

Table x.
Agriculture, Forestry, and Waste Management Technical Work Group
Summary List of Mitigation Options

	Mitigation Option	GHG Reductions (MMtCO ₂ e)			Net Present Value 2007-2020 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2010	2020	Total 2007-2020			
	AGRICULTURE, FORESTRY, AND WASTE MANAGEMENT						
AFW-1	Agricultural Soil Carbon Management						TBD
AFW-2	Biodiesel Production (incentives for feedstocks and production plants)						TBD
AFW-3	Ethanol Production						TBD
AFW-4	Incentives for Enhancing GHG Benefits of Conservation Provisions of Farm Bill Programs						TBD
AFW-5	Preserve Open Space & Working Lands						TBD
AFW-6	Forest Health Programs for Carbon Management						TBD
AFW-7	Expanded Use of Biomass Feedstocks for Energy Use						TBD
AFW-8	Afforestation and Reforestation Programs						TBD
AFW-9	Improved Management and Restoration of Existing Stands						TBD
AFW-10	Expanded Use of Wood Products for Building Materials						TBD
AFW-11	Programs to Promote Local Food & Fiber						TBD
AFW-12	Enhanced Solid Waste Recovery & Recycling						TBD
	SECTOR TOTAL AFTER ADJUSTING FOR OVERLAPS						
	REDUCTIONS FROM RECENT ACTIONS (table to be added below)						
	SECTOR TOTAL PLUS RECENT ACTIONS						

AFW-1. Agricultural Soil Carbon Management Programs

Mitigation Option Description

Use of conservation tillage/no-till and other soil management practices can increase the level of organic carbon in the soil, which sequesters carbon dioxide. In addition, some practices lower fossil fuel consumption through less intensive equipment use. Other practices, such as the application of bio-char can also increase the level of soil carbon and improve the soil. Organic farming methods may tend toward an increased use of these soil management practices. This option is designed to increase the acreage using soil management practices that lead to higher soil carbon content for both conventional and organic farming.

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other:**

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

Estimated GHG Savings and Costs per MtCO₂e

TBD

- **Data Sources:** TBD
- **Quantification Methods:** TBD
- **Key Assumptions:** TBD

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AFW-2. Biodiesel Production (incentives for feedstocks and production plants)

Mitigation Option Description

Use of biodiesel offsets the consumption of diesel fuel produced from oil (fossil diesel). Since biodiesel has a lower GHG content than fossil diesel (being derived from biogenic sources), overall GHG emissions are reduced. By producing biodiesel in the state for consumption within the state, the highest benefits can be achieved, since the fuel is transported over shorter distances to the end user. This option covers incentives needed to increase biodiesel production in Montana.

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other:**

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO₂e

TBD

- **Data Sources:** TBD
- **Quantification Methods:** TBD
- **Key Assumptions:** TBD

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AFW-3. Ethanol Production

Mitigation Option Description

Offset fossil fuel use (gasoline) with production and use of starch-based and cellulosic ethanol. Offsetting gasoline use with ethanol can reduce GHGs to the extent that the ethanol is produced with lower GHG content than gasoline. Provide incentives for the production of ethanol from crops, forest sources, animal waste, and municipal solid waste.

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other:**

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO_{2e}

TBD

- **Data Sources:** TBD
- **Quantification Methods:** TBD
- **Key Assumptions:** TBD

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AFW-4. Incentives for Enhancing GHG Benefits of Conservation Provisions of Farm Bill Programs

Mitigation Option Description

Agricultural lands that have been placed into conservation programs such as those in the US Farm Bill may sequester carbon dioxide as a result of implementing practices that build soil carbon over time. For example, land in the Conservation Reserve Program (CRP) is taken out of production and in the absence of tillage practices, soil carbon is sequestered over time. This policy seeks to extend the GHG benefits of current Farm Bill programs, looking particularly at land that is scheduled to retire from Farm Bill programs and potentially go back into production.

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other:**

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO_{2e}

TBD

- **Data Sources:** TBD
- **Quantification Methods:** TBD
- **Key Assumptions:** TBD

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AFW-5. Preserve Open Space & Working Lands

Mitigation Option Description

Reduce the rate at which existing crop/pasture, rangeland, and forests are converted to developed uses. The carbon sequestered in the soils and aboveground biomass of these open spaces and working lands is often much higher than in developed land uses. Policies that preserve open space and working lands provide additional GHG benefits by reducing the vehicle miles traveled that would otherwise occur from unwise or unplanned development.

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other:**

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO₂e

TBD

- **Data Sources:** TBD
- **Quantification Methods:** TBD
- **Key Assumptions:** TBD

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AFW-6. Forest Health Programs for Carbon Management

Mitigation Option Description

This policy seeks to increase forest carbon stocks through changes in management practices on existing forestland. The focus for this option is to identify elements within existing forest health programs that can be enhanced to achieve carbon benefits. These program elements would increase tree density, enhance forest growth rates, alter rotation times, or decrease the chances of biomass loss from fires, pests, and disease. Existing forest health programs could include the following: Ecosystem Health Risk Reduction Programs; Drought Management Programs; Flood and Riparian Management Programs; Watershed Management Programs; Habitat Management Programs; and Fire Management and Risk Reduction Programs. Note that there is a companion policy option (AFW-9. Improved Management and Restoration of Existing Stands) which promotes new programs for enhancing the GHG benefits on existing forested lands in Montana.

