Chapter 6
Agriculture, Forestry, and Waste Management

Overview of GHG Emissions

The agriculture, forestry, and waste management (AFW) sectors are directly responsible for a small amount of North Carolina's current greenhouse gas (GHG) emissions. For agriculture, net emissions were 11.0 million metric tons (MMt) of carbon dioxide equivalent (CO_2e) in 2000. Agricultural emissions include methane (CH_4) and nitrous oxide (N_2O) emissions from the digestive systems of livestock (enteric fermentation), manure management, agriculture soils, and agriculture residue burning. As shown in Figure 6-1, emissions from agricultural soils and manure management in cattle account for the largest portions of agricultural emissions. The agricultural soils category includes N_2O emissions resulting from activities that increase nitrogen in the soil, including fertilizer (synthetic, organic, and livestock) application and production of nitrogen-fixing crops. Agricultural residue burning emissions are too small to show up in Figure 6-1.

Note that, in keeping with United States Environmental Protection Agency (US EPA) methods and international reporting conventions, the inventory and forecast covers human-caused (anthropogenic) sources of GHGs. There could be some natural sources of GHGs that are not represented in the inventory and forecast; however, these are not addressed in the Climate Action Plan Advisory Group (CAPAG) process. In the forestry sector, all emissions are treated as anthropogenic, since all of the State's forests are managed in some way (GHG reporting conventions are to treat all managed forests as anthropogenic sources). Sources such as carbon dioxide from forest fires and decomposing biomass are captured within the inventory and forecast (as part of the carbon stock modeling performed by the U.S. Forest Service [USFS]). However, methane emissions from anaerobic decomposition of biomass in forests are not currently captured due to a lack of data.

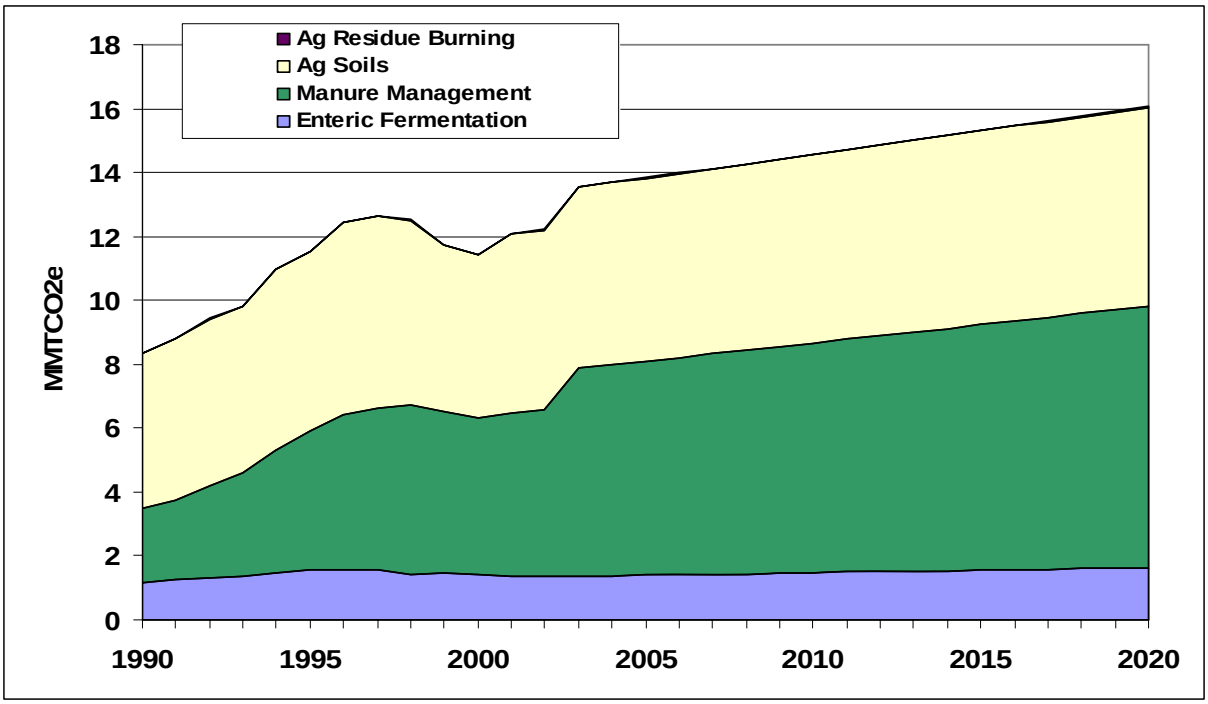
The contributions from agricultural soils and manure management have grown significantly since 1990, and they are projected to contribute 90% of agricultural emissions by 2020. Emissions from enteric fermentation have stayed the same since 1990 and are projected to stay relatively constant until 2020. GHG emissions from agricultural burning are estimated to continue to contribute a very small amount to the agricultural sector emissions.

