



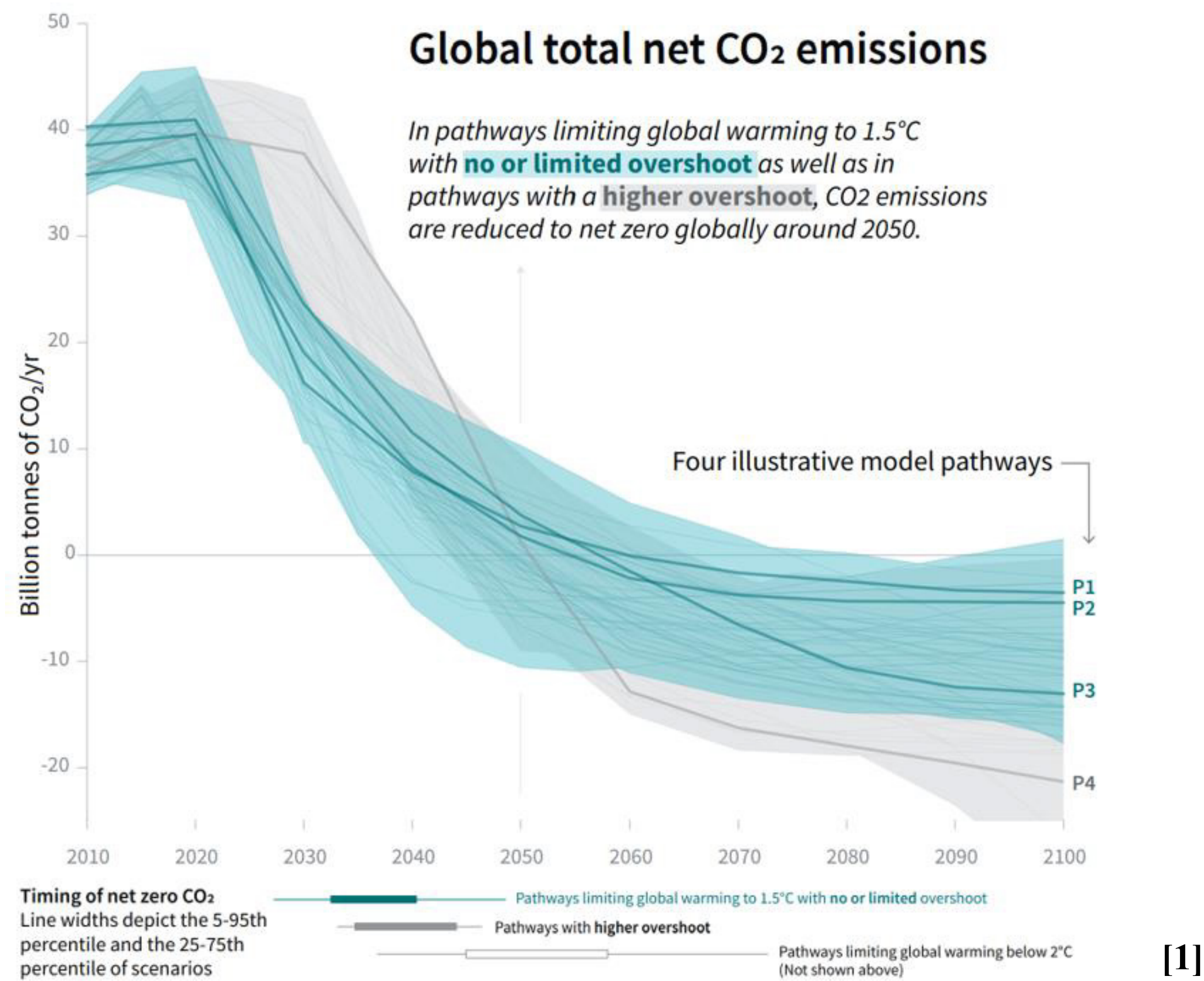
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## INTRODUCTION

Limiting global warming to between 1.5°C - 2.0°C requires the development and use of anthropogenic **carbon dioxide removal (CDR) activities** (IPCC, 2021). These activities need to remove CO<sub>2</sub> from the atmosphere and “**durably store** it in geological, terrestrial or ocean reservoirs” (IPCC, 2021).



