Appendix A - Natural Climate Solutions Descriptions

The table below provides descriptions compiled from peer-reviewed studies, scientific reports, and other Oregon resources to make them regionally specific. This list is necessary to be able to pair activities with metrics to track natural climate solution implementation in the state. The list includes descriptions of the NCS and the pathways through which they alter greenhouse gases, and whether they lead to GHG emission reductions, additional GHG sequestration and storage, or both. The main resources that support the descriptions are cited.

ODOE will review and update the literature review over time as new research is published and as staff engage with Tribes to add Indigenous Traditional Ecological and Cultural Knowledge (ITECK) and practices here or elsewhere in our work (as agreed upon with Tribes). More extensive coordination is needed with Tribes to first decide what may be appropriate to include and then to co-develop a process for working together to incorporate traditional practices and more. ODOE will be focusing on this aspect of NCS work in the second half of 2026.

Table A1: Draft Shared Terminology

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Forest Land	1	Reduced forest degradation in forest land	Sustainably stopping further spread of invasive species and pathogens; managing for drought and extreme weather; use of relevant climate smart forestry practices	Avoided emissions that would occur from degraded working or natural forests; additional sequestration and storage due to continued forest growth	x	x	x	1, 2, 12, 26, 56
Forest Land	2	Forest conservation, protection, and reduced deforestation in forest land	Retention of forest; forest protection including protection of old-growth forest stands; includes all forms of reduced deforestation not included in other activities/pathways	Avoided emissions that would occur from changing land categories after deforestation; additional sequestration and storage due to continued forest growth and protection	x	x	x	1, 3, 4, 13, 14, 16, 17, 19, 20, 23, 25, 33

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Forest Land	3	Wildfire risk reduction strategies in forest land	Use of fire as management tool (e.g., prescribed fire, pile burns, cultural burns, fire control) to reduce wildfire intensity; sustainable harvesting, thinning of living biomass to reduce fuels [Note: As used here, "cultural burns" is to be defined on a Tribe-by-Tribe basis in consultation with Oregon Tribes. Other traditional practices should be similarly defined in consultation with Oregon Tribes.]	Reduced emissions by use of managed fire (e.g., prescribed fire, pile burns, cultural burns, fire control) compared to unmanaged wildfire; fire management may generate emissions as low-intensity prescribed fires become more frequent but fire management also helps to protect carbon stocks in remaining stands; avoided emissions from establishing fuel breaks; potential for additional storage in harvested wood products as trees are harvested as pre- and post-fire treatments	x	-	x	1, 3, 9, 12, 13, 19, 25, 33, 55, 56, 69

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Forest Land	4	Climate-smart forestry practices	Climate-smart forestry practices include changing forest structure, management approaches, and incentivizing efforts to incorporate climate change into management decisions. May include reduced-impact logging practices that avoid damage to non-commercial trees; additional leave trees; modified harvest regimes; increased large-downed wood; increasing tree diversity	Additional carbon sequestration in above- and below-ground tree biomass by modified harvest regimes; potential avoided emissions from reducing damage to non-commercial trees; potential for additional storage in durable harvested wood products; increased security of long-term storage of carbon due to diversifying forest stands	x	x	x	1, 2, 3, 4, 9, 12, 13, 14, 16, 19, 20, 24, 25, 33

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Forest Land	5	Reforestation and restoration of forest	Restoration of forest; improving forest quality (e.g., replanting with native species, creating multi-story forests); reforesting formerly degraded lands	Additional sequestration and storage due to improving forest and adding trees to land [Note: NCS do not move ecosystems further from their natural state (e.g., non-forested wetlands, prairie, savannah that are not forested in the historical record)]	-	x	x	1, 2, 3, 4, 9, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 29, 33

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Forest Land	6	Afforestation	Encouraging conversion of other marginal or impaired land cover types (e.g., brown fields) to forest	Additional sequestration and storage due to adding trees to land [Note: NCS do not move ecosystems further from their natural state (e.g., non-forested wetlands, prairie, savannah that are not forested in the historical record)]	-	x	x	2, 8, 9, 12, 16, 24, 33

