Towards net-zero sediment management of inland waterways – comparing embedded and embodied carbon emissions for dredging and reuse scenarios

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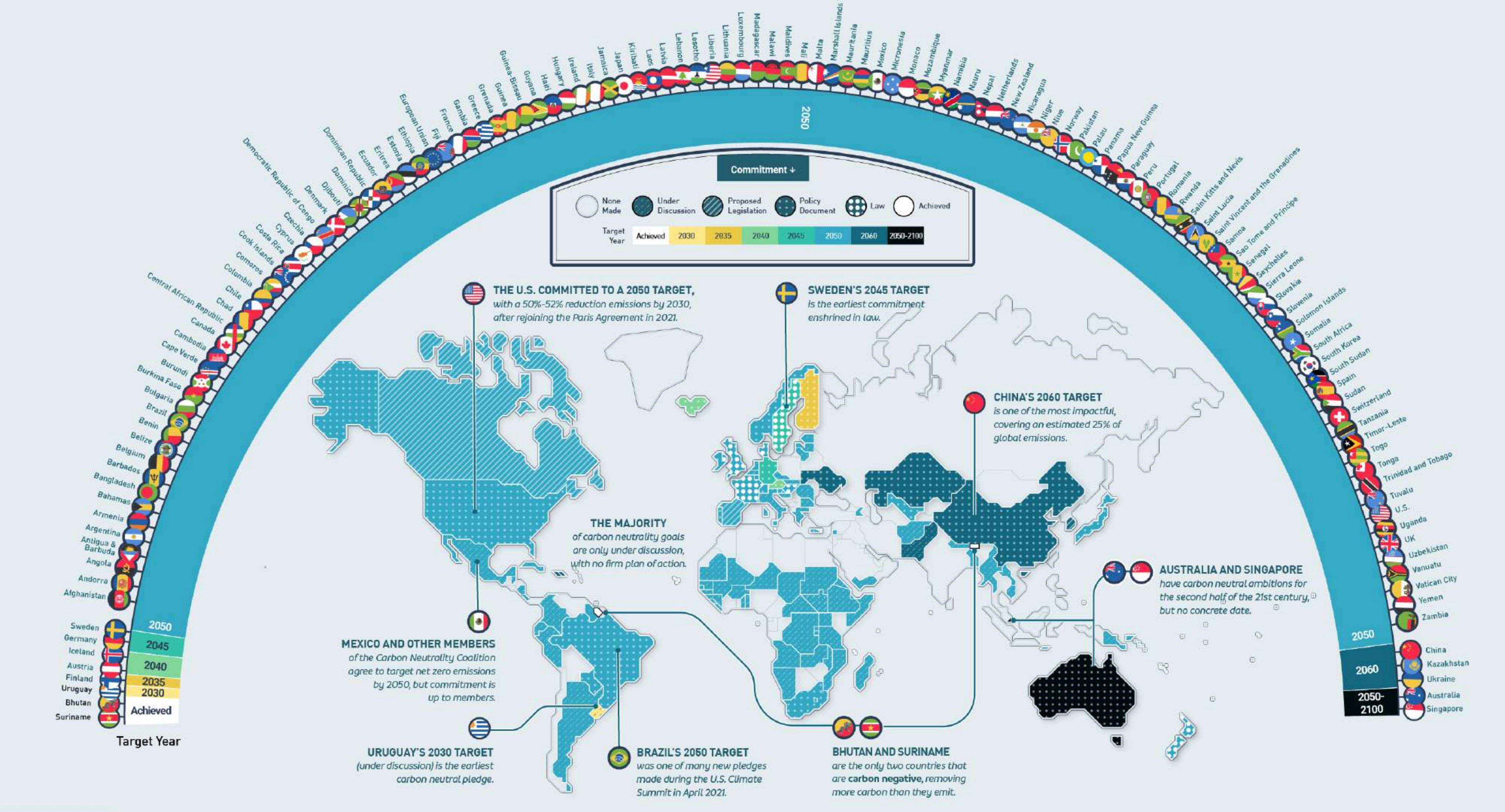

https://www.visualcapitalist.com/sp/race-to-net-zero-carbon-neutral-goals-by-country/

