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Carbon Dew

Innovations in Climate Resilience Conference
Columbus, OH, USA; 30 March 2023

Contact: smetzger@battelleecology.org

Web: www.carbondew.org

Direct Greenhouse Gas Exchange Measurements for Equitable Worldwide Emissions Trading

WIRED

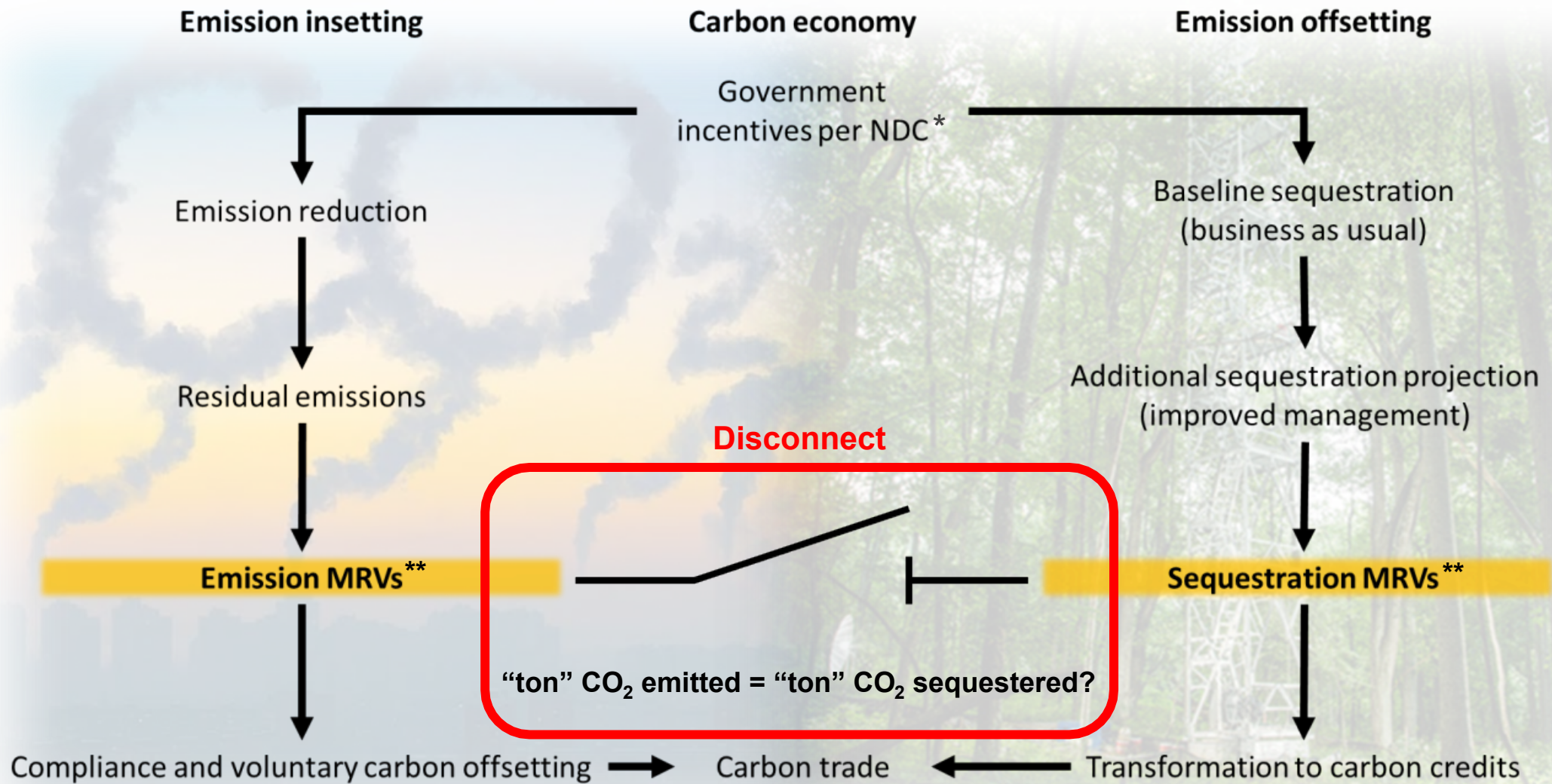
Saving Net Zero

The Climate Enforcers:

How scientists, activists and lawyers
are keeping the world on track

*"... bridge the
knowledge gap between
what we can say
scientifically and what
has so far been used in
terms of evidence ..."*

Status quo: market-based decarbonization with discipline-specific MRVs**

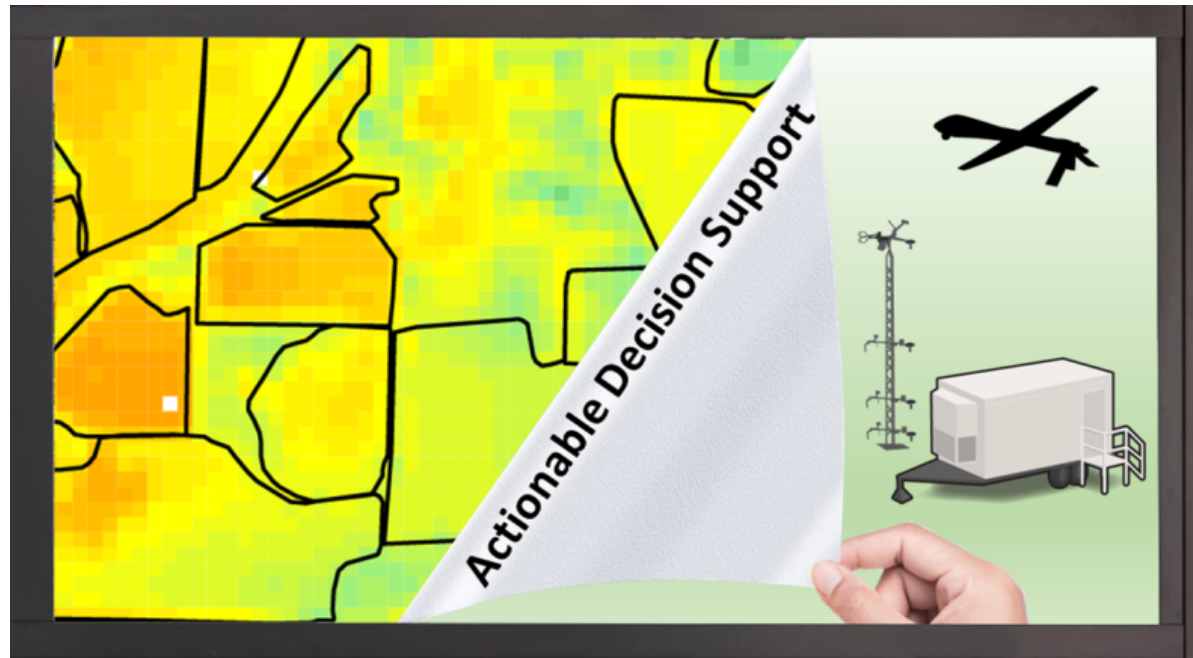


* NDC = Nationally Determined Contribution: US 50-52 percent below 2005 levels in 2030“ (UNFCCC, 2021-04-21)

** MRV = Measurement, Reporting and Verification

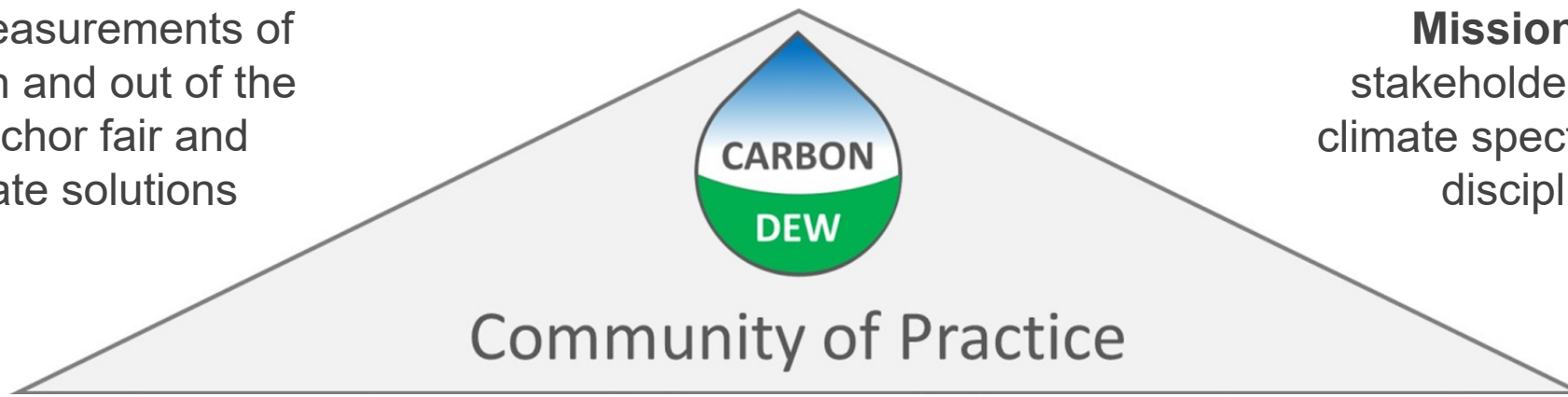
North American Carbon Program (NACP) Workshop on Carbon Dioxide Removal (CDR)