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Forest Land	7	Riparian area improvement	Planting native riparian zone tree and understory species; re-introducing beavers where ecologically appropriate; floodplain restoration; widening of riparian area buffers beyond minimum requirements that retain mature trees	Additional sequestration and storage due to restoring riparian vegetation and hydrological/geomorphic processes	-	x	x	58, 59
Developed Land	8	Forest conservation, protection, and reduced deforestation in developed land	Conservation; forest protection in developed land; includes all forms of reduced deforestation not included in other activities/pathways	Avoided emissions that would occur from loss of above- and below-ground biomass during deforestation on developed land; additional sequestration and storage due to continued forest growth in developed land	x	x	x	30, 31, 32

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Developed Land	9	Reduced forest degradation in developed land	Sustainably stopping further spread and/or reducing invasive species and pathogens; managing for drought and extreme weather	Reduced emissions due to managing, conserving and protecting existing trees and associated carbon pools in developed land; additional sequestration and storage from continued forest growth and conservation/protection in developed land	x	x	x	2, 4, 9, 30, 31, 32
Developed Land	10	Afforestation in developed land	Encouraging expansion of forest and greenspace in developed land	Additional sequestration and storage due to adding trees to developed land	-	x	x	1, 9, 15, 18, 19, 30, 32
Wetlands	11	Protection and avoided conversion of wetlands and peatlands	Protection of wetlands; prevention of wetlands/peatlands from conversion to other land uses	Avoided emissions from, and continued sequestration and storage in, above- and below-ground biomass and soil carbon due to avoided loss of wetlands and peatlands	x	x	x	1, 2, 3, 4, 9, 14, 17, 33

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Wetlands	12	Reduced wetlands and peatland degradation	Sustainably stopping further spread of invasive species and pathogens; improved inflow water quality; improved development practices that result in reduction of sediment loads and temperature; avoiding hydrological disturbance	Avoided emissions due to avoided degradation of wetlands and peatlands; additional sequestration and storage due to continued growth of peat-building vegetation	x	x	x	2, 9, 12, 17, 23, 24, 25

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Wetlands	13	Peatland restoration	Restoration of lands that were formerly peatlands through rewetting; restoration of natural hydrology	Avoided emissions from oxidation of soil due to re-wetting peatland soils; additional sequestration and storage due to restoring peat-building vegetation; additional soil carbon storage due to restoration of anaerobic conditions that slow decomposition	x	x	x	1, 2, 3, 13, 16, 17, 18, 22, 23, 24

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Wetlands	14	Protection and avoided conversion of seagrass	Improving water quality; implementing sustainable coastal development and fisheries practices; protecting seagrass from impacts of development and climate change	Avoided emissions of above- and below-ground biomass and soil carbon due to avoided degradation and/or loss of seagrass meadows; additional sequestration and storage due to continued seagrass growth and conservation/protection	x	x	x	2, 9, 12, 19, 35, 36, 37, 38, 39
Wetlands	15	Coastal wetlands restoration	Restoration of lands that were formerly coastal wetlands through rewetting, tidal reconnection, and/or restoration of natural hydrology	Avoided oxidation of soil carbon and additional sequestration and storage due to tidal reconnection, soil re-wetting, and restoration of wetland vegetation	x	x	x	1, 2, 3, 4, 9, 12, 17, 18, 22, 32

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Wetlands	16	Inland freshwater wetlands restoration	Restoration of lands that were formerly freshwater wetlands (e.g., emergent, scrub-shrub, forested, wet prairie) through rewetting, restoration of natural hydrology, plantings, and/or use of protective fencing	Avoided oxidation of soil carbon and additional sequestration and storage due to soil re-wetting and restoration of wetland vegetation	x	x	x	63, 64
Wetlands	17	Kelp forest restoration	Restoration of kelp forest through outplanting spores; removing urchin pressure; enabling natural recolonization by reversing drivers of decline	Additional sequestration and storage in biomass and soils due to additional kelp forest area, density, and ocean decomposition/burial	-	x	x	60, 61, 62