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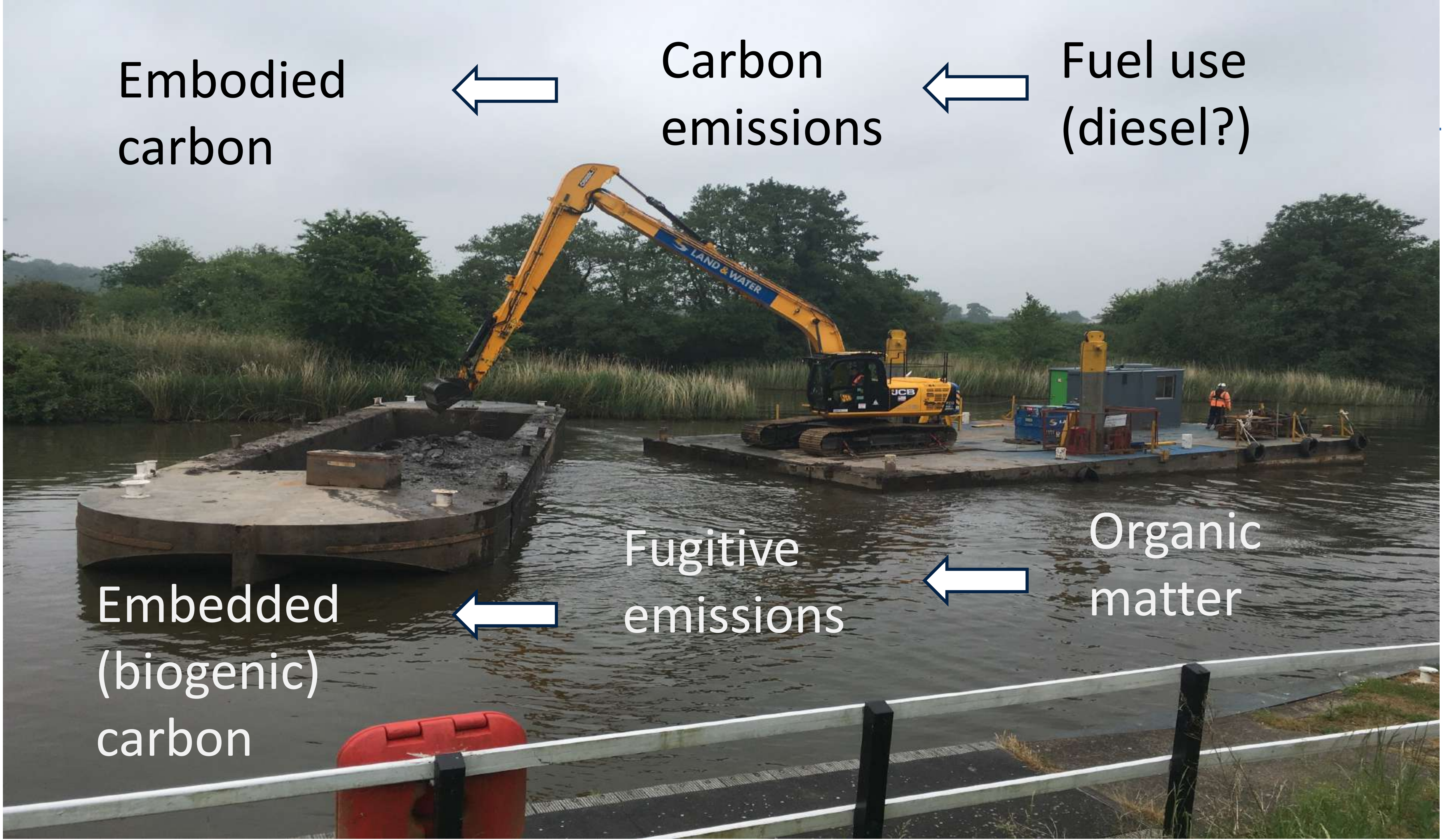
Typical inland dredging

