10 sources are from California

Cap-and-trade extension bill – SB 840

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Resources

- Summary of literature on CA's forest protocol:
<https://gspp.berkeley.edu/berkeley-carbon-trading-project/repository-of-articles#IFM>
- California EMAC report with summary of literature on California's offset program:
<https://calepa.ca.gov/wp-content/uploads/2025/02/2024-ANNUAL-REPORT-OF-THE-IEMAC-final.pdf> (Chapter 7)
- My email: bhaya@berkeley.edu