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Wetlands	18	Seagrass restoration	Restoration of seagrass through improvement of water quality, restoration of natural hydrology, and/or seagrass transplant	Additional carbon sequestration and storage due to increased area and density of seagrass meadows, and ocean decomposition/burial	x	x	x	19, 36, 38, 39
Grassland/ Arid Lands	19	Protection and avoided conversion of grassland and arid lands	Protection of grasslands and arid lands; prevention of grassland and arid lands from conversion to other land uses; includes all forms of grassland and arid lands protection not included in other activities/pathways	Avoided emissions of belowground biomass and soil carbon by avoiding the conversion of grassland or arid lands to land categories with lower relative amounts; additional sequestration and storage due to continued grassland and arid lands growth and conservation/protectio n	x	x	x	1, 2, 3, 9, 16, 19, 23, 33

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Grassland/ Arid Lands	20	Optimized grazing strategies	Optimizing grazing intensity on lands ecologically managed through less intensive practices like seasonal schedule, duration, etc.; fencing management [Note: These lands are generally not irrigated. Invasive species management is a separate NCS.]	Additional carbon sequestration in above- and belowground biomass due to increased plant development resulting from optimizing grazing; avoided soil emissions due to overgrazing and erosion of soils	x	x	x	1, 3, 9, 12, 15, 16, 19, 23, 33, 53, 70

Grassland/ Arid Lands	21	Reduced grassland and arid lands degradation	Sustainably stopping further spread of invasive species and pathogens; preventing conversion to invasive annual plant- or juniper-dominated systems; stopping further spread of invasive species	Avoided emissions of above- and below-ground biomass and soil carbon due to avoided degradation and/or loss of grasslands and arid lands; additional sequestration and storage due to continued grassland and arid lands growth and conservation/protection [Note: While juniper sequester and store carbon aboveground, they may reduce belowground carbon stocks compared to intact sagebrush ecosystems; removing juniper is in line with ecological management, fire risk reduction, and the NCS definition. There is also potential additional soil carbon storage when	x	x	x	9, 34, 41, 42, 43, 44, 45, 53

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
				removed juniper is buried.]				

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Grassland/ Arid Lands	22	Wildfire risk reduction practices in grassland and arid lands	Managing grassland and arid land fires (e.g., prescribed fire, fire control) compared to unmanaged wildfire; managing living biomass to reduce fuels; other practices that contribute to lower fire risk not captured by other activities/pathways	Additional sequestration by managed grassland or sagebrush steppe fire (prescribed fire, cultural fire, or fire control) compared to unmanaged wildfire; fire management may generate emissions as low-intensity prescribed fires become more frequent but fire management also helps to protect carbon stocks in remaining stands	x	-	x	24, 25, 33, 43, 44, 46

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Grassland/ Arid Lands	23	Grassland and arid lands restoration	Restoring deep-rooted native perennial grasses to areas impacted by invasive species and burns; restoring native riparian species; converting marginal cropland to regionally appropriate native grasses, forbs, shrubs	Additional sequestration from restoring grassland, sagebrush steppe or other arid land; additional carbon storage as restored plants grow	-	x	x	3, 9, 12, 13, 15, 16, 19, 33

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Cropland	24	Nutrient management	Substituting high emissions fertilizers with low emissions fertilizers; substituting chemical fertilizers with manure where appropriate; improving fertilizer and manure application methods; improving fertilizer and manure application timing	Reduced nitrous oxide emissions from changes in fertilizer chemistry and substitution with manure under appropriate conditions; reduced nitrous oxide emissions from reduced amount of fertilizer applied due to improved application methods and timing (e.g., with season and irrigation); additional soil carbon storage due to introduction of carbon to soils by manure	x	-	x	1, 3, 4, 9, 12, 13, 14, 15, 16, 19, 23, 25, 33, 47, 54

