



North Carolina
Climate Action Plan Advisory Group

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[SUMMARY TABLE THAT WILL ULTIMATELY BE APPENDED TO MITIGATION OPTIONS DOCUMENT AS QUANTIFICATION IS COMPLETED]

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

#	Mitigation Option Name	2010 GHG Savings (MMtCO ₂ e)	2020 GHG Savings (MMtCO ₂ e)	2007-2020 GHG Savings (MMtCO ₂ e)	Cost-Effectiveness (\$/MtCO ₂ e)
AFW-1	Manure Digesters/Other Waste Energy Utilization				
AFW-2	Biodiesel Production (incentives for feedstocks and production plants)				
AFW-3	Conservation Tillage/No-Till (carbon sequestration and reduced energy use)				
AFW-4	Preserve Open Space/Agricultural Land				
AFW-5	Agricultural Biomass Feedstocks for Electricity or Steam Production				
AFW-6	Policies to Promote Ethanol Production				
AFW-7	Forest Protection – Reduced Clearing and Conversion to Nonforest Cover				
AFW-8	Afforestation and/or Restoration of Nonforested Lands				
AFW-9 & 10	Expanded Use of Forest Biomass for Electricity, Heating and Liquid Fuels				
AFW-11	Landfill Methane and Biogas Energy Programs				
AFW-12	Increased Recycling Infrastructure and Collection				

[MITIGATION OPTIONS DESCRIPTION TEMPLATE TO BE COMPLETED FOR EACH HIGH PRIORITY MITIGATION OPTION, STARTING WITH THE “DESIGN” AND “DESCRIPTION” ELEMENTS]

AFW-1 Manure Digesters/Other Waste Energy Utilization

Mitigation Option Description

Manure Digesters / Other Waste Energy Utilization – The emissions inherent in the manure decomposition process may be captured and used as an energy source. In so doing, it is possible to sequester carbon, while reducing emissions from animal operations. However, the cost of emission capture, and energy production is generally higher than the cost of energy, making this option cost prohibitive for producers operating in a tight margin business.

Mitigation Option Design

Provide economic incentives / cost offsets for producers interested in manure to energy projects.

- **Goals:** To provide a cost offset / economic return for manure to energy projects
- **Timing:** 12 – 24 months
- **Coverage of parties:** ?
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per MtCO₂e

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

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, 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 North Carolina.

Mitigation Option Design

[Insert text as appropriate]

- **Goals:** *Produce enough biodiesel to offset 25% of NC's fossil diesel consumption by 2020.*
- **Timing:** *By 2010, produce enough biodiesel to offset 5% of fossil diesel consumption. By 2020, produce enough biodiesel to offset 12.5% of in-state fossil diesel consumption.*
- **Coverage of parties:**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per MtCO_{2e}

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-3 Conservation Tillage/No-Till

Mitigation Option Description

Use of conservation tillage/no-till practices increases the level of organic carbon in the soil, which sequesters carbon dioxide. Studies in NC have found the potential to sequester one ton of carbon per acre through conservation tillage/no-till practices¹ (equivalent to about 3.3 MtCO₂e/acre). In addition, fossil fuel consumption is lowered through less intensive equipment use. This option is designed to increase the acreage using conservation tillage/no-till practices.

Mitigation Option Design

[Insert text as appropriate]

- **Goals:** *By 2020, apply conservation tillage/no-till practices on 50% of cultivated lands that currently do not use these techniques.*
- **Timing:** *By 2010, apply conservation tillage/no-till methods on 20% of acres that currently do not use these practices. Achieve an increase to 50% of these acres by 2020.*
- **Coverage of parties:** NC Department of Agriculture, NC DENR, NCSU (CALs, CNR), NC Extension, other agricultural organizations and associations
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per MtCO₂e

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

¹ Source: <http://southeastfarmpress.com/news/030106-Naderman-conservation/>.

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-4 Preserve Open Space/Agricultural Land

Mitigation Option Description

Reduce the rate at which existing crop and rangelands are converted to developed uses. The carbon sequestered in soils and aboveground biomass is much higher in croplands than in developed land uses. Policies are needed to preserve working farms and forests (see AFW-7) from unwise and unplanned development.

Mitigation Option Design

State and national programs have been established to protect farm and forestland communities from conversion to development. Funding of state programs will help meet goals and act as a needed match to national programs. Programs are being investigated that help farmers transition lands to beginning farmers.

- **Goals:** Reduce the rate at which agricultural lands are converted to developed use by 50% by 2020 from current levels.
- **Timing:** By 2010, reduce the rate of conversion by 20% from current levels. By 2020, reduce the rate of conversion by 50%.
- **Coverage of parties:** NCDA&CS, NC Farm Bureau, NCDF, USDA-FS, NCFR, NCSU
- **Other:** North Carolina lost 4000 farms between 2004-2005. North Carolina loses over 33,000 acres of farmland each year.