Typically transported for disposal


Embodied carbon
Carbon emissions
Fuel use (diesel?)
Embedded (biogenic) carbon
Fugitive emissions
Organic matter

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Fuel use emissions – embodied C

- Example from CRT – up to 100,000 tonnes dredged every year (exc. Water Injection Dredging type works);

Annual Carbon Emissions for NDT contract (2019/20)			GHG emissions (Tonnes CO_2 equivalent)	
<u>on-site generators and plant</u>				
total red diesel purchased	151,668	litres	418.30	31%
<u>mobilisation</u>				
estimated mobilisation distance	7,000	miles		
CO_2 emissions	4,043.884	gCO_2/mile	28.31	2%
<u>personnel transport</u>				
petrol	9,579.2	litres	21.04	2%
diesel	69,754.8	litres	178.57	13%
<u>Disposal haulage</u>				
estimated mileage	1,299,126	miles	693.82	52%
	(c. 55,000 tonnes of waste)			
total annual carbon budget of NDT Team			**1340.04**	

Canal & River Trust Organic matter in sediments -embedded (biogenic) C

- Example from CRT – up to 100,000 tonnes dredged every year (exc. Water Injection Dredging type works);
- Total GHG fuel emissions 1340 (T CO_2 equivalent)

Total dredged sediment	**100,000 Tonnes**
Total on dry basis (@ 38% dry matter)	38,000
Total organic matter (@ 12% SOM)	4560
Total C (assuming SOM = 58% SOC)	2645
Equivalent CO_2 (assuming 1 T C = 3.67 T CO_2)	9706

So embedded (biogenic) C in dredged sediment is 7 x embodied C from operational fuel emissions of dredging & transport for disposal/reuse

So need to consider fuel use AND potential release of C from dredging method & fate

