

Natural Climate Solutions Literature Review

| N&WL Sector | Activity/Pathway | Description and/or examples, if needed | GHG Reductio | GHG Storage | Citation |
|-------------------|---|--|--------------|-------------|---|
| Forest/shrublands | Reduced degradation: forest and shrubland | Stopping further spread of invasive species and pathogens, managing for drought and extreme weather | x | x | 1, 2, 12, 26, 27 |
| Forest/shrublands | Avoided conversion of forest and shrubland | Avoided carbon emission resulting from changing forest types after deforestation; increasing carbon storage through continued forest and shrub growth | x | x | 1, 3, 4, 13, 14, 16, 17, 19, 20, 23, 25, 34 |
| Forest/shrublands | Fire management | Additional CO ₂ (and other GHG) sequestration by managed forest fire (prescribed fire or fire control) compared to unmanaged wildfire. Regeneration of biomass after fires. | x | x | 1, 3, 9, 12, 13, 19, 25, 34 |
| Forest/shrublands | Improved plantations | Reducing harvests, extending harvest rotation length, and improving the disposal of logging residues/slash through mulching/chipping of slash | x | x | 1, 3, 9, 12, 13, 14, 16, 19, 34 |
| Forest/shrublands | Improved/natural forest management in logged forest | Natural regeneration of natural forests and the reduction of CO ₂ emissions to the atmosphere due to the cessation of natural forest logging; extension of logging rotations; reduced-impact logging practices that avoid damage to non-commercial trees; voluntary | x | - | 1, 2, 3, 4, 9, 12, 14, 16, 19, 20, 24, 25, 34 |

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|--------------------------|--|---|----------|----------|--|
| | | certification programs; regulatory requirements that limit impacts from logging; improved land tenure | | | |
| Forest/shrublands | Reduced deforestation: forest and shrubland conservation; forest and shrubland protection | Includes all forms of deforestation not included in other activities/pathways; conservation of old-growth forest | x | x | 2, 9, 14, 24 |
| Forest/shrublands | Reforestation; restoration of forest and shrubland | Additional CO ₂ sequestration potential from restoring forest (including slash land, barren land, mountain, sloping cropland, or after wildfire) or shrubland to areas that were previously forest or shrubland. Improving forest and shrubland quality (e.g. replanting with native species). Also includes restoring tidal and riparian forest. | - | x | 1, 2, 3, 4, 9, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 30, 34 |
| Forest/shrublands | Afforestation | Encouraging conversion of other land cover types, including urban, to forest or shrubland Stopping further spread of | - | x | 2, 8, 9, 12, 16, 24, 34 |
| Urban forest | Reduced urban forest degradation | invasive species and pathogens, managing for drought and extreme weather | x | x | 2, 4, 9, 31, 32, 33 |

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|---------------------|--|---|----------|----------|-------------------------------------|
| Urban forest | Afforestation in developed areas | Encouraging conversion of other land cover types within urban areas to urban forest; incorporating more trees in urban areas | - | x | 1, 9, 15, 18, 19, 31, 33 |
| Wetland | Avoided wetland/peatland conversion; wetland/peatland protection | Avoided CO ₂ emission of above- and belowground biomass and soil carbon due to avoided loss of wetlands and peatlands | x | x | 1, 2, 3, 4, 9, 14, 17, 34 |
| Wetland | Reduced wetland, peatland, seagrass degradation | Improved water quality; improved development practices like reduction of sediment loads and temperature controls; avoiding hydrological disturbance | x | x | 2, 9, 12, 17, 23, 24, 25 |
| Wetland | Peatland restoration | Avoided oxidation and leaching of soil carbon balanced against methane emission due to soil rewetting | x | x | 1, 2, 3, 13, 16, 17, 18, 22, 23, 24 |
| Wetland | Reduced seagrass degradation and conversion; seagrass protection | Improved water quality; implementing sustainable coastal development practices and fisheries practices; reducing risk of disturbance | x | x | 2, 9, 12, 19, 36, 37, 38, 39, 40 |
| Wetland | Coastal and terrestrial wetland restoration | Avoided oxidation of soil carbon and enhanced ecosystem carbon sink due to soil rewetting in mangroves, salt marshes, and seagrass beds. | x | x | 1, 2, 3, 4, 9, 12, 17, 18, 22, 33 |
| Wetland | Seagrass restoration | Additional carbon sequestration in below-ground biomass and soil carbon by restoring seagrass | x | x | 19, 37, 39, 40 |