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per MtCO₂e

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-5 Agricultural Biomass Feedstocks for Electricity or Steam Production

Mitigation Option Description

Offset fossil fuels with agricultural biomass as feedstock for electricity, steam, or heat generation. Agricultural biomass includes, but is not limited to, poultry litter, livestock manure, and crop residues.

Mitigation Option Design

- **Goals:** Increase agricultural biomass use for electricity, steam, and heat generation to utilize 10% of available biomass by 2010, 25% of available biomass by 2020 and 50% of available biomass by 2030. Voluntary, incentive based programs should be used to foster development of the industry and associated economic markets.
- **Timing:** See above.
- **Coverage of parties:** NCDA&CS, NCSU, NCA&T, Cooperative Extension, NC State Energy Office, DAQ, Utilities Commission, Electric Utilities, Livestock & Poultry Producers, Crop Producers.
- **Other:** Explore biomass utilization from electricity, steam, and heat generation using 100% biomass and/or co-firing with other feedstocks.

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per MTCO₂e

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-6 Policies to Promote Ethanol Production

Mitigation Option Description

Offset fossil fuel use with production and use of starch-based and cellulosic ethanol. Provide incentives for the production of ethanol from crops, forest sources, and animal waste.

Mitigation Option Design

- **Goals:** Several projects are being proposed that would result in the production of 150 million gallons of ethanol annually in North Carolina by 2008. Incentives could increase this amount *to a volume equivalent to offsetting gasoline consumption in the state by 10% in 2015 and 25% by 2025.*
- **Timing:** See above.
- **Coverage of parties:** NCDA&CS, Department of Administration, Motor Carrier Enforcement Division, DENR, Department of Commerce, NC Rural Center, NCSU, NCA&T, other state agencies, agricultural associations which represent producers of feedstock, petroleum industry trade groups, and various industry associations.
- **Other:** Identify incentives that encourage the growing of feedstocks, production of ethanol in North Carolina, and the utilization of ethanol all across the state.
 - Consider impact of expected increases in transportation costs on delivery of feedstocks to processing facilities, and how this effects optimal distribution of production infrastructure.

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per MtCO_{2e}

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-7 Forest Protection – Reduced Clearing and Conversion to Nonforest Cover

Mitigation Option Description

Reduce losses of forested lands and their carbon sequestration potential to development or poor forest management.

Mitigation Option Design

North Carolina is losing on average 61,390 acres of productive forest each year over the last 30 years to development and a lack of regeneration post-harvest. This amounts to a loss of about 10% since 1974, or about 0.36% annually compounded loss. Moreover of the forested land that is harvested each year (timberland) but not lost to development, about 25% is improperly harvested, greatly reducing its ability to generate value for forestland owners and its ability to sequester carbon in durable products.

- **Goals:** Achieve zero net loss of productive forest (timberland) by 2010. 5% gain in productive timberland by 2020.
- **Timing:** see goals above.
- **Coverage of parties:** NC Division of Forest Resources, NC Extension, NCSU College of Natural Resources, NC Forestry Association, NC Woodlands
- **Other:** The loss of forested lands is not consistent; between 1984 and 1990, there was actually an increase in the timberland area of 260,000 acres. This offers hope that one might reverse the overall trends in forest losses.

Implementation Mechanisms

- Use valuation, perhaps subsidize where use value is same as commercial value
- Higher value to forestry, see AFW 9 & 10
- Intent to Harvest Law: 6 months notice prior to contracting for tree removal on area greater than 1 acre (either forestry or development). Registering this intent with the Division of Forest Resources who will post on their website as well as with local newspaper. Intended to give forestry opportunity to compete with development as an economic activity, allows conservation groups, state opportunity to offer economic inducements to not harvest.
- Economic inducements to not harvest in priority zones.

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per MTCO₂e

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-8 Afforestation and/or Restoration of Nonforested Lands

Mitigation Option Description

Afforestation of nonforested areas (e.g., marginal agricultural land) or restoration of poorly managed forested lands can reduce GHG emissions by sequestering carbon at higher rates than the pre-existing condition. This option includes mechanisms for identifying lands for afforestation/restoration projects and incentives for conducting these projects.

Mitigation Option Design

[Insert text as appropriate]

- **Goals:** *Initiate afforestation/restoration projects on 50% of lands identified as candidates for these projects by 2020.*
- **Timing:** *By 2010 complete an identification of candidate lands and initiate projects on 10% of these lands. By 2020, initiate projects on at least 50% of candidate lands.*
- **Coverage of parties:**
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per MTCO₂e

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-9 & 10 Expanded Use of Forest Biomass and Better Forest Management for Electricity, Heating and Liquid Fuels

Mitigation Option Description

Direct the products of forest management to the highest value markets that currently exist and the currently unmarketable logging residue, culls and saplings to the appropriate processing centers for electricity, heating or liquid fuels. Increase the growth and yield of production from sustainably managed forest resources through site preparation, competition control, thinning, fertilization, and improved genetics. Increased benefits from forest management would increase forestland owner incomes and the probability of retaining forest cover.