**Problem:** To date, no study has synthesized the evidence for assigning specific carbon storage durations to each available reservoir and accounted for the differing methods used to generate storage duration estimates.

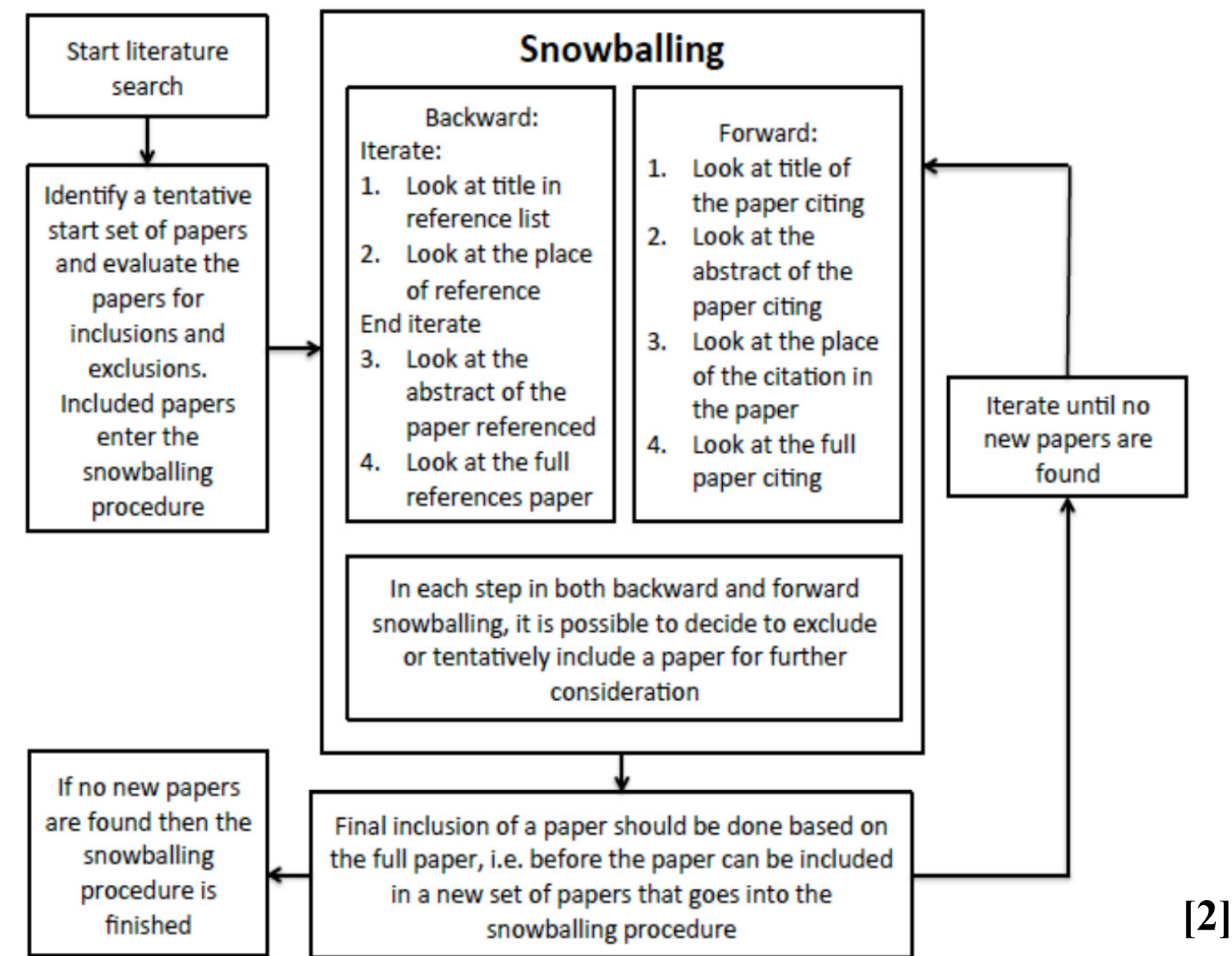
**Research Goal:** To compare the maximum storage durations of available carbon storage reservoirs, identify gaps in available data and subsequently offer suggestions of areas for further research for each reservoir.

