



Certified carbon removal is critical to an effective and resilient response for stabilizing the climate



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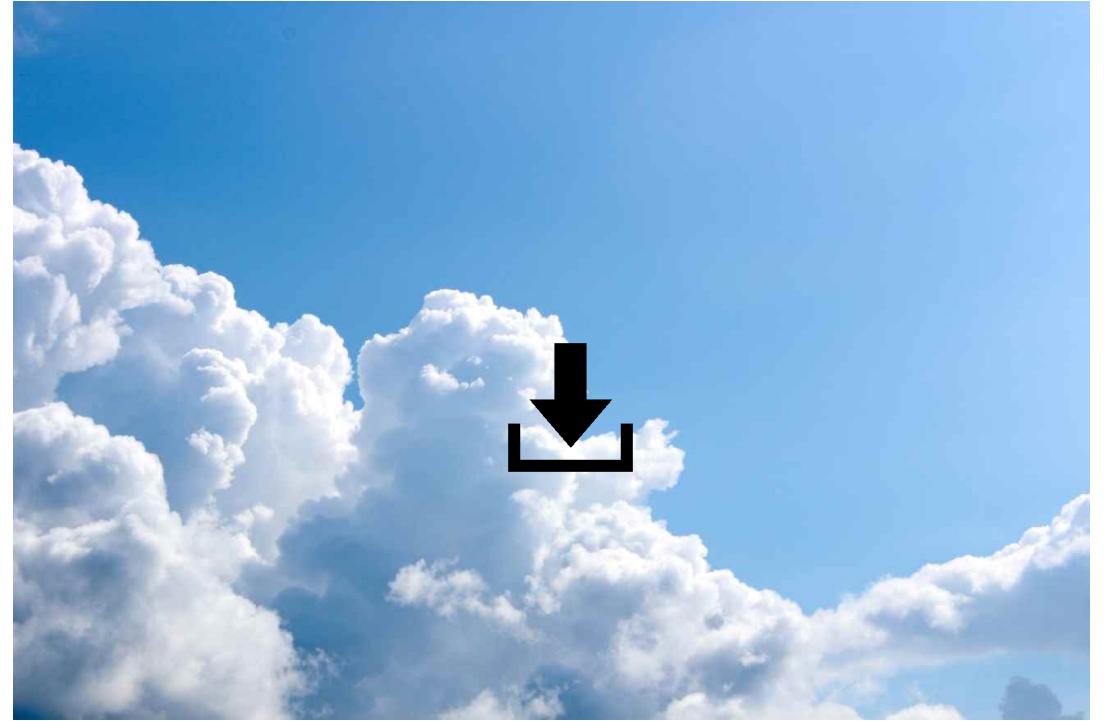
The main driver of climate change is the unmitigated waste stream of CO₂ resulting from the still rising consumption of fossil fuels



Only two options: avoid emitting, or emit and remove



Avoiding



Removing

Removal is the price to pay for not avoiding.

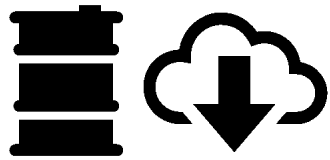
Stabilizing the climate requires certified, permanent disposal of excess carbon in many types of reservoirs

A conceptual framework for the certification of carbon sequestration

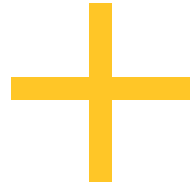
Arcusa, Lackner, Hagood, Page, Sriramprasad
ASU KEEP 172390