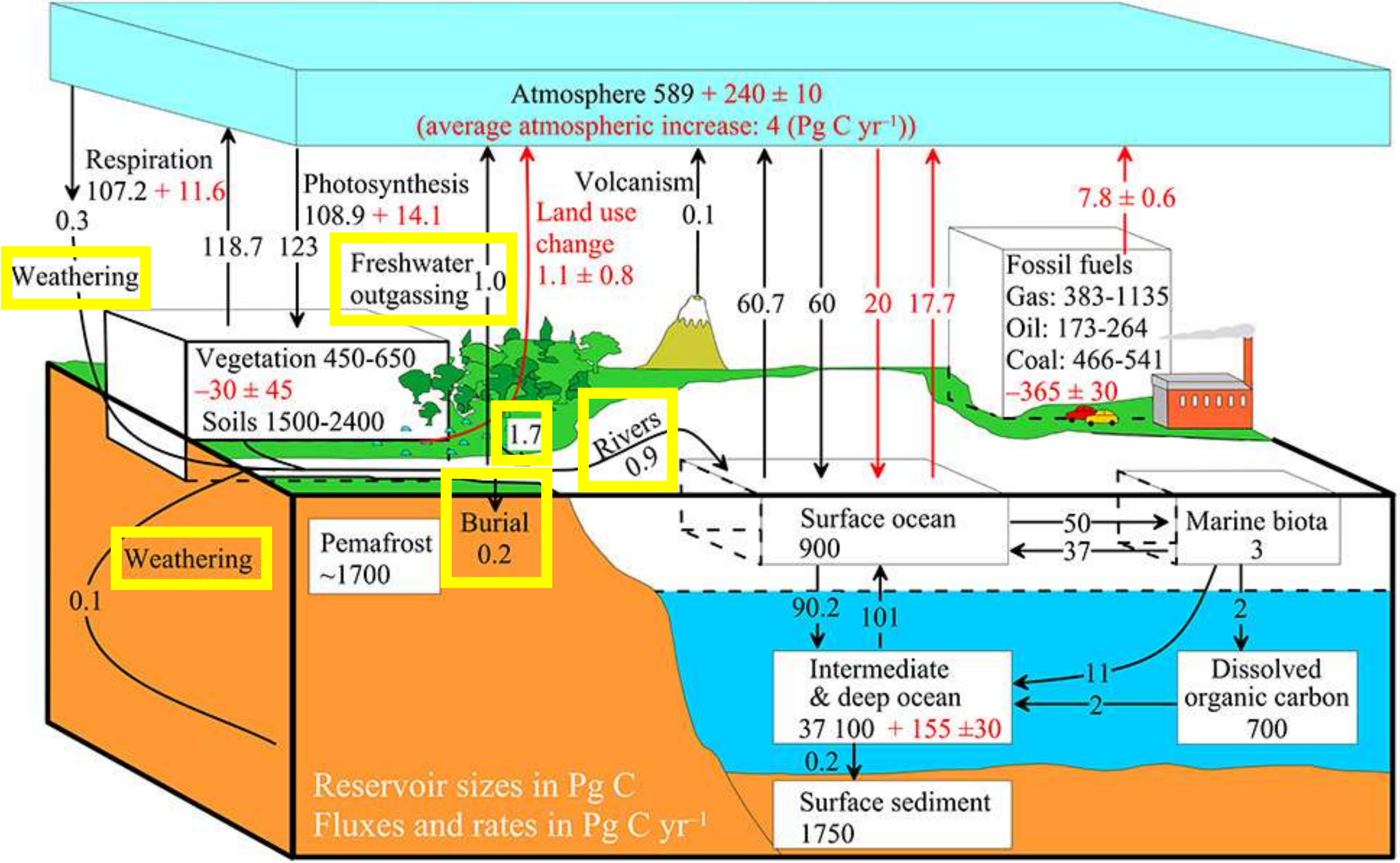
Disturbance by dredging and impact on the carbon cycle

- Are in situ sediments a source of GHG emissions or a future carbon sink (blue carbon)?

- If navigational disturbance and dredging releases GHGs is sediment removal beneficial?