- Explore dialogue among academia and industry
 - From high-tech potpourri ...
 - ... via inter/discipline-aware integration of multi-scale observations ...
 - ... to simple yet rich, attributable and interoperable data presentations in units relevant to CDR.
- Applications and beneficiaries
 - Public awareness, support, ownership, e.g., GHG “weather app”
 - CDR industry and economy, e.g., protocol integrity via traveling standards, gold datasets
 - CDR regulation, e.g., improved emission factors



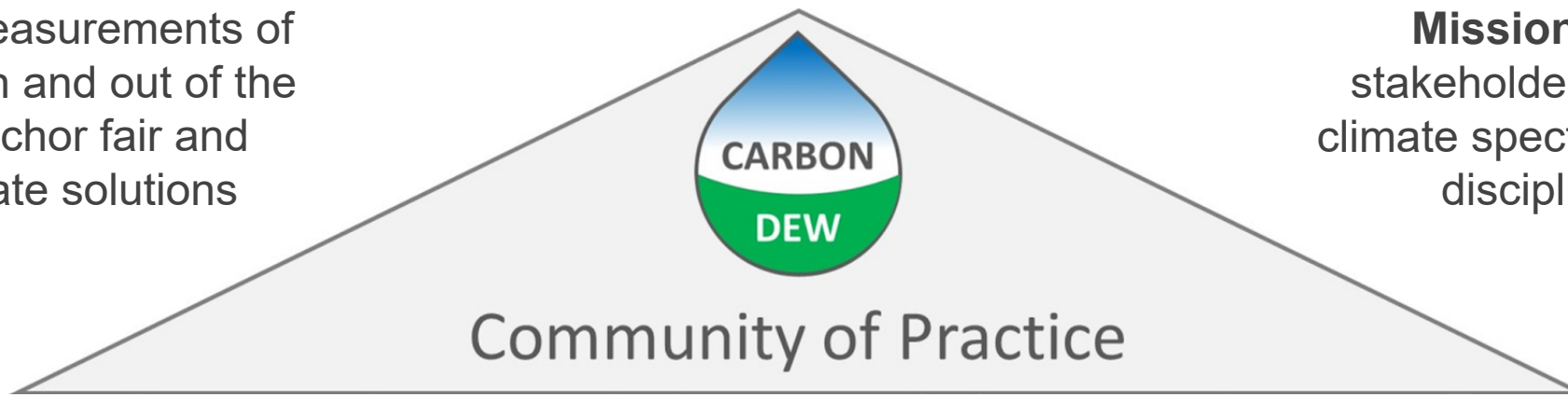
Vision: Direct measurements of GHG exchange in and out of the atmosphere anchor fair and equitable climate solutions

Mission: Bring together stakeholders across the entire climate spectrum to unlock cross-disciplinary expertise



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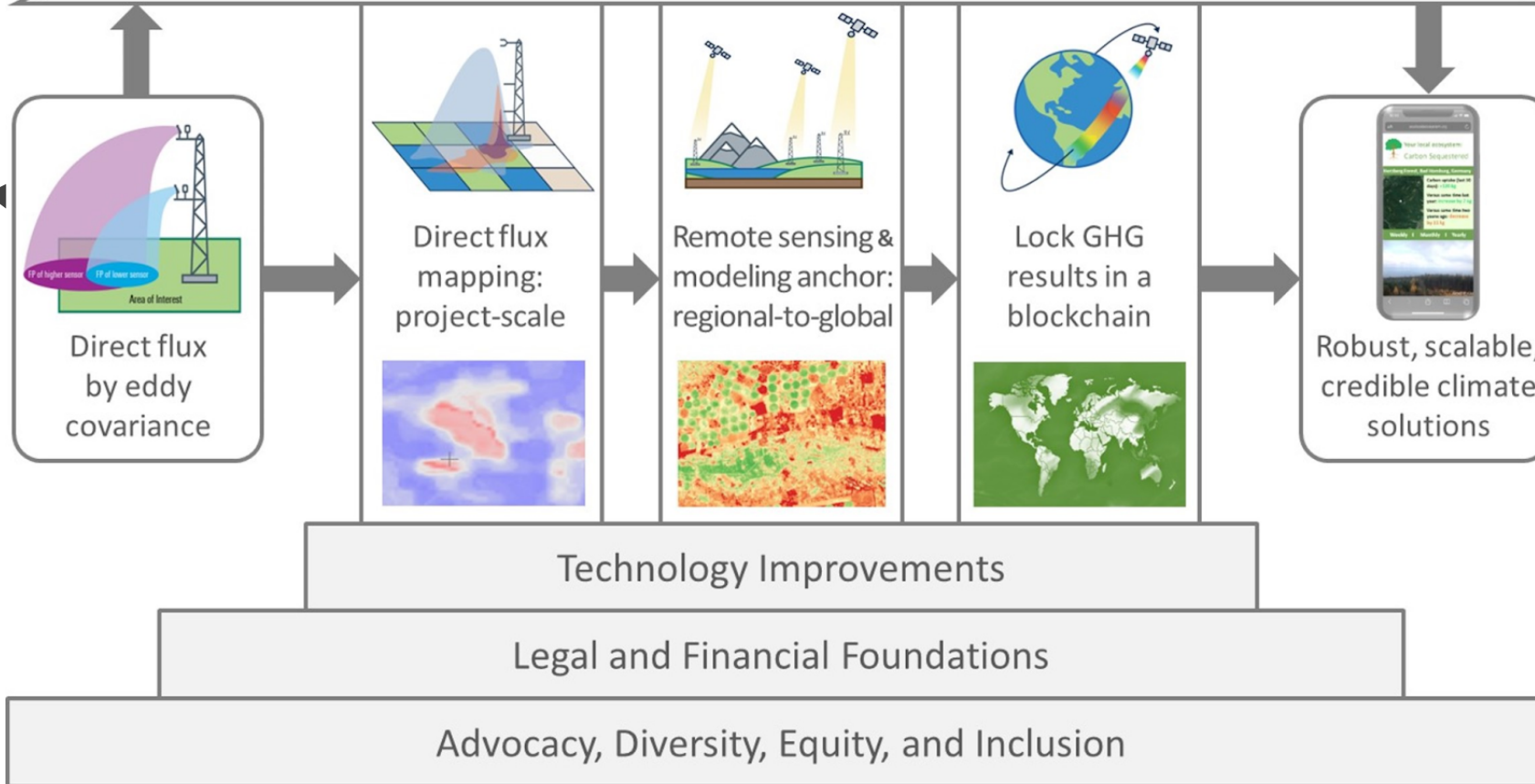


Vision: Direct measurements of GHG exchange in and out of the atmosphere anchor fair and equitable climate solutions