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Cropland	25	Composting	Application of composted organic wastes to cropland or pastures; substitution of chemical fertilizers with compost amendments	Additional soil carbon storage due to introduction of carbon to soils by compost [Note: Diverting carbon waste from landfills to compost may reduce sector-based emissions but GHG pathways listed here are focused on land-based emissions, removals, and storage]	-	-	x	72, 73, 74

Cropland	26	Optimized irrigation strategies	Alternative irrigation strategies and efficiencies affecting timing, method, and frequency	Irrigation strategies that are water efficient generally reduce nitrous oxide and methane emissions by limiting changes in soil moisture that are conducive to the production of these GHGs; additional storage from additional above- and below-ground biomass that contributes to soil carbon [Note: Improved irrigation strategies and efficiencies may improve growth of above- and below-ground biomass but do not increase storage in biomass if harvested. Additionally, improving irrigation efficiencies may reduce sector-based emissions but GHG pathways listed here are focused on	x	-	x	9, 10, 47, 48, 57, 71

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
				land-based emissions, removals, and storage.]				
Cropland	27	Prescribed and rotational grazing	Managing the harvest of vegetation with grazing and/or browsing animals on more intensively managed lands	Additional carbon storage in soils due to lower-intensity grazing and restoring nutrients to soils; avoided emissions due to overgrazing and disturbance	x	-	x	9, 12, 15, 19, 25, 33
Cropland	28	No till and reduced tillage	Limiting soil disturbance to manage amount, orientation, and distribution of crop and plant residue on the soil surface year-round	Additional carbon storage in soils and reduced emissions due to reducing soil exposure to oxygen	x	-	x	4, 9, 11, 12, 13, 14, 15, 54, 57

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Cropland	29	Cover crops, strip cropping, alley cropping	Use of cover crops, crop rotation, strip cropping, alley cropping on cropland to increase continuous soil cover, diversity of crop rotations, and reduce erosion risk	Additional soil carbon storage due to planting cover crops during the part of the year when the main crop is not growing; additional sequestration and storage in biomass due to conservation agriculture practices being applied in areas where crops are not grown; reduced soil carbon loss from erosion; reduced use of fertilizer and related emissions due to additional nitrogen fixation by legumes	x	x	x	1, 3, 4, 9, 12, 13, 15, 16, 18, 19, 20, 21, 22, 33, 54, 57

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Cropland	30	Trees in croplands and buffers	Integration of trees into croplands, such as windbreaks/shelter belts, water quality buffers, and stream buffers; edge-of-field herbaceous conservation practices; trees incorporated into croplands in ways not captured in other NCS; often referred to as agroforestry.	Additional sequestration and storage in above- and below-ground tree biomass due to integration of trees into croplands; increased soil carbon storage as biomass converts to soil carbon	-	x	x	1, 2, 4, 9, 12, 15, 16, 18, 19, 20, 23, 24, 25, 27, 33, 54
Cropland	31	Avoided conversion of cropland	Avoiding conversion to developed land	Avoided loss of sequestration and carbon storage from converting cropland to developed land; avoided emissions from loss of soil carbon during conversion	x	x	x	9, 49, 50, 51

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Cropland	32	Silvopasture	Integrating trees, forage crops, and livestock systems on the same land through planting of trees and forages on same lands that animals graze [Note: Silvopasture emphasizes trees planted in pasture used for livestock grazing.]	Additional sequestration and storage due to adding trees to land formerly devoted to pasture	-	x	x	4, 6, 9, 12, 15, 52

Land Category	ID	NCS Name	Description	GHG Pathway Description	Reduced or Avoided GHG Emission	GHG Sequestration	GHG Storage	Citation
Cropland	33	Optimized poplar plantations	Improving planting density and timing; improving clone selection; improving soil management; improving irrigation; extending harvest rotations [Note: Typically established on agricultural lands of lower productivity, poplar may be grown for multiple end uses or to treat wastewater.]	Additional sequestration in above- and below-ground tree biomass due to limited extension of rotation lengths; reduced emissions associated with poplar harvest and management; potential for additional storage in harvested wood products	x	x	x	65, 66, 67

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