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other:**

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO_{2e}

TBD

- **Data Sources:** TBD
- **Quantification Methods:** TBD
- **Key Assumptions:** TBD

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AFW-7. Expanded Use of Biomass Feedstocks for Energy Use

Mitigation Option Description

This policy seeks to expand the use of biomass energy sources (from forests, agriculture, and other biomass resources). Biomass can be used to generate renewable energy in the form of liquid fuels (such as cellulosic ethanol), or through direct combustion to generate electricity, heat, or steam (through biomass combustion). Carbon in biomass is considered biogenic under sustainable systems; carbon dioxide emissions from biomass energy combustion are replaced by future carbon sequestration. Expanded use of biomass energy in place of fossil fuels results in net emissions reductions by shifting from high to low carbon fuels (when sustainably managed), provided the full lifecycle of energy requirements for producing fuels does not exceed the energy content of the renewable resource. Expanded use of biomass energy can be promoted through increasing the amount of biomass produced and used for renewable energy, and providing incentives for the production and use of renewable energy supplies.

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other:**

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO_{2e}

TBD

- **Data Sources:** TBD
- **Quantification Methods:** TBD
- **Key Assumptions:** TBD

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

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Level of Group Support

TBD

Barriers to Consensus

TBD

AFW-8. Afforestation and Reforestation Programs

Mitigation Option Description

Increase carbon stored in forests through expanding the forestland base. Establishing new forests, either on historically non-forested land (“afforestation”) or on land that has not been managed as forest land for some time (“reforestation”) increases the amount of carbon in biomass and soils compared to pre-existing conditions. Afforestation and reforestation accomplished with stocking/planting and other practices (e.g., soil preparation, erosion control, etc.) can increase carbon stocks above baseline levels and ensure conditions that support forest growth.

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other:**

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO_{2e}

TBD

- **Data Sources:** TBD
- **Quantification Methods:** TBD
- **Key Assumptions:** TBD

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AFW-9. Improved Management and Restoration of Existing Stands

Mitigation Option Description

This policy seeks to increase forest carbon stocks through changes in management practices on existing forestland. In contrast to the companion policy AFW-6, this policy is not restricted to working through existing forest health programs to promote new practices that increase tree density, enhance forest growth rates, alter rotation times, or decrease the chances of biomass loss from fires, pests, and disease. In addition, increasing the transfer of biomass to long-term storage in wood products can increase net carbon sequestration, provided a proper balance is maintained where enough biomass remains on site as residues to serve as nutrient inputs to the forest. Practices may include management of rotation length, biomass density, biomass energy use, and sustainable use of wood products.

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other:**

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO₂e

TBD

- **Data Sources:** TBD
- **Quantification Methods:** TBD
- **Key Assumptions:** TBD

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AFW-10. Expanded Use of Wood Products for Building Materials

Mitigation Option Description

This policy seeks to enhance the use and lifetime of durable wood products. Durable products made from wood prolong the length of time forest carbon is stored and not emitted to the atmosphere. Following their useful life which could last for decades, wood products disposed of in landfills may store carbon for long periods under conditions that minimize decomposition. Additional GHG benefits can be achieved when methane gas is captured from landfills and used as an energy source (carbon originally stored in wood products becomes methane during decomposition). Increasing carbon stored in the wood products pool increases carbon sequestration from forests. This can be achieved through improvements in production efficiency, product substitution, expanded product lifetimes, and other practices. In addition, increasing the efficiency of the manufacturing lifecycle for wood products enhances greenhouse gas benefits.

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other:**

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD.

Estimated GHG Savings and Costs per MtCO₂e

TBD

- **Data Sources:** TBD
- **Quantification Methods:** TBD
- **Key Assumptions:** TBD

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AFW-11. Programs to Promote Local Food & Fiber

Mitigation Option Description

Programs that promote the production, distribution and consumption of locally-grown food and fiber products reduce transportation and manufacturing emissions by offsetting the consumption of products with higher embodied energy. Food and fiber products consumed in the U.S. can travel thousands of miles before reaching a grocery or clothing store in the form of a final product. Increasing the percentage of locally grown food and fiber consumed in Montana will significantly reduce fossil fuel use and its associated GHG emissions.

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other:**

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO_{2e}

TBD

- **Data Sources:** TBD
- **Quantification Methods:** TBD
- **Key Assumptions:** TBD

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AFW-12. Enhanced Solid Waste Recovery & Recycling

Mitigation Option Description

Programs are needed to increase the quantity of materials recovered for recycling with specific attention given to materials with the greatest ability to reduce energy consumption during the manufacturing process and to materials that may be used as a fuel source (e.g., clean wood waste). Reducing the quantity of materials being landfilled reduces future landfill methane emissions potential, while recycling reduces emissions associated with the manufacturing of products from raw materials.

Mitigation Option Design

- **Goals:**
- **Timing:**
- **Coverage of parties:**
- **Other:**

Implementation Mechanisms

TBD

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings and Costs per MtCO₂e

TBD

- **Data Sources:** TBD
- **Quantification Methods:** TBD
- **Key Assumptions:** TBD

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

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Level of Group Support

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Barriers to Consensus

TBD