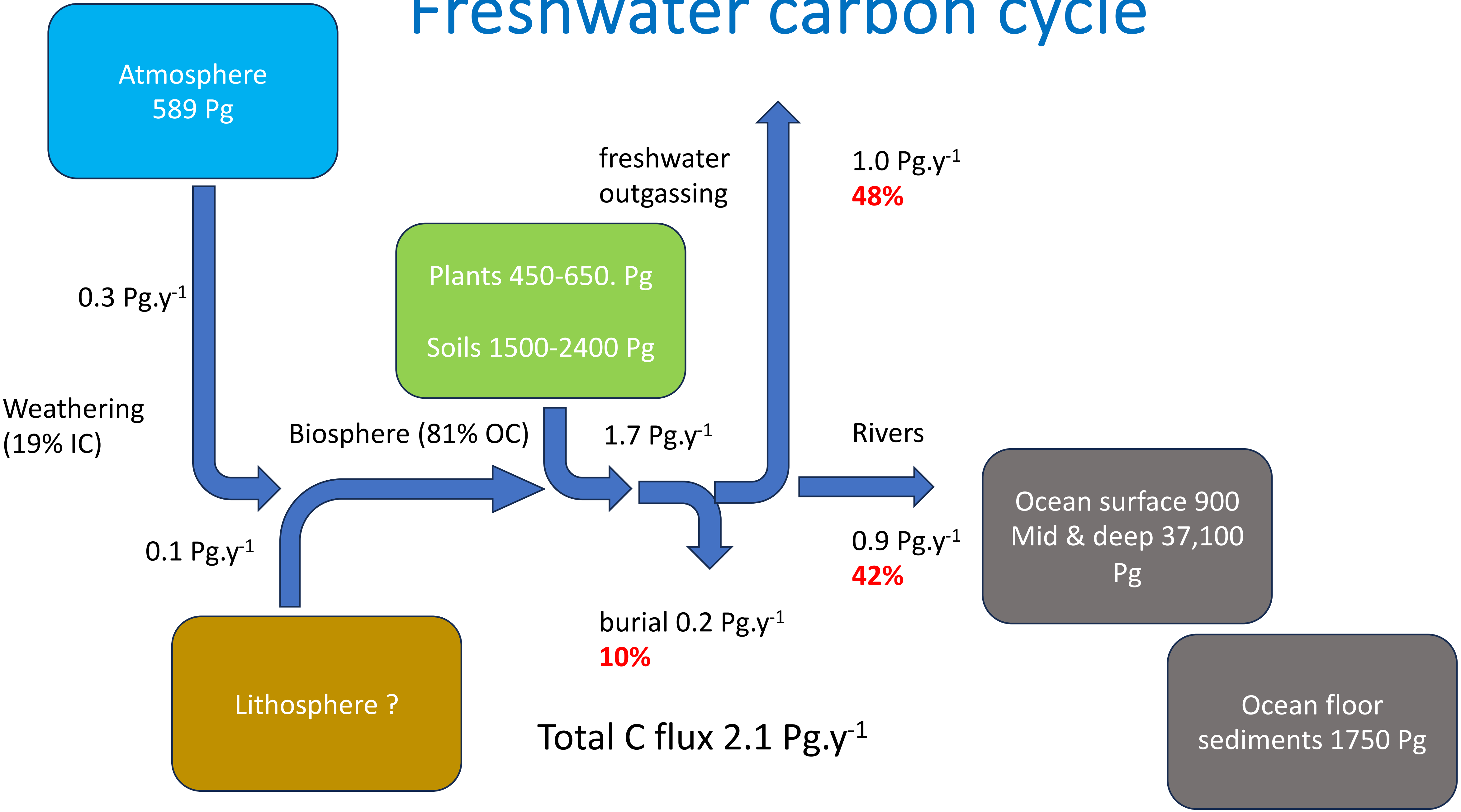
- What are the GHG impacts of different dredging and disposal methods

Global carbon cycle



Kandasamy & Nath (2016), Front. Mar. Sci 15 (3), 259 https://doi.org/10.3389/fmars.2016.00259

Freshwater carbon cycle



GHG Impacts of dredging methods / disposal options (and C storage potential?)

1. Ploughing and similar methods (reallocation & suppletion)

1. Fuel use – low
2. Disturbance of sediment - minimal
3. Future GHG emissions - as before?

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2. Standard UK canal dredging method, hydraulic excavator into barge, or occasionally direct to bank

2. (cont.). Most commonly, excavated into barge, so double-handling to bank or road transport for disposal/reuse

1. Fuel use (plant, haulage, staff, site) –high
2. Disturbance of sediment – moderate to high
3. Future GHG emissions – highly variable/site-specific
   1. high (cement addition, landfill)
   2. low (topsoil use)
   3. negative (energy crops, nature-based carbon capture)

3. Novel cutter suction dredging, hydraulic transport of sediment & lagoon dewatering

1. Fuel use – lower (especially transport)
2. Disturbance of sediment - high
3. Future GHG emissions – low or negative if reused for soil & substituting primary aggregates