Elements

1



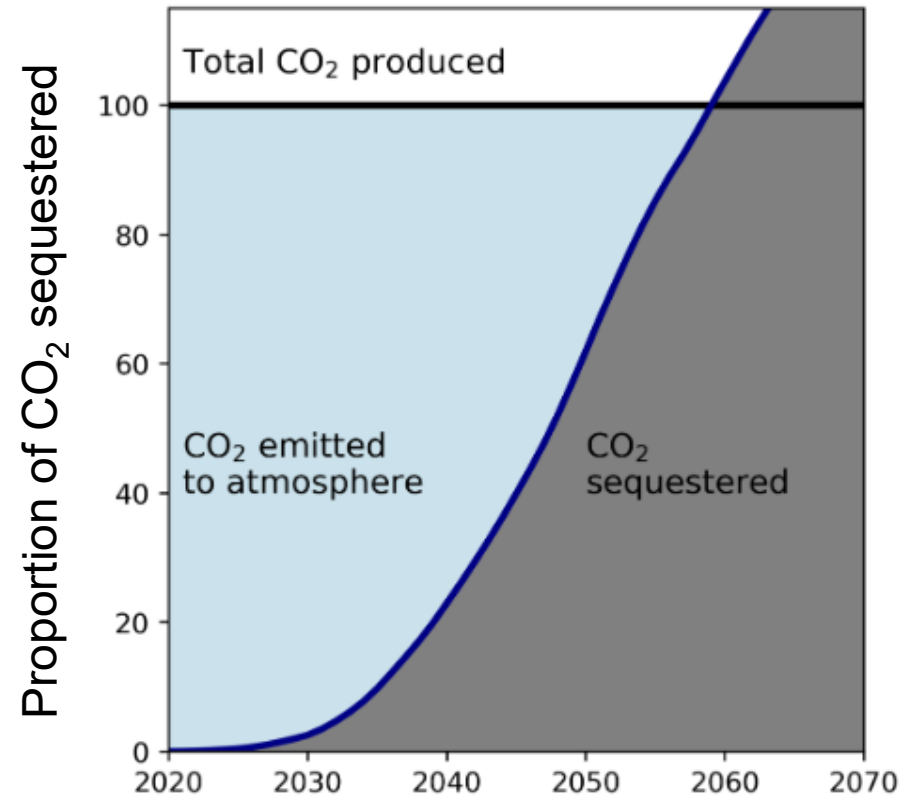
Upstream 1:1 carbon
take back obligation