Mitigation Option Design

The goal is the expansion of the production and use of wood products for solid wood products, fiber and fuel. The use of each of these offsets the use of fossil fuels in the production of substitute material (cement, steel for solid wood products, plastic for wood fiber) or directly in the case of fossil fuels for biomass energy. Having a market for relatively low value biomass products enables forest management for higher value solid wood products (see Additional Benefits and Costs section below for more background).

- **Goals:** *Initiate programs to increase forest productivity by 50% on half of NC timberlands by 2020.*
- **Timing:** *Begin 2007 and increase to full implementation of management programs on 50% of timberlands by 2020. Increase coverage to all managed timberlands by 2030.*
- **Coverage of parties:** Division of Forest Resources, NC Extension, NCSU College of Natural Resources, NC Forestry Association, NC Woodlands
- **Other:** [Insert text if/as appropriate]

Implementation Mechanisms

Below are some ideas for discussion, I am not committed to anyone:

- A renewable portfolio standard (depending on how it was defined) could generate a market for forest biomass, likewise some
- state incentive for cellulosic biomass to ethanol plant.
- A state carbon tax could incentivise renewable fuel production (liquid and electricity) and encourage the use of durable wood products over steel and concrete. The largest emitters of CO₂ (coal, liquid fuels, concrete, etc.) could be taxed on their emissions of fossil carbon. The funds could be allocated to carbon sequestration efforts in which forestry could compete cost effectively. FDP might be the mechanism to allocate carbon tax funds.

- Perhaps the state could participate in carbon trading and retain the carbon credits for any state funded carbon sequestration on private land through FDP.

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per MTCO_{2e}

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

The goal is to double the productivity of timberland for high value products and claim these products and energy as carbon offsets. We estimate that 1.75% (~57 year rotation) of the state timberland (totaling 17.6 million acres) is cut each year, so most timberland is currently under some sort of management, although much of it is of a very low intensity, indeed 25% of harvested stands continue to be high-graded. Our goal is to improve the management and productivity of these lands, especially on the 11.4 million acres held by non-industrial private forest land owners.

A standard application of fertilizer on otherwise unmanaged land can increase average productivity about 66% for hardwood and 77% for softwoods. Improved genetics continues to add 5 to 10% in productivity for each improved generation. Improved thinning and competition control can increase high value product growth by 20%. The logging residue that currently is left in the woods is about 15% of total productivity and this too would be increased by fertilization and could be used for biomass energy. While not all improvements are directly multiplicative, it is clear that we can double forest productivity and more than double carbon sequestration by forests in North Carolina.

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-11 Landfill Methane and Biogas Energy Programs

Mitigation Option Description

Provide incentives that will result in an increase in the recovery of landfill methane for use as an energy source.

Mitigation Option Design

Out of approximately 130 landfills in the state, only about 15 sites are currently recovering landfill methane for energy use.

- **Goals:** *Increase the number of landfills recovering methane as an energy source, such that 50% of the landfills in the state are operating a landfill gas to energy (LFGTE) project by 2020.*
- **Timing:** *By 2010 implement LFGTE at 10 sites; by 2020 achieve full implementation.*
- **Coverage of parties:** Municipal and county governments, private solid waste management companies, local economic development agencies, NC Department of Environment and Natural Resources, NC Department of Commerce, NC Utilities Commission.
- **Other:** No distinction is made between the direct use of landfill methane (e.g. for heat or steam) and the use of methane for electricity generation.

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per MTCO₂e

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]

AFW-12 Increased Recycling Infrastructure and Collection

Mitigation Option Description

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).

Mitigation Option Design

- **Goals:** Increase per capita recovery in the state 25% by 2020.
- **Timing:** Achieve a 10% increase in per capita recovery by 2010 and a 25% increase in per capita recovery by 2020.
- **Coverage of parties:** Municipal and county government, private solid waste and recycling management companies, commercial, industrial and institutional generators, NC Department of Environment and Natural Resources.
- **Other:** For the purpose of calculating per capita recovery, yard waste (yard trash as defined in G.S. 130A-290) and other vegetative debris are not included. Yard waste is banned from disposal in MSW and C&D landfills and experiences large annual fluctuations in both generation and recovery.

Implementation Mechanisms

[Insert text as appropriate]

Related Policies/Programs in Place

[Insert text as appropriate]

Types(s) of GHG Reductions

[Insert text as appropriate]

Estimated GHG Savings and Costs per MTCO₂e

[Insert text as appropriate]

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

Key Uncertainties

[Insert text as appropriate]

Additional Benefits and Costs

[Insert text as appropriate]

Feasibility Issues

[Insert text as appropriate]

Status of Group Approval

[Pending or Completed]

Level of Group Support

[Insert text as appropriate]

Barriers to Consensus

[Insert text as appropriate]