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ARDENT
HIGHWAY MAINTENANCE


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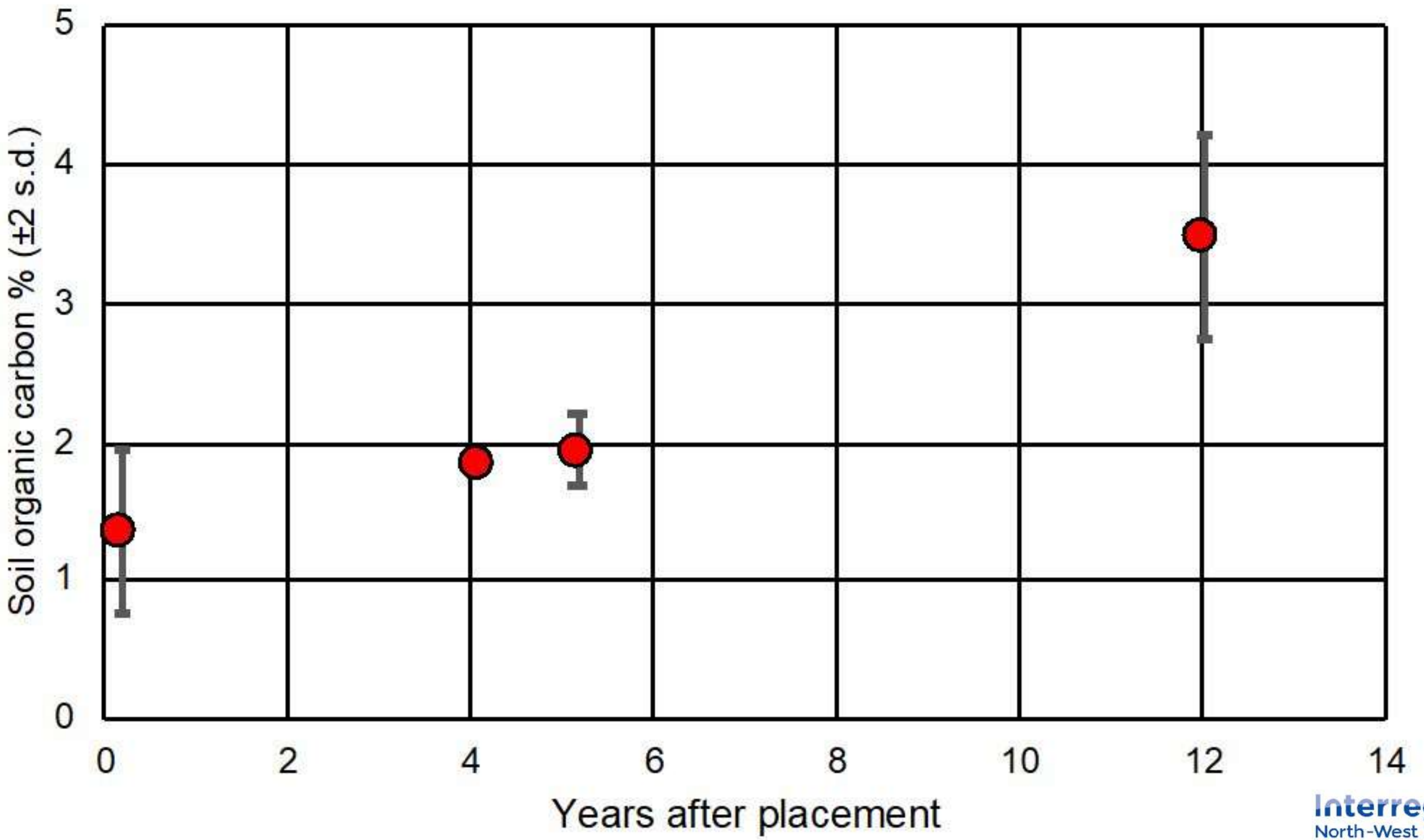