## RESERVOIRS

Reservoir Category	Reservoir Type
Mineral & geologic formations	Carbonate minerals; Deep saline aquifer; Depleted oil reservoirs
Ocean	Organic carbon; Inorganic Carbon; Sedimentary
Long-lived products	Timber in Construction; Long-lived plastics; Concrete & aggregates
Soil Carbon	Biochar; Soil Organic Carbon; Soil Inorganic Carbon; Terrestrial & coastal waterlogged soils
Terrestrial Biomass	Forests; Buried Trees; Wetland & coastal vegetation

## METHODS

Literature Review uses **Snowballing** method cross-referenced with a **Boolean** search-generated database. Snowballing is used due to the lack of common terminology between reservoirs and allows for the identification of original source data publications. The Boolean search is used to cross-reference the Snowballing effort and allows for identification of publications produced after the source publications.



## Snowballing Source Documents

- **Geologic & Mineral:** *IPCC Special Report on Carbon Dioxide Capture and Storage Prepared by Working Group III of the Intergovernmental Panel on Climate Change.* (B. Metz, O. Davidson, H. C. de Coninck, M. Loos, & L. A. Meyers, Eds.). (2005).
- **Multiple:** *Negative Emissions Technologies and Reliable Sequestration, National Academies of Sciences Engineering and Medicine.* (2019),
- **Ocean:** *High Level Review Of A Wide Range Of Proposed Marine Geoengineering Techniques, GESAMP.* (2019).
- **Soil Carbon, Terrestrial Biomass:** *The science needed for robust, scalable, and credible nature-based climate solutions in the United States: Full Report, Novick, K. et. al... Woodall, C. (2022).*

## Boolean Search Criteria

- “{Reservoir Type Name} carbon storage duration,”
- “{Reservoir Type Name} carbon storage durability,”
- “{Reservoir Type Name} carbon storage mean residence time,”
- “{Reservoir Type Name} carbon storage permanence,”
- “{Reservoir Type Name} carbon storage timescale,”
- “{Reservoir Type Name} carbon storage lifespan,” (and life span)
- “{Reservoir Type Name} carbon storage lifetime,” (and lifetime)