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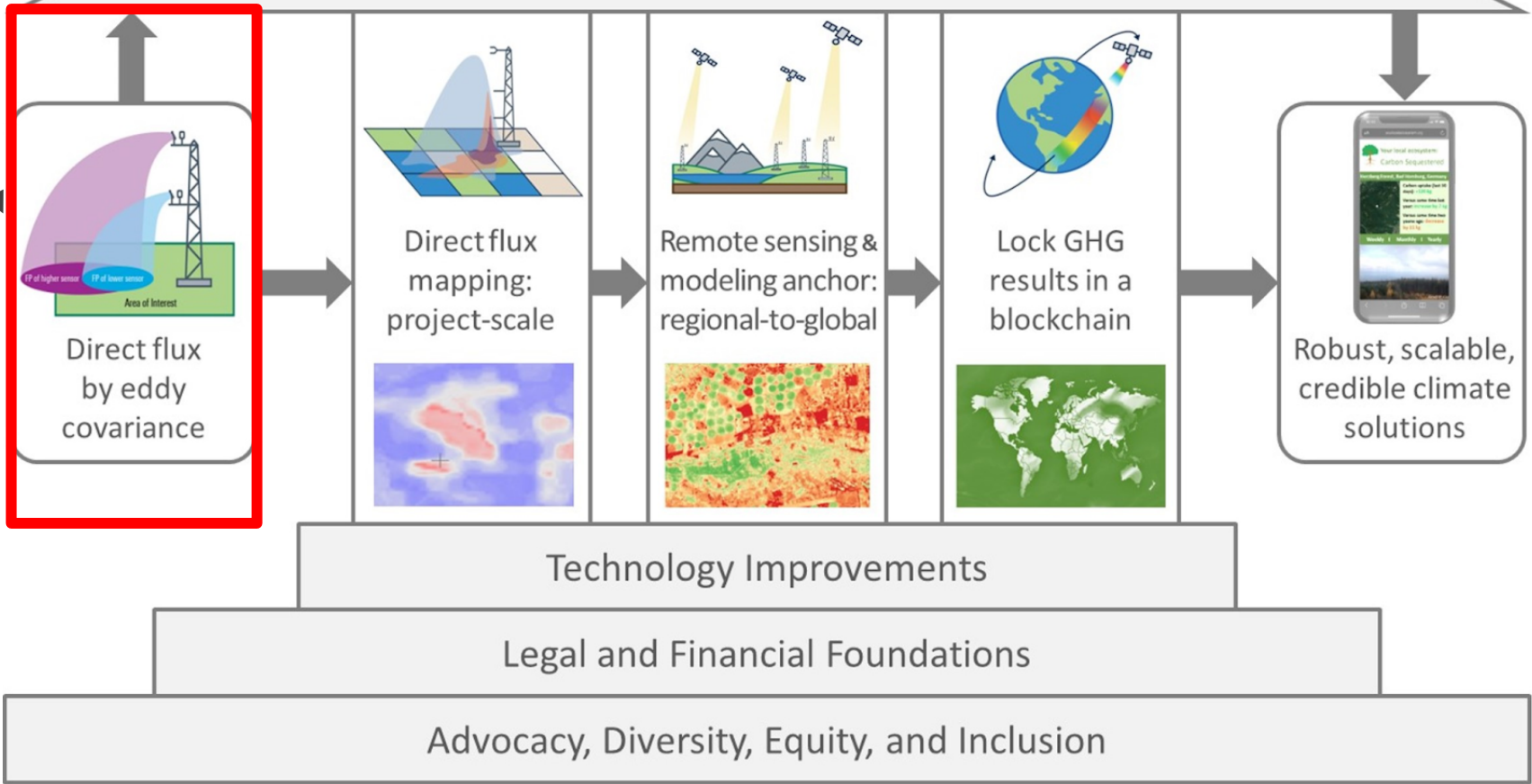
Community of Practice



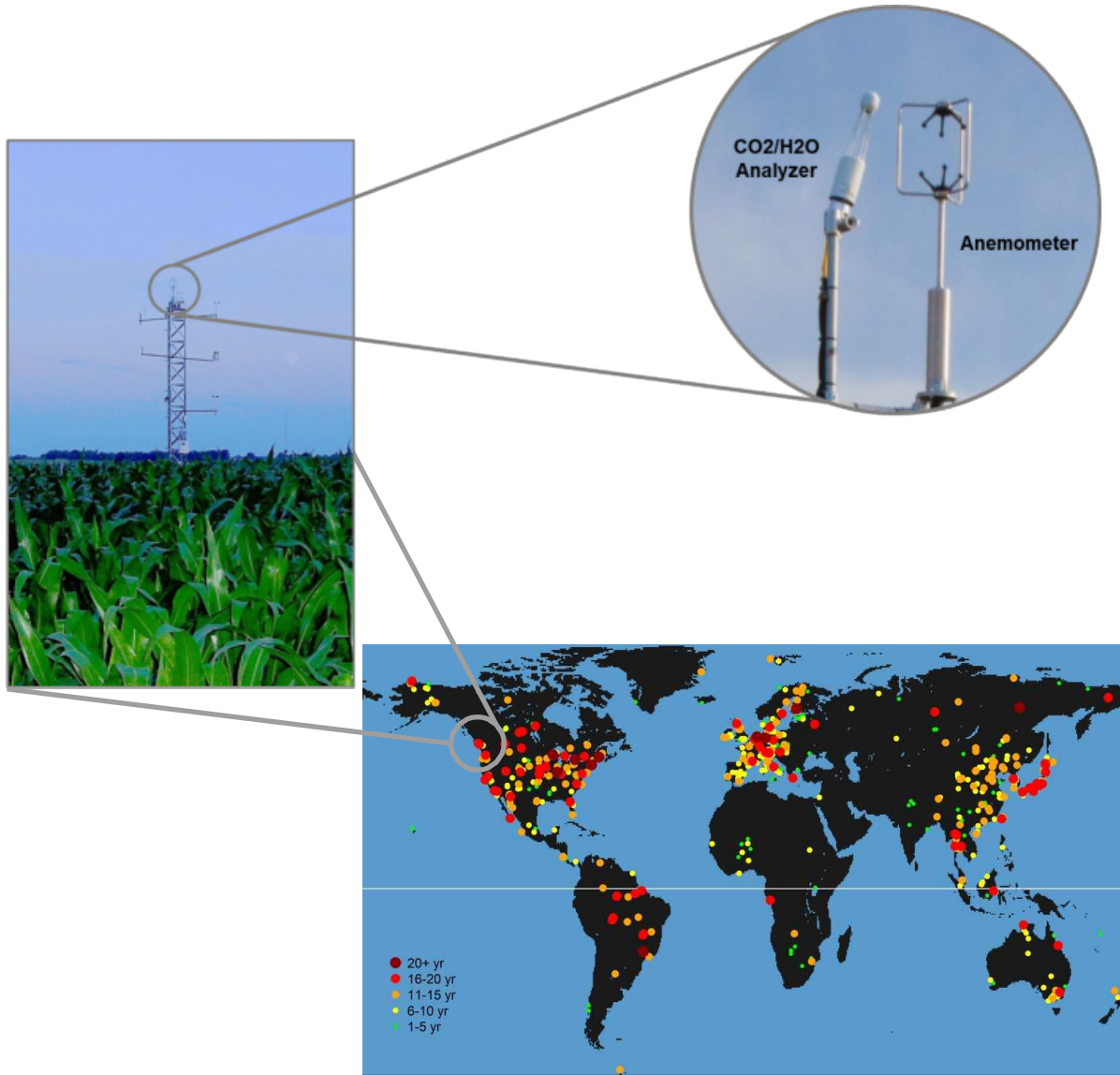
Direct GHG exchange measurements unlock climate solutions potential



