Appendix

Mitigation potential of different CDR measures

Table 1. Summary of status, costs, potentials, risk and impacts, co-benefits, trade-offs and spillover effects and the role in mitigation pathways for CDR methods. TRL = Technology Readiness Level. (ch 12.p.58-61)

CDR option	Status (TRL)	Cost (USD tCO2 -1)	Mitigation Potential (GtCO2 yr)	Risk & Impacts	Co-benefits	Trade-offs and spill-over effects	Role in modelled mitigation pathways
DACCS	6	100–300 (84–386)	5–40	Increased energy and water use.	Water produced (solid sorbent DAC designs only).	Potentially increased emissions from water supply and energy generation.	In a few IAMs: DACCS complements other CDR methods.
Enhanced weathering (EW)	3–4	50–200 (24–578)	2–4 (<1–95)	Mining impacts. Air quality impacts of rock dust when spreading on soil.	Enhanced plant growth, reduced erosion, enhanced soil carbon, reduced pH, soil water retention.	Potentially increased emissions from water supply and energy generation.	In a few IAMs: EW complements other CDR methods.
Ocean alkalinity enhancement	1–2	40–260	1–100	Increased seawater pH and saturation that may impact marine life, possible release of nutritive or toxic elements and compounds, mining impacts.	Limiting ocean acidification.	Potentially increased emissions of CO2 and dust from mining, transport and deployment operations.	No data.
Ocean fertilisation	1–2	50–500	1-3	Nutrient redistribution, restructuring of the ecosystem, enhanced oxygen consumption and acidification in deeper waters, potential for decadal-to-millennial-scale return to the atmosphere of nearly all the extra carbon removed, risks of unintended side effects.	Increased productivity and fisheries, reduced upper ocean acidification.	Subsurface ocean acidification, deoxygenation, altered meridional supply of macronutrients as they are utilised in the iron-fertilised region and become unavailable for transport and utilisation in other regions, fundamental alteration of food Webs and biodiversity.	No data.
Blue carbon management in coastal wetlands	2–3	Insufficient data, estimates range from ~ 100 to ~ 10000	<1	If degraded or lost, coastal blue carbon ecosystems are likely to release most of their carbon back to the atmosphere, potential for sediment contaminants, toxicity, bioaccumulation and biomagnification in organisms, issues related to altering degradability of coastal plants, use of subtidal areas for tidal wetland carbon	Provide many non-climatic benefits and can contribute to ecosystem based adaptation, coastal protection, increased biodiversity, reduced upper ocean acidification, could potentially benefit human nutrition or produce fertiliser for terrestrial agriculture, anti-methanogenic	If degraded or lost, coastal blue carbon ecosystems are likely to release most of their carbon back to the atmosphere. The full delivery of the benefits at their maximum global capacity will require years to decades to be achieved	Not incorporated in IAMs, but in some bottom-up studies: Small contribution

				removal, effect of shoreline modifications on sediment redeposition and natural marsh accretion, abusive use of coastal blue carbon as means to reclaim land for purposes that degrade capacity for carbon removal.	feed additive, or as an industrial or materials feedstock.		
BECCS	5–6	15–400	0.5–11	Competition for land and water resources to grow biomass feedstock, biodiversity and carbon stock loss if from unsustainable biomass harvest.	Reduction of air pollutants, fuel security, optimal use of residues, additional income, health benefits and, if implemented well, can enhance biodiversity, soil health and land carbon	Competition for land with biodiversity conservation and food production	Substantial contribution in IAMs and bottom-up sectoral studies
Afforestation/ Reforestation	8–9	0–240	0.5–10	Reversal of carbon removal through wildfire, disease, pests may occur. Reduced catchment water yield and lower groundwater level if species and biome are inappropriate.	Enhanced employment and local livelihoods, improved biodiversity, improved renewable wood products provision, soil carbon and nutrient cycling. Possibly less pressure on primary forests	Inappropriate deployment at large scale can lead to competition for land with biodiversity conservation and food production.	Substantial contribution in IAMs and also in bottom-up sectoral studies.
Biochar		10–345	0.3–6.6	Particulate and GHG emissions from production, biodiversity and carbon stock loss from unsustainable biomass harvest.	Increased crop yields and reduced non-CO2 emissions from soil, and resilience to drought.	Environmental impacts associated particulate matter, competition for biomass resource.	In development - not yet in global mitigation pathways simulated by IAMs.
Soil carbon sequestration in croplands and grasslands	8–9	45–100	0.6–9.3	Risk of increased nitrous oxide emissions due to higher levels of organic nitrogen in the soil, risk of reversal of carbon sequestration.	Improved soil quality, resilience and agricultural productivity.	Attempts to increase carbon sequestration potential at the expense of production, net addition per hectare is very small, hard to monitor.	In development - not yet in global mitigation pathways simulated by IAMs. In bottom-up studies: Medium contribution.
Peatland and coastal wetland restoration	8–9	Insufficien t data	0.5–2.1	Reversal of carbon removal in drought or future disturbance, risk of increased methane emissions.	Enhanced employment and local livelihoods, increased productivity of fisheries, improved biodiversity, soil carbon and nutrient cycling.	Competition for land for food production on some peatlands used for food production.	Not in IAMs but some bottom-up studies with medium contribution.
Agroforestry	8–9	Insufficien t data	0.3–9.4	Risk that some land area lost from food production; requires high skills	Enhanced employment and local livelihoods, variety of products improved soil	Some trade-off with agricultural crop production, but enhanced biodiversity and resilience of the system.	No data from IAMs, but in bottom-up sectoral studies: Medium contribution

					quality, more resilient systems.		
Improved Forest management	8–9	Insufficient data	0.1–2.1	If improved management is understood as merely intensification involving increased fertiliser use and introduced species, then it could reduce biodiversity and Increase eutrophication.	In case of sustainable forest management, leads to enhanced employment and local livelihoods, enhanced biodiversity, improved productivity.	If it involves increased fertiliser use and introduced species, it could reduce biodiversity and increase eutrophication and upstream GHG emissions.	No data from IAMs, but in bottom-up sectoral studies: Medium contribution.

Source: IPCC- WG3 Chapter 12