2

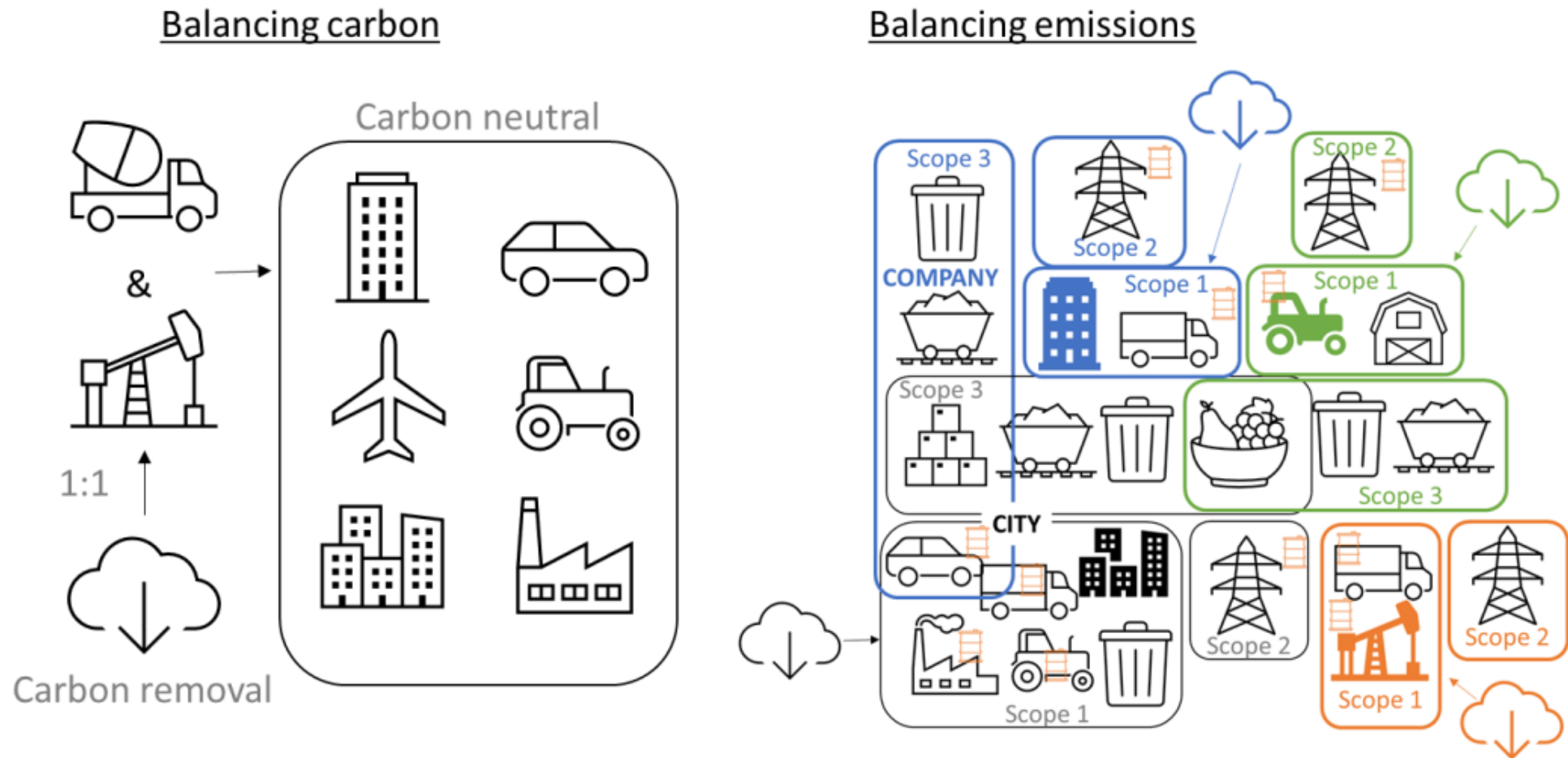


(1) Transitioning from today's economy to a net zero economy through the carbon producer's responsibility



For more information: www.carbontakeback.org
<https://pacemissions.org/>

Applied upstream to simplify and increase accuracy of carbon accounting



(2) A common framework for the certification of carbon sequestration

A **set of guidelines** to develop standards that will:

Certify the sequestration of carbon in any **suitable** reservoir; **engineered and natural**