Community of Practice

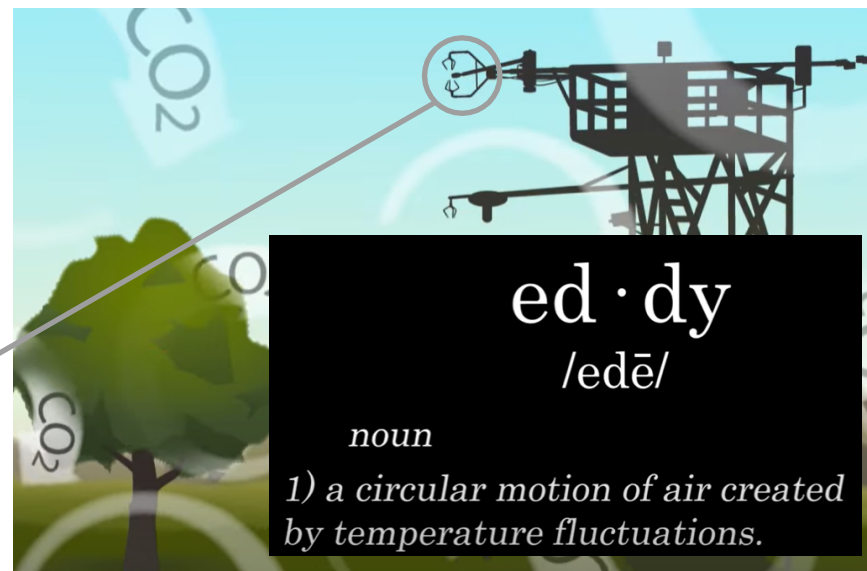
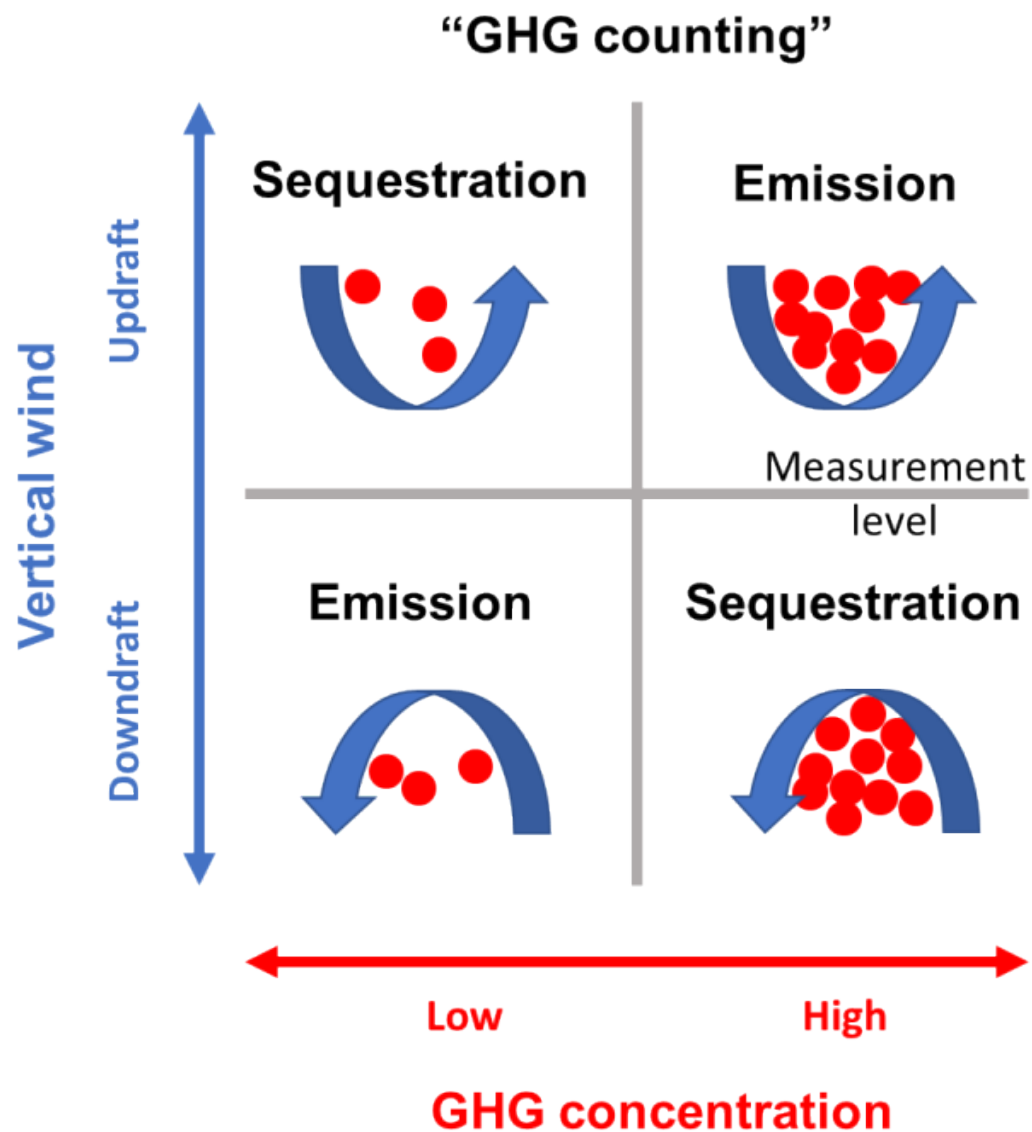


Eddy-covariance measurement



- Measures atmosphere 20 times per second
- Sonic anemometer measures wind
- Gas analyzers measure GHGs
- Mounted side-by-side on a mast (“flux tower”), aircraft, vessel, buoy etc.
- Operational flux towers: 47 NEON, 100s across Americas (“AmeriFlux”), 1,000s worldwide (“FLUXNET”)