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|----------------------------|--|--|----------|----------|-------------------------------------|
| Grassland/rangeland | Avoided grassland conversion; grassland protection | Avoided CO ₂ emissions of belowground biomass and soil carbon by avoiding the conversion of grassland to urban or cropland | x | x | 1, 2, 3, 9, 16, 19, 23, 34 |
| Grassland/rangeland | Improved/rotational grazing | Optimizing grazing intensity, planting legumes in pastures, improving feed (inclusion of energy-dense feeds (e.g., cereal grains) in the ration), animal management (e.g., improved livestock breeds, increased reproductive performance, health, and liveweight gain); additional carbon sequestration in above- and belowground biomass and soil carbon by grassland fencing management and pasture sowing | x | x | 1, 3, 9, 12, 15, 16, 19, 23, 34, 54 |
| Grassland/rangeland | Reduced grassland degradation | Prevent conversion to invasive annual plant-and juniper-dominated systems | x | x | 9, 13, 35, 42, 43, 44, 45, 46, 54 |
| Grassland/rangeland | Grassland fire management | Additional CO ₂ (and other GHG) sequestration by managed fire; other practices that contribute to lower fire risk not captured by other activities/pathways | x | x | 24, 25, 34, 44, 45, 47 |
| Grassland/rangeland | Grassland restoration | Additional carbon sequestration in below-ground biomass and soil carbon by restoring deep-rooted native perennial grasses to areas impacted by invasive species. Restoring native riparian grass species. | x | x | 3, 9, 12, 13, 15, 16, 19, 34 |

Converting idle or unproductive cropland to native grasses.

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|------------------|--|---|----------|----------|------------------------------------|
| Croplands | Nutrient management | Improving crop nutrient management can reduce N ₂ O emission by reducing the overuse of fertilizer and improvement in N fertilizer use efficiency. Improve N application timing; replace N fertilizer with soil amendments such as compost or manure | x | - | 1, 3, 4, 9, 12, 13, 16, 19, 25, 34 |
| Croplands | Improve irrigation strategies and efficiencies | Irrigating at appropriate times reduces overall GHG emissions from soils | x | - | 9, 10, 48, 49 |
| Croplands | Prescribed/rotational grazing | Managing the harvest of vegetation with grazing and/or browsing animals to reduce crop residue and reduce GHG of providing other feed to livestock; increase organic carbon stocks in soils | x | x | 9, 12, 15, 19, 25, 34 |
| Croplands | No-till/reduced tillage | Limiting soil disturbance to manage amount, orientation, and distribution of crop and plant residue on the soil surface year-round | x | x | 4, 9, 11, 12, 13, 14, 15, 57 |

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| Croplands | Conservation agriculture/cover crops/strip cropping | Additional soil carbon sequestration by cover crops (i.e., green manure crops), crop rotation, edge-of-field herbaceous conservation practices, and strip cropping. Area suitable for planting cover crops includes cropland already planted with a perennial or winter crop. | - | x | 1, 3, 4, 9, 12, 13, 15, 16, 18, 19, 20, 21, 22, 34, 57 |
| Croplands | Biochar/compost amendments | Amending agricultural soils with biochar can increase the soil carbon pool by converting labile carbon to recalcitrant carbon through pyrolysis. Biochar mainly comes from crop residue. Applying composted organic wastes to cropland or pastures. | - | x | 3, 4, 12, 14, 15, 16, 19, 23, 24, 34, 48, 55, 56, 57 |
| Croplands | Legume crops/legumes in pastures | Increase carbon sequestration in soils and reduce need for application of N; growing forage grasses and legumes in a way that provides food sources for livestock while increasing soil carbon storage | - | x | 4, 5, 15, 16, 23, 34 |
| Croplands | Trees in croplands/agroforestry | Trees in windbreaks and riparian areas, alley cropping, and farmer-managed natural regeneration (FMNR) | - | x | 1, 2, 4, 9, 12, 15, 16, 18, 19, 20, 23, 24, 25, 28, 34 |
| Croplands | Avoid conversion of agriculture | Avoid conversion to urban land cover | x | x | 9, 50, 51, 52 |

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| Croplands | Silvopasture | Integrating trees, forage crops, and livestock systems on the same land through planting of trees and forages on same lands that animals graze | - | x | 4, 6, 9, 12, 15, 53 |
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