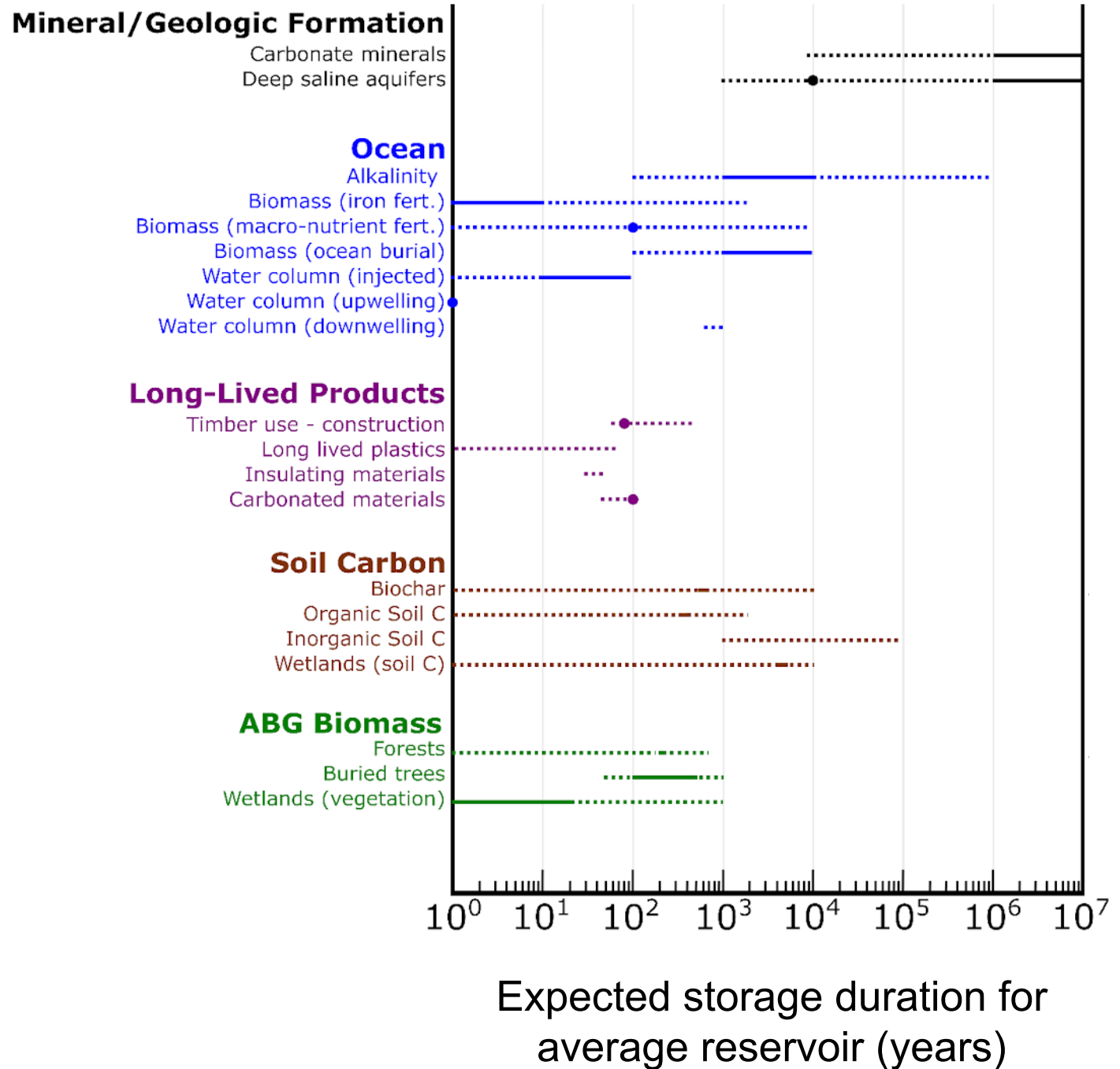
Guarantee **permanence**

Ensure **verifiability**

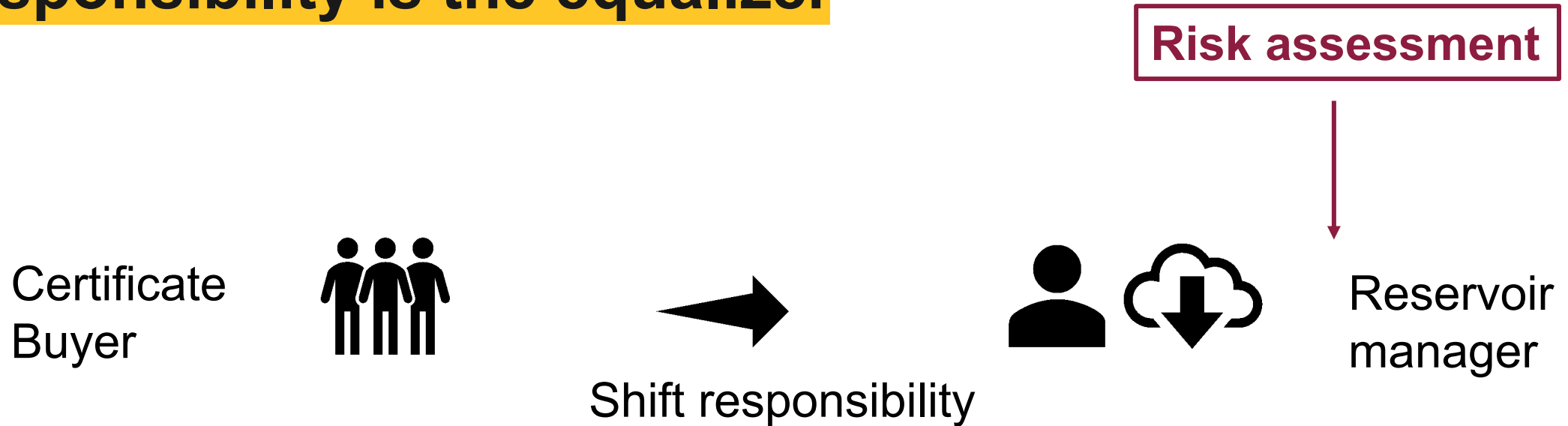


Reservoirs will keep carbon stored for various lengths of time

- Solid line – best estimate
- Dashed line – full range



Responsibility is the equalizer



- Monitoring
- Remediation of CO₂ released from storage

Planning for the risk of paying for remediation will nudge the system towards safer reservoirs and will insure total sequestration efforts, unlike buffer pools.

Options to guarantee permanence

(A) Transfer of responsibility

- Contractual agreement
- Monitor and remediate
- Transfer responsibility to willing party
- Upfront payment mechanism



Contractual management



10

100

Years

(B) Permanence test (case-by-case)

- Demonstration of stability
- Reduced monitoring frequency
- Climate-relevant timescales



Scientific management



1000

...10000

Establishing a chain of custody with a way out that doesn't compromise future generations, unlike current use of "fixed liability".

Monitoring and remediation require verifiable outcomes which require data



Each reservoir and activity will need its own protocol and equipment.



But all protocols must have a method that does the following:

1. Defines the boundaries of the reservoir,
2. Quantifies additions to the reservoir,
3. Quantifies the carbon content of the reservoir on demand.



All measurements must be made to the same level of agreed certainty.

For accuracy and simplicity, the focus is on measuring sequestration, not net removal, i.e., no LCA nor counterfactuals.

A focus on direct measurements allows for third party verification and supports a digital dual ledger for reporting, eliminating greenwashing and double counting.



Upsides

Simple

Measurable

Safe

Guaranteed
permanence

Comparable yet
specific

Compensation for work
done

Supports net-zero & net-
negative goals



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