Eddy-covariance data interpretation



Eddy-covariance strength: Impartiality, high-integrity GHG certificates

DAC + CCUS

*Industry Emission
Reduction*

*Climate-Smart
Agriculture, Forestry*

Oil and Gas

Biochar

EMW

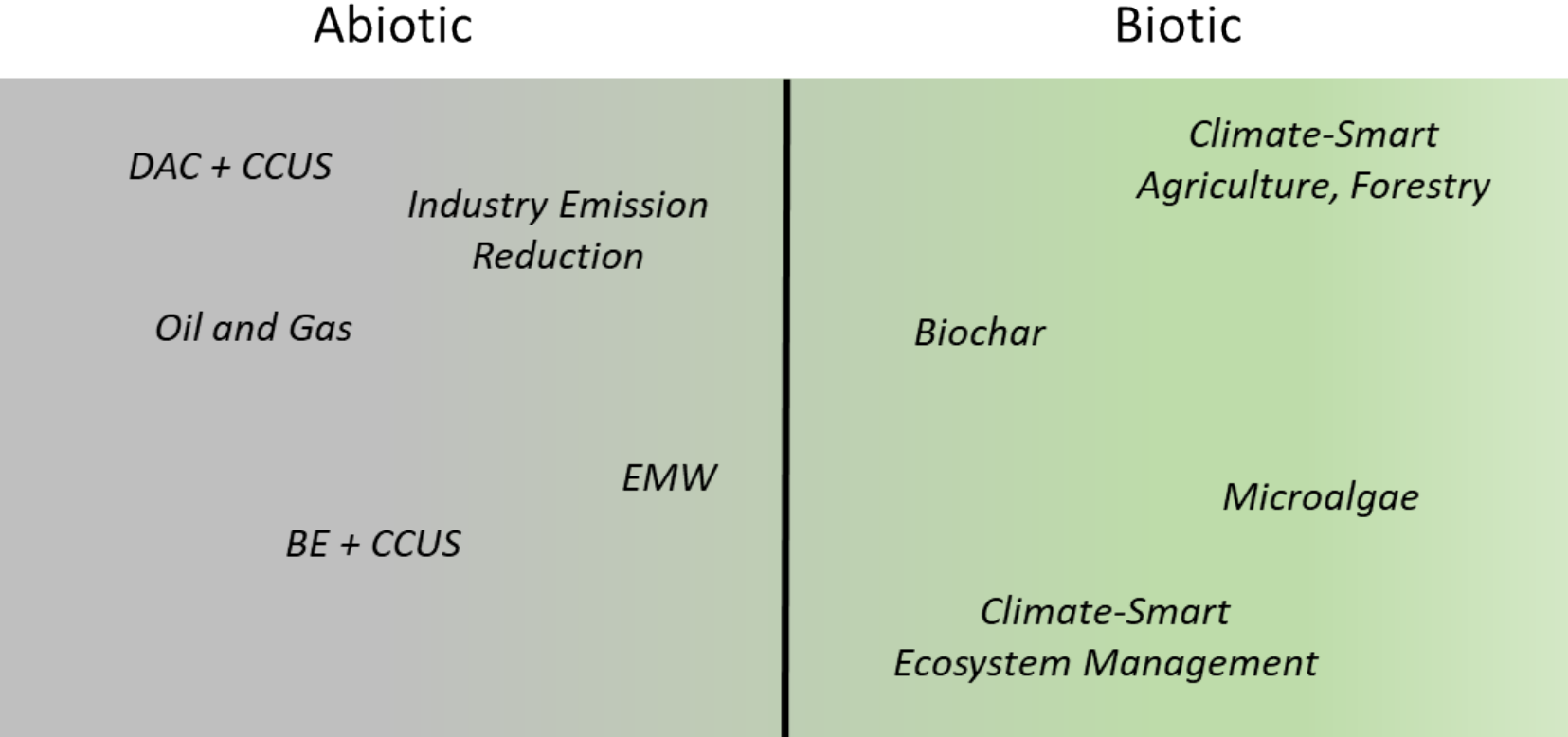
Microalgae

BE + CCUS

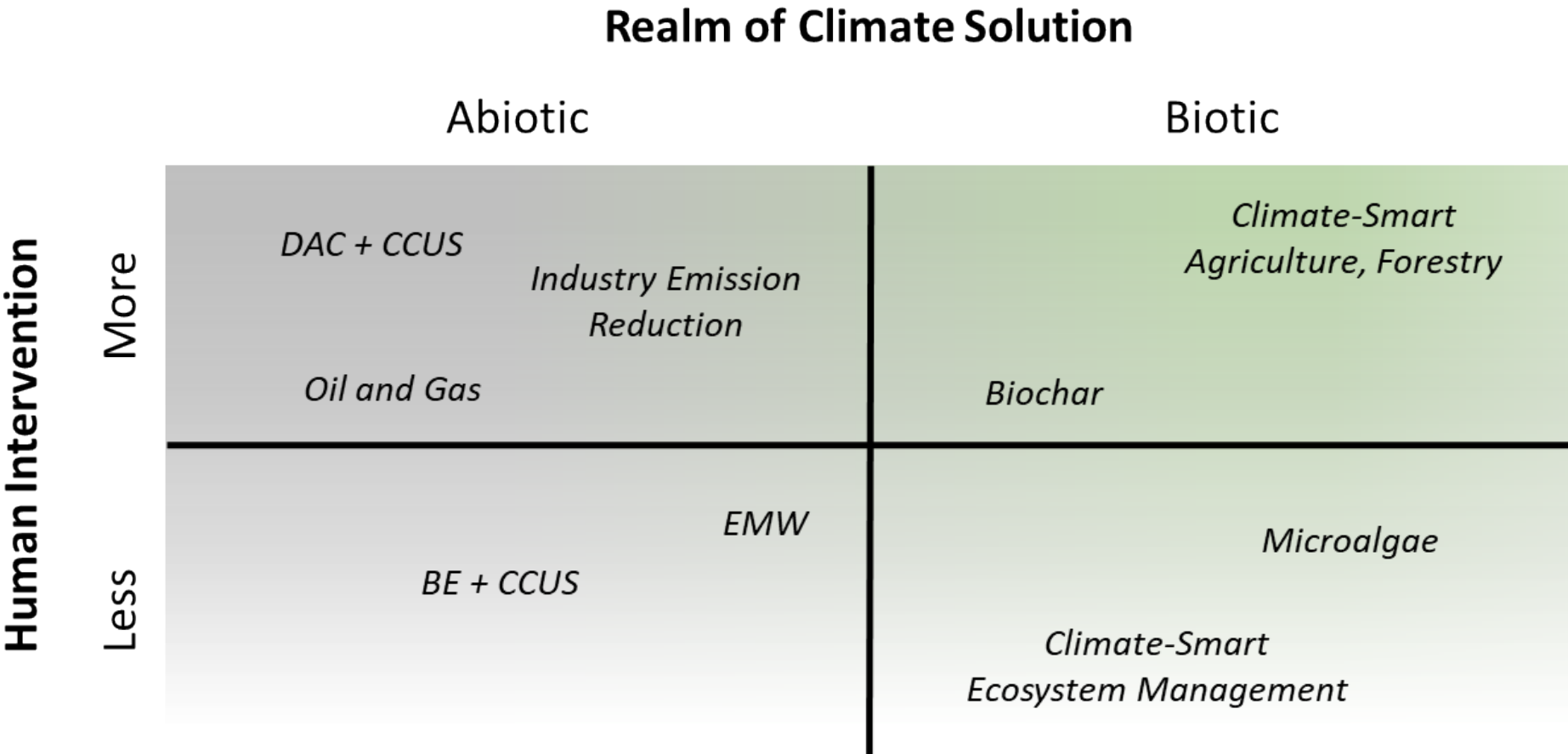
*Climate-Smart
Ecosystem Management*

Eddy-covariance strength: Impartiality, high-integrity GHG certificates

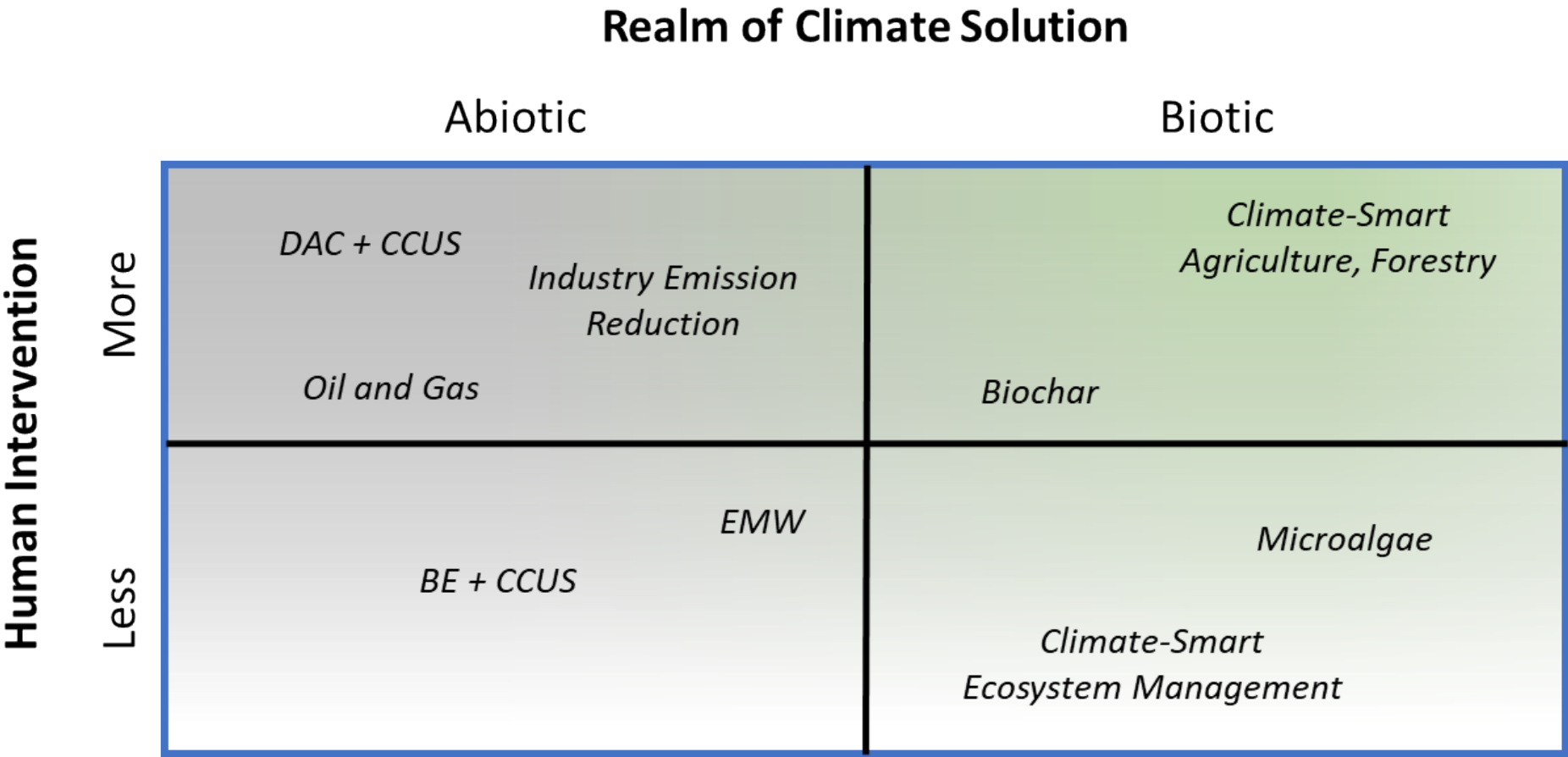
Realm of Climate Solution



Eddy-covariance strength: Impartiality, high-integrity GHG certificates

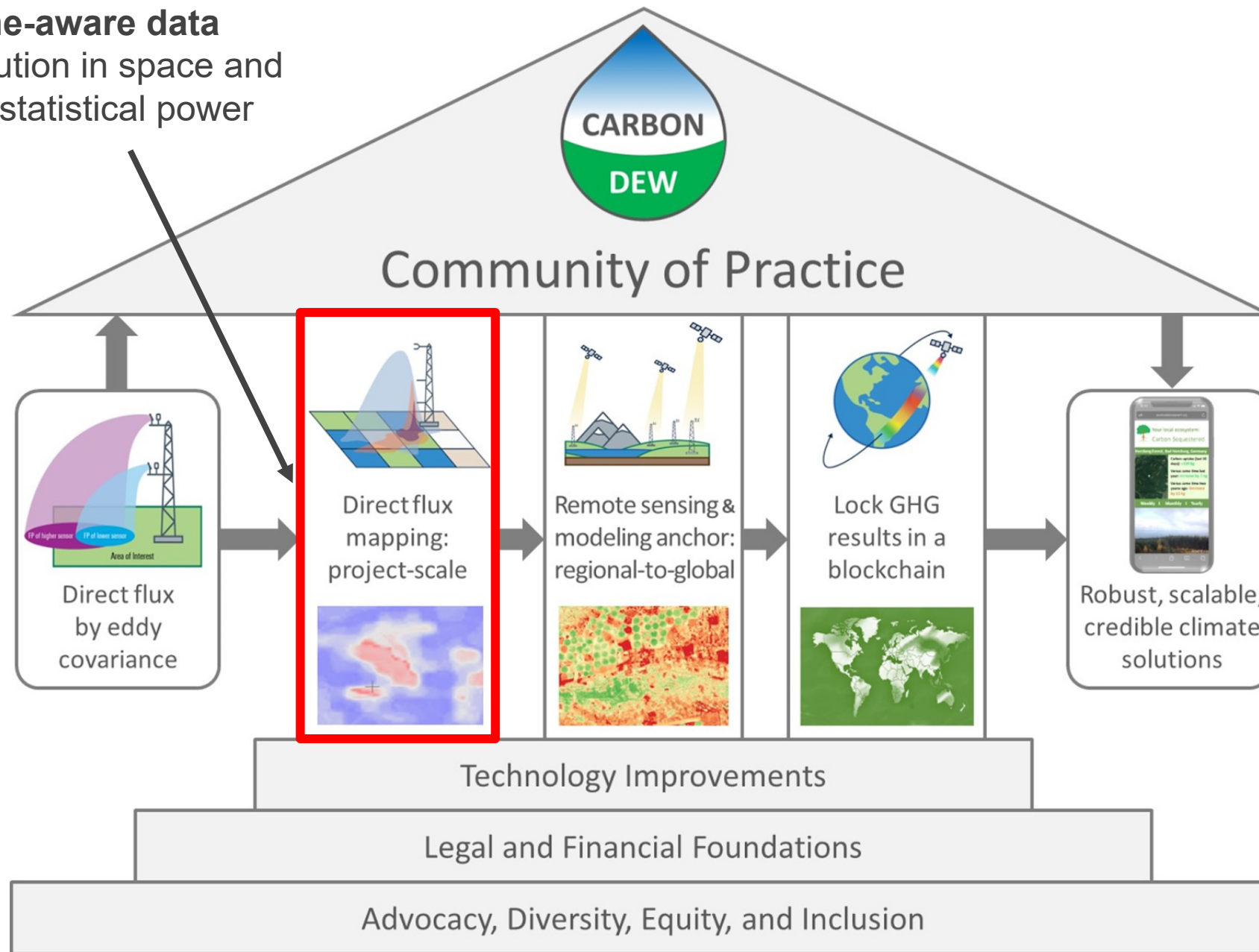


Eddy-covariance strength: Impartiality, high-integrity GHG certificates