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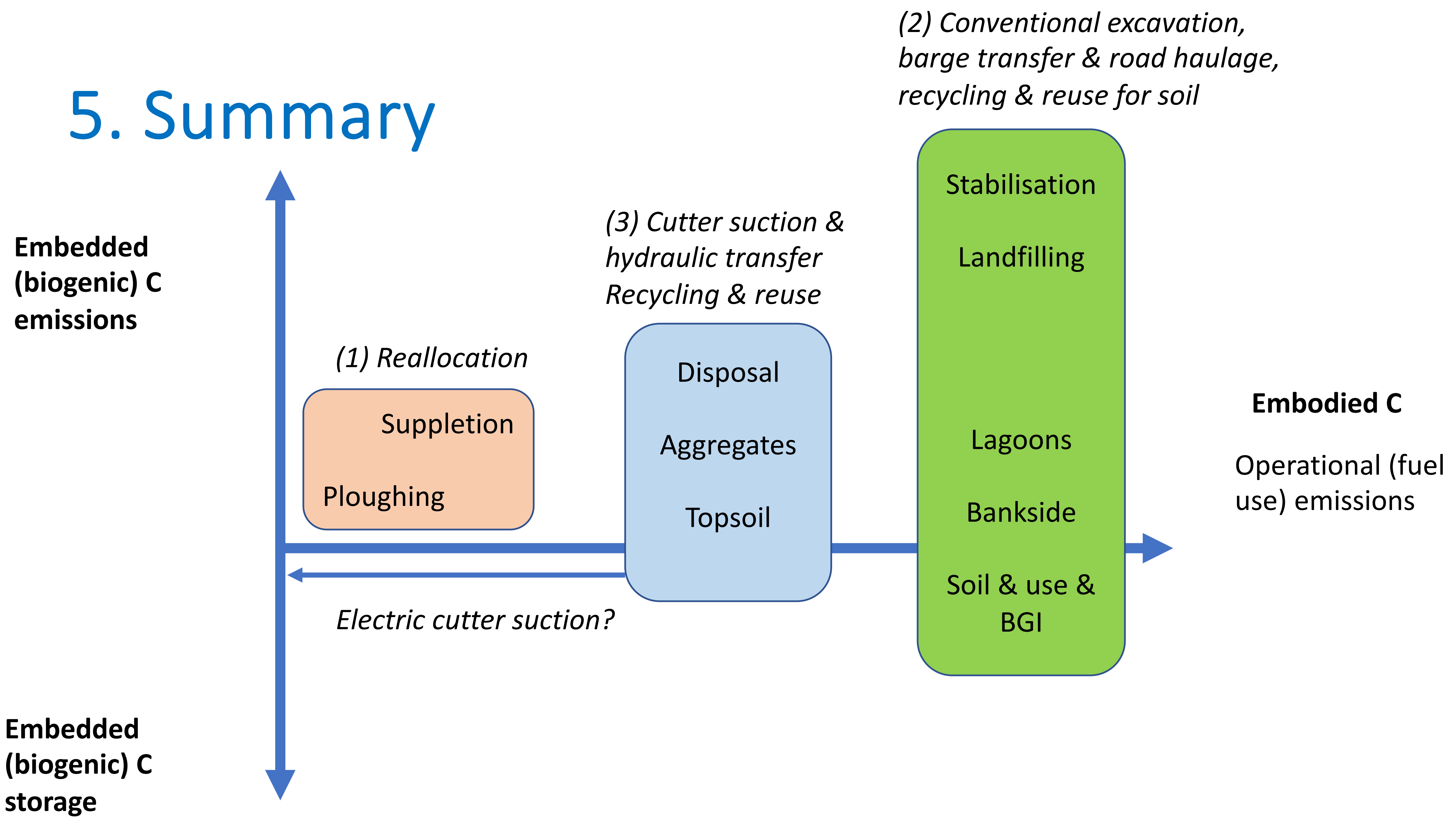
5. Summary


(2) Conventional excavation, barge transfer & road haulage, recycling & reuse for soil
Embedded (biogenic) C emissions
(3) Cutter suction & hydraulic transfer Recycling & reuse
Stabilisation
Landfilling
(1) Reallocation
Disposal
Suppletion
Aggregates
Ploughing
Topsoil
Lagoons
Bankside
Soil & use & BGI
Embodied C
Operational (fuel use) emissions
Electric cutter suction?
Embedded (biogenic) C storage

UK rejoins EU science research scheme Horizon

12 minutes ago

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The UK is to rejoin the EU's flagship scientific research scheme, Horizon, the government has announced.

UK-based scientists and institutions will be able to apply for money from the £85bn fund from today.