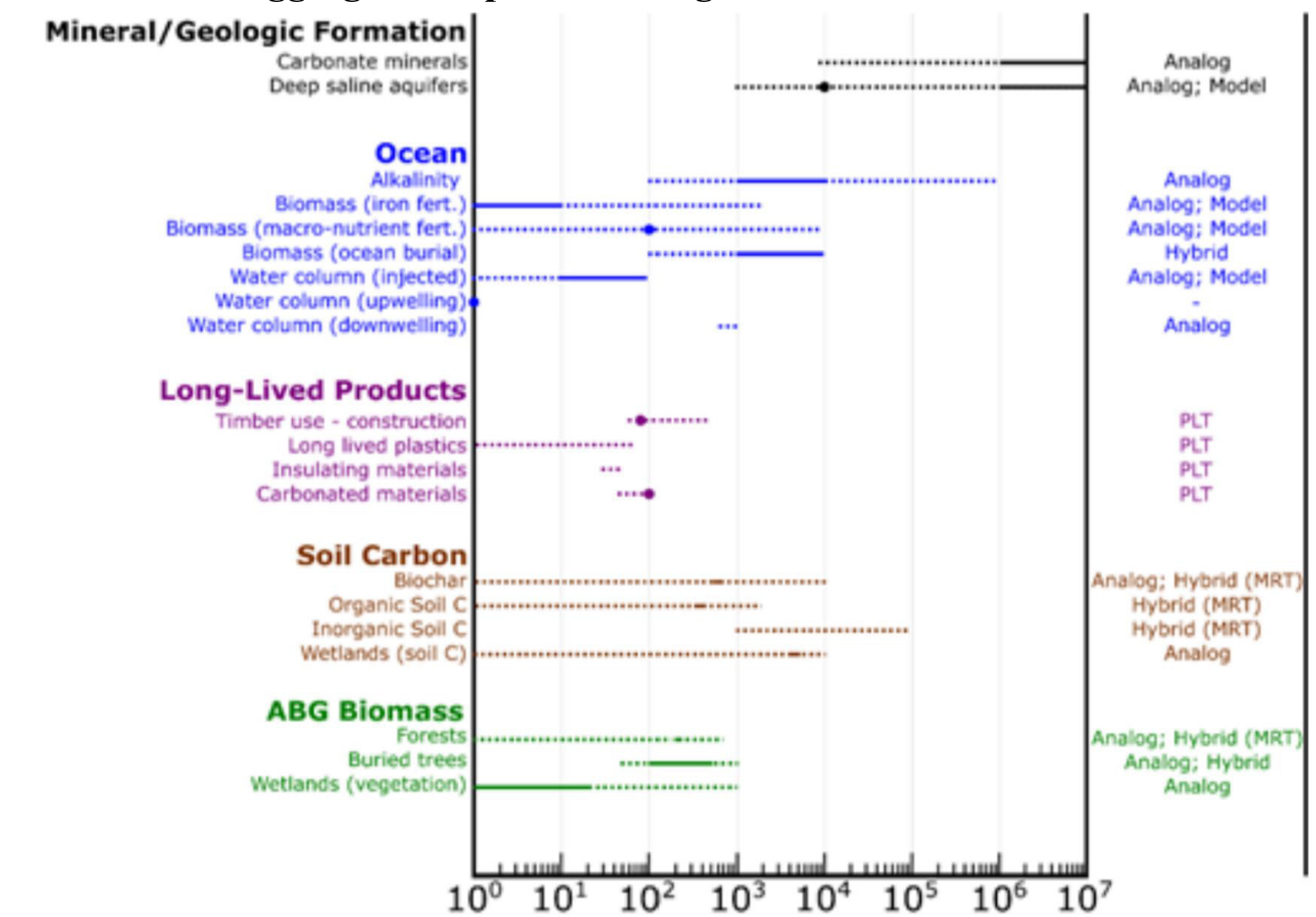
## ONGOING AND ANTICIPATED RESULTS

### Snowballing Chain Example: Biochar

Example of snowballing chain from seed source branching to final-chain publication.

No.	Reservoir Category	Chain No.	Title	Pub. Year	Data Type	Min (yrs)	Max (yrs)
1	Biochar	1	SEED: Novick K, "The science needed for robust, scalable, and credible nature-based climate ..."				
2	Biochar	2	Kuzyakov Y, "Biochar stability in soil...14C analysis"	2014	Radiocarbon Dating (14C)	400	4000
3	Biochar	3	Wang J, "Biochar stability in soil: meta-analysis of decomposition & priming"	2015	Mean Residence Time (Radiocarbon Dating Studies)	0.30	556
4	Biochar	4	Glaser B "The 'Terra Preta' phenomenon"	2001	Radiocarbon Dating	740	2460
5	Biochar	5	Schmidt M, "Carbon isotope geochemistry and nanomorphology of soil blackcarbon ..."	2002	Radiocarbon Dating	1160	5040
6	Biochar	6	Singh N, "Fire-derived organic carbon in soil turns over on a centennial scale"	2012	Model	3	870

### Presentation of aggregated expected storage durations across carbon reservoirs.



\*\*This figure was generated by a previous iteration of this research effort and is used as an example of expected research findings; however, this figure was unpublished. Author Credit should be given to the following: Stephanie Arcusa, Emily Hagood, and Starry Sprengle-Hyppolite.

## REFERENCES

- [1] IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 3-24. [2] Wohlin, C. (2014). Guidelines for snowballing in systematic literature studies and a replication in software engineering. Proceedings of the 18th International Conference on Evaluation and Assessment in Software Engineering, 1-10.