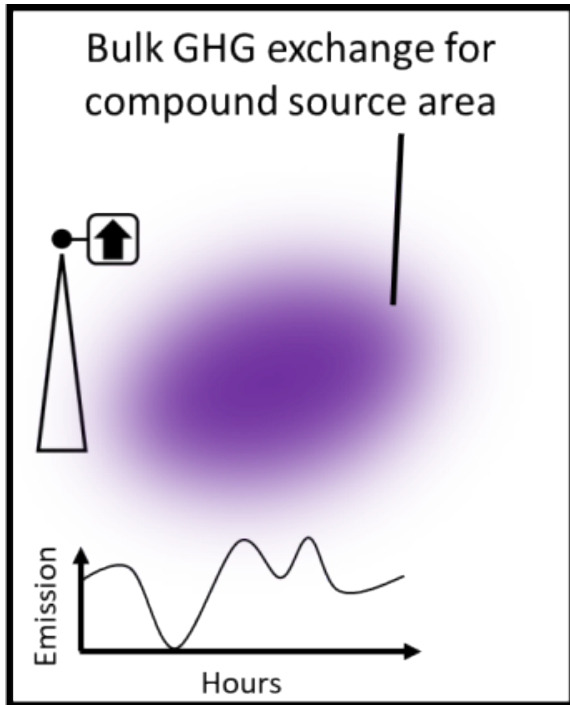
Impartial eddy-covariance: traveling standard, gold datasets etc...

Inter/discipline-aware data integration: attribution in space and time, 10 - 100 X statistical power



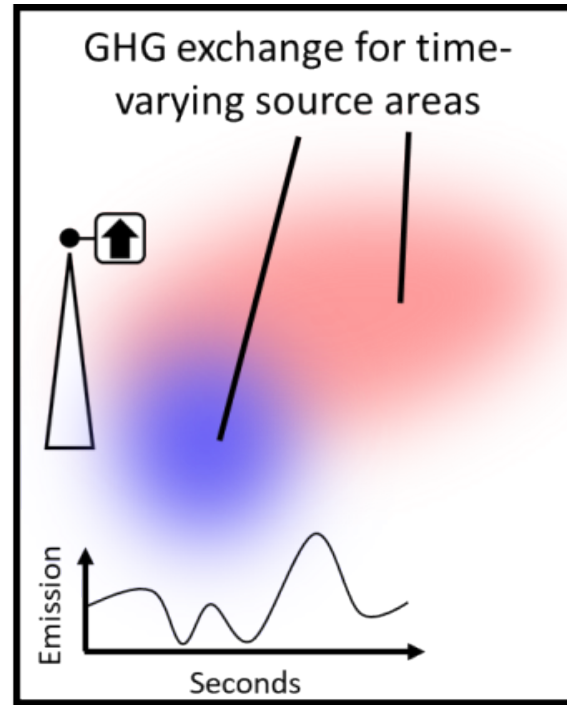
The Flux Mapping solution to the eddy-covariance puzzle

Traditional 30-min mixing



- 1 x 30-min data point
- 7+ decades tradition
- Information averaging
- Ambiguous interpretation

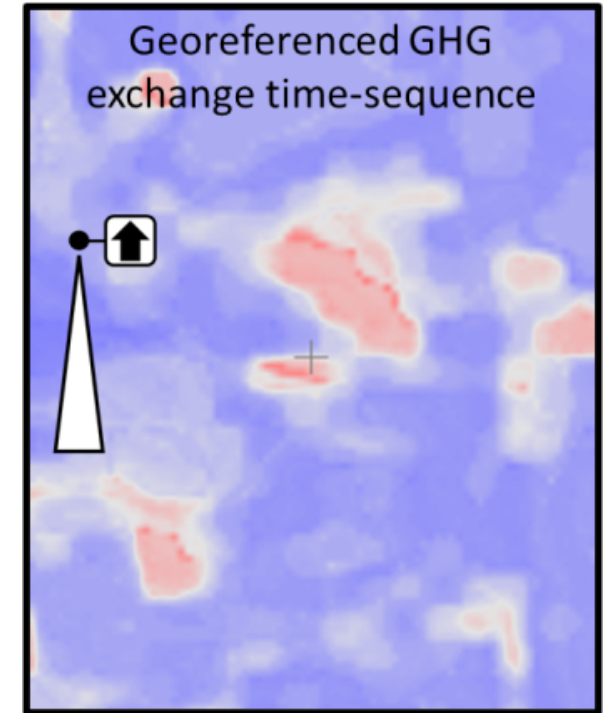
Flux tower 20 Hz data



- 10,000s x 20 Hz data points

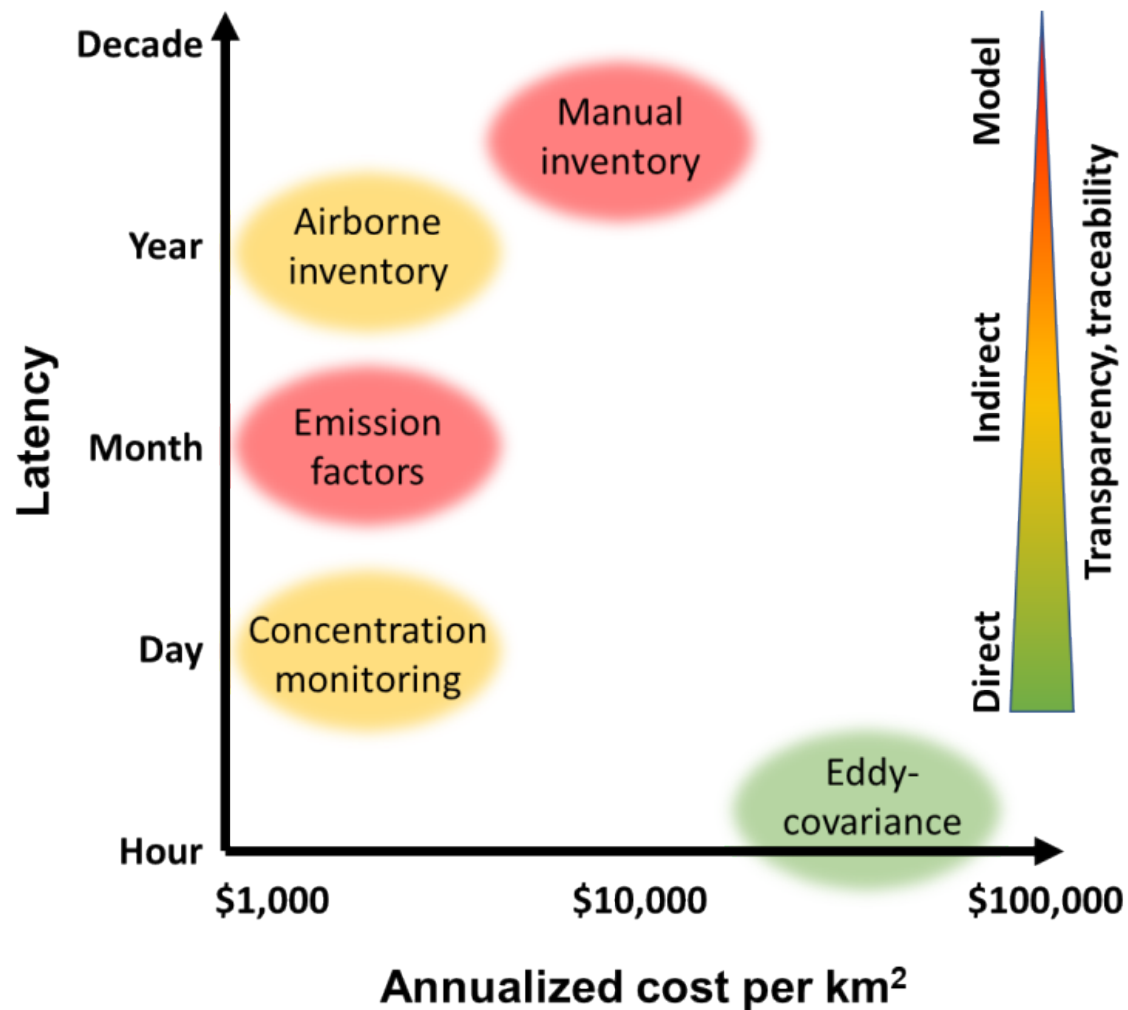
7+ decades innovation: time-frequency decomposition, dispersion modeling, physics-guided AI

