Forests and carbon offsetting: the need for direct measurements

California air resources board forest carbon protocol invalidates offsets

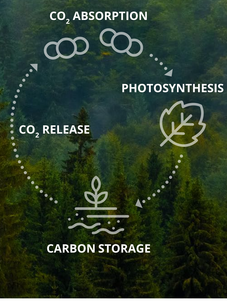
HOW FORESTS STORE CARBON

Forests store carbon – as one the Earth's free and natural CO_2 absorbing services.

Forests absorb CO_2 through photosynthesis - and the carbon is stored mostly in vegetation and soils.

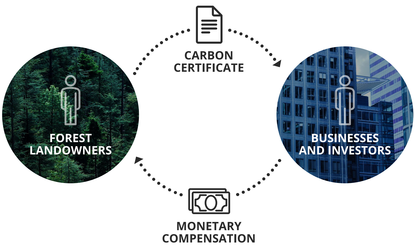
Forests also release CO_2 through ecosystem respiration - the "breathing" of all plants, animals and soils, and via forest fires.

Ongoing deforestation threatens forests as sinks for CO_2, in part, because forest carbon markets are uncertain. This creates urgency to support carbon markets and expand restoration.



FORESTS AS INVESTMENTS IN THE CARBON OFFSET MARKET

One way to restore and conserve forests is to **make them part of financial markets**. In the carbon offset market, forest landowners can sell carbon storage certificates, or credits, to investors who need to offset their greenhouse gas emissions.



OUR STUDY

A requirement for the forest carbon financial system to work is an accurate direct measurement of net stored carbon. The State of California and the Climate Action Reserve (CARB-CAR) use a forest carbon protocol based on limited biometric measurement and growth simulation models; actual CO_2 (photosynthesis, respiration) is not measured.

In our study, **we compared the CARB-CAR protocol with direct measurement of CO_2 flux**, called Eddy Covariance (EC). EC integrates fluxes of photosynthesis and respiration resulting in Net Ecosystem Exchange, or NEE, and a complete accounting of forest carbon.

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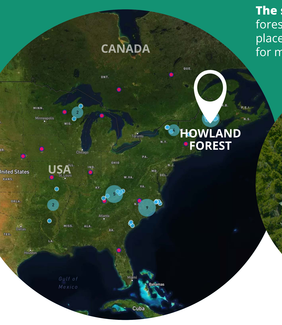
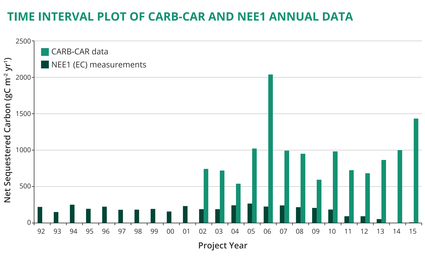
The study included the Howland forest in Maine (USA) – the only place where both methods are used for measuring net carbon storage.



MEASURING VS. MODELLING

We found **large statistical differences that do not reflect natural forest systems for CARB-CAR versus EC** for the Howland Forest and for populations of both methods. Overlapping time intervals showed that CARB-CAR resulted in excess stored carbon compared to NEE data.

TIME INTERVAL PLOT OF CARB-CAR AND NEE1 ANNUAL DATA



One of the reasons for these differences is that the CARB-CAR protocol **does not include CO_2 release through soil and ecosystem respiration**, inconsistent with available NEE data and a criterion for invalidation.

THE FUTURE OF FORESTS

All claims of greenhouse gas emission reduction must be validated by direct measurements. If this is not done, public trust and integrity of emission reduction products will be compromised.

If **nations and policies** (Paris Agreement, REDD+) **adopt and share standardized methodologies** of measuring forest carbon storage (similar to how it was done for the Montreal Protocol on ozone depletion) we can save the forests.

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