Flux Mapping 30-min un-mixing



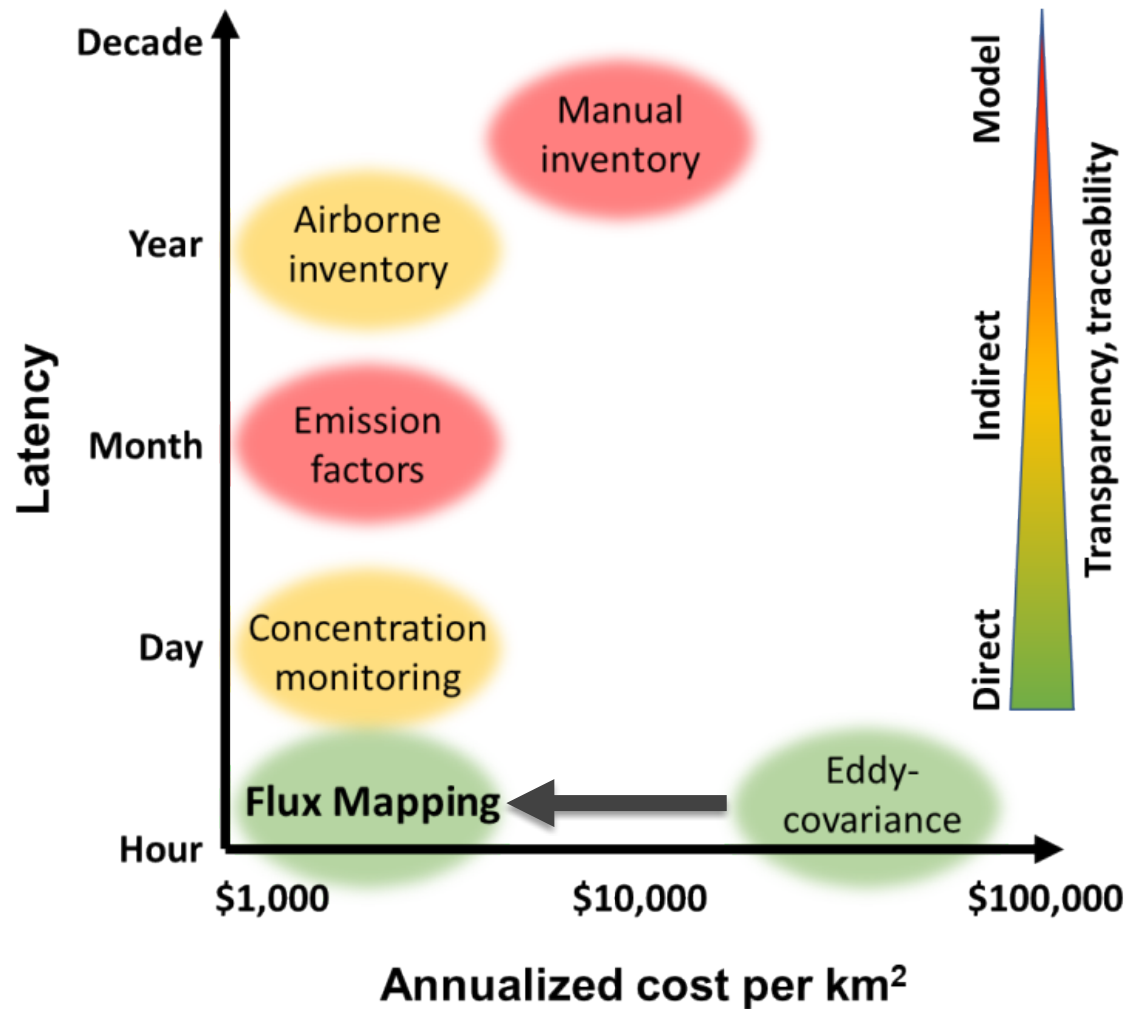
- 10,000s x 30-min data points
- NKOTB, dozen applications
- Information transcription
- Unambiguous interpretation

Flux Mapping – more relevant now than ever

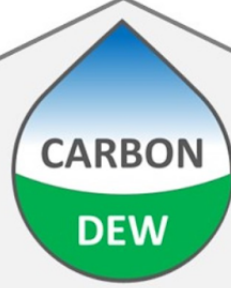


- Discipline-specific tech array that quantifies GHG emission and sequestration at differing transparency, latency, cost
- Eddy-covariance: highest transparency but expensive and complex to interpret, limiting it to academia (e.g., Springer Handbook of Atmospheric Measurements, 2021)

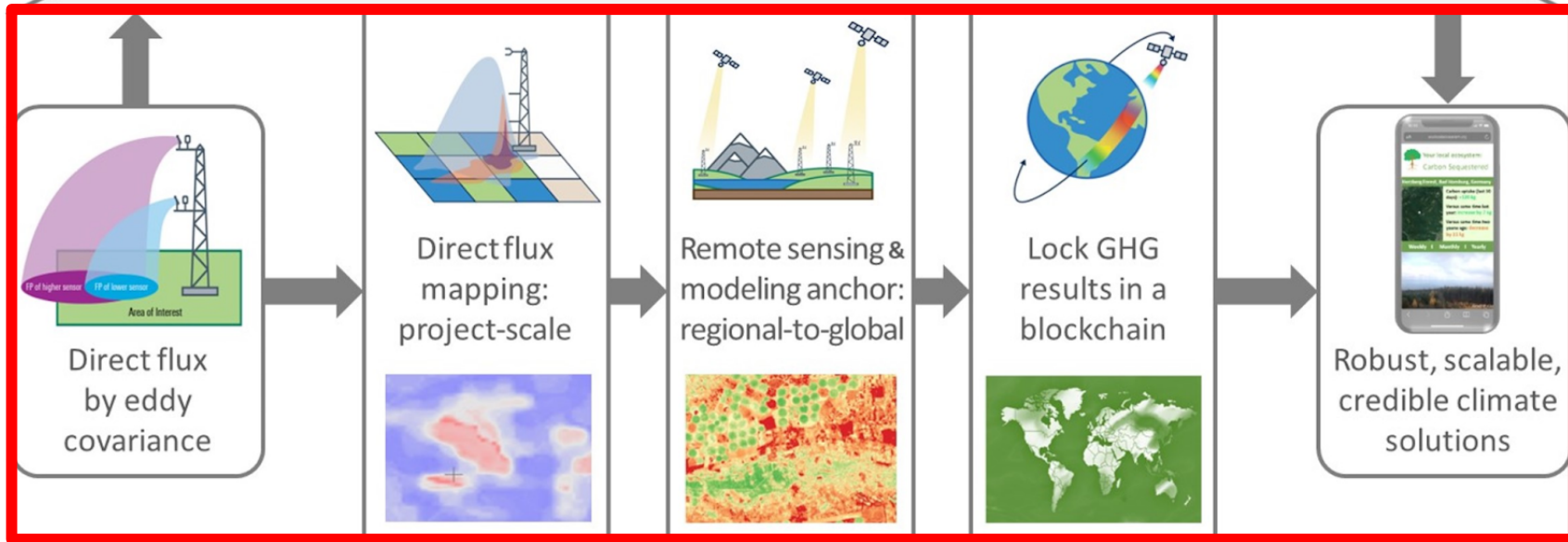
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- Flux Mapping overcomes eddy-covariance challenges: market-ready, robust and scalable GHG exchange quantification
- Price of GHG certificates differs order-of-magnitude as a function of integrity: wide compensation margin for highest integrity



Community of Practice

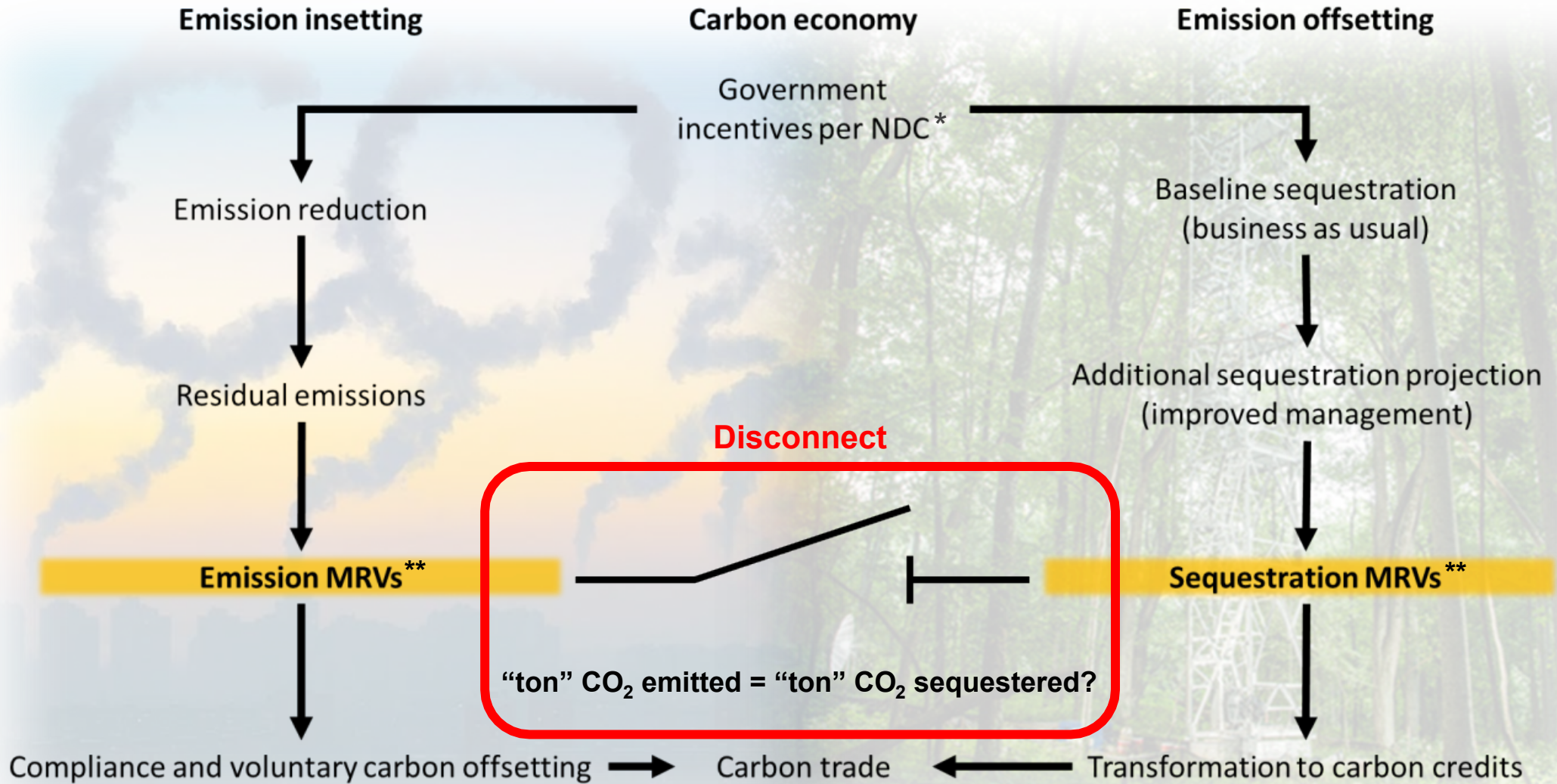


Technology Improvements

Legal and Financial Foundations

Advocacy, Diversity, Equity, and Inclusion

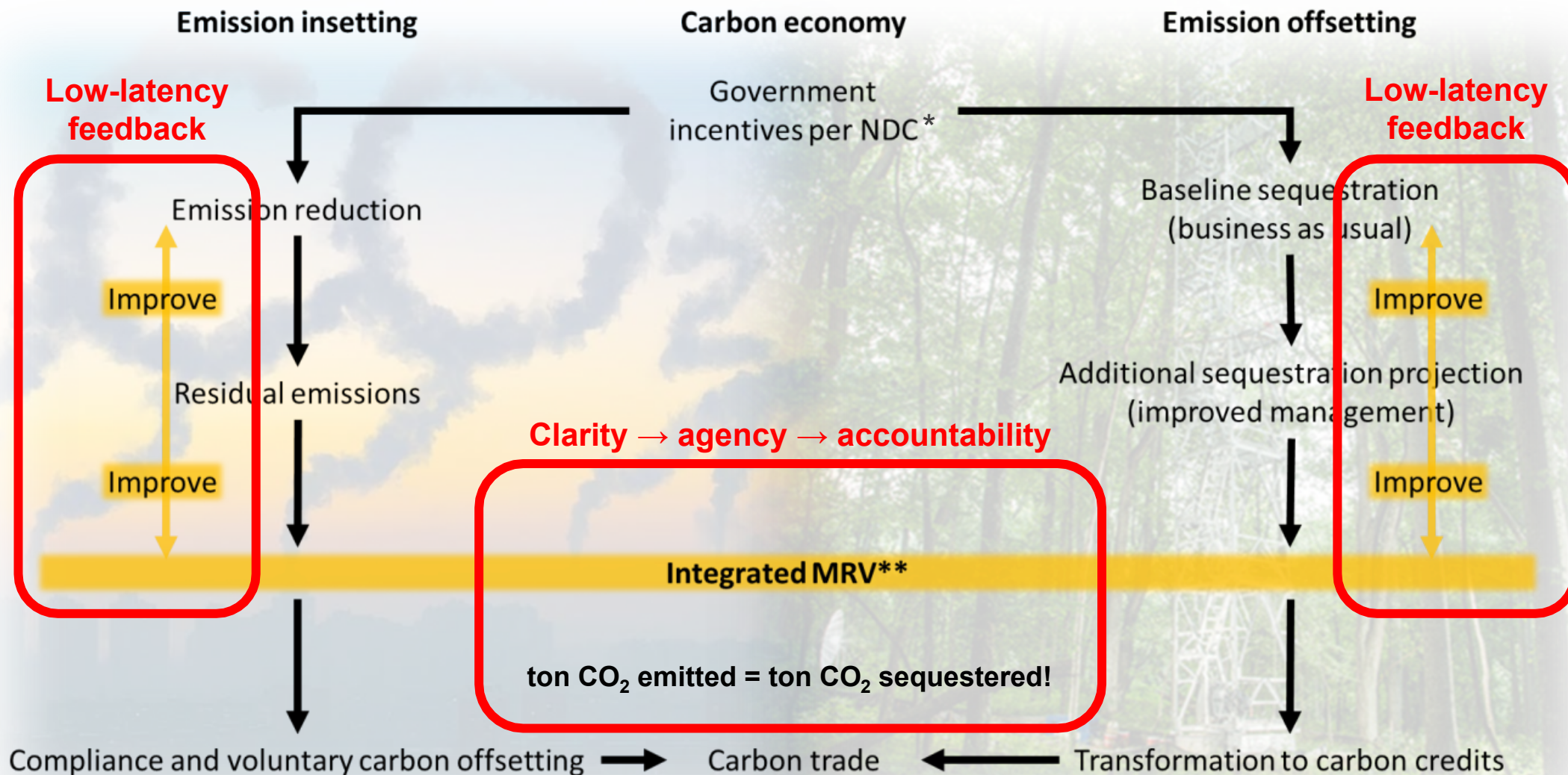
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Carbon Dew: market-based decarbonization with integrated MRV**



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Activities – Let's Make Science Matter Together!

- ✓ 24/7/365 direct emissions mapping, e.g., for carbon sequestration and soil health monitoring



- ✓ Connect mapped emissions and financial incentives, from individual projects to planet



- ✓ Towards open example maps for industry & regulation



Community of Practice
Fair & Equitable Climate Solutions
Anchored by Direct Atmospheric Measurements

THE FEDERAL STRATEGY TO ADVANCE AN INTEGRATED U.S. GREENHOUSE GAS MONITORING & INFORMATION SYSTEM



Prepared by the
Greenhouse Gas Monitoring & Measurement Interagency Working Group

- ✓ Call for public feedback by Apr 4, 2023
- ✓ Need for systematic ground-truthing of remotely sensed carbon products
- ✓ Coordinated group response with signatories from academia, observing networks, industry, stakeholders etc.
- ✓ Join www.tinyurl.com/carbondew-response



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