Forestland emissions refer to the net carbon dioxide flux[1] from forested lands in North Carolina, which account for about 56% of the state's land area. As shown in Table 6-1, USFS data suggest that North Carolina forests captured and stored (sequestered) an average of 23.7 $MMtCO_2e$ per year from 1987 to 1997. The CO_2 is sequestered in forest carbon pools such as live trees, debris on the forest floor, and forest soils, as well as in harvested wood products (e.g., furniture and lumber) and the landfilling of forest products. The data show an accumulation of carbon in each

[1] "Flux" refers to both emissions of CO_2 to the atmosphere and removal (sinks) of CO_2 from the atmosphere.

of the forest carbon pools during this period.[2] These rates of sequestration are assumed to remain constant through 2020.

Figure 6-1. Historical and projected GHG emissions from the agriculture sector, North Carolina, 1990–2020



Enteric Fermentation = production of methane and from the digestive systems of livestock.

Table 6-1. GHG emissions (sinks) from the forestry Sector

Forest Carbon Pool	1990–2020* $MMtCO_2e$
Live and dead-standing trees and understory	–6.9
Forest floor and coarse woody debris	–0.8
Soils	–3.1
Harvested wood products and landfills	–13
Total	–23.7

* Based on USFS data from 1983 to 1997.

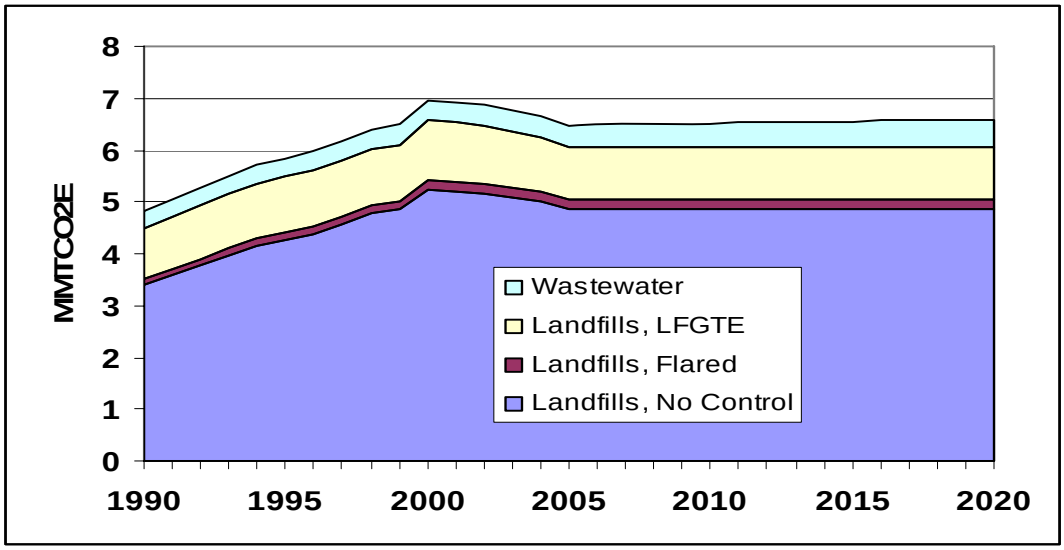
Figure 6-2 shows estimated historical and projected emissions from the management and treatment of solid wastes and wastewater. Emissions from waste management consist largely of CH_4 emitted from landfills, while emissions from wastewater treatment include both CH_4 and N_2O. Landfill emissions are broken down into three subsectors: uncontrolled landfills (no CH_4 collection or control), flared landfills (CH_4 collected and flared), and landfill-gas-to-energy

[2] This is not to say that the dead carbon pools (e.g., standing dead, forest floor) are sequestering carbon directly from the atmosphere. These pools accumulate carbon from trees/biomass that transition from a live carbon pool to a dead carbon pool.

(LFGTE) landfills (CH_4 collected and used as an energy source). Overall, the waste management sector accounts for less than 4% of North Carolina's total gross emissions per year from 1990 through 2020.

Opportunities for GHG mitigation in the AFW sector involve measures that can reduce emissions within the sector or reduce emissions in other sectors. For example, production of liquid biomass fuels can offset emissions in the transportation sector, while biomass energy can reduce emissions in the energy supply (ES) or residential, commercial, and industrial (RCI) sectors. Similarly, actions that promote solid waste recycling can reduce emissions within the sector (future landfill CH_4) as well as emissions associated with the production of recycled products (recycled products often require less energy to produce than similar products from raw materials).

Figure 6-2. Estimated historical and projected emissions from waste and wastewater management in North Carolina



The following are primary opportunities for GHG mitigation.

- *Control and utilization of CH_4* —Methane emissions from manure management can be reduced through the use of anaerobic digesters or other technology. Methane can also be collected from landfills. The CH_4 captured can then be used to create electricity, steam, or heat to offset fossil fuel use.
- *Protection of forest and agricultural land from conversion to developed use*—By protecting these areas from development, the carbon in aboveground biomass and belowground soil organic carbon can be maintained, and additional emissions of CO_2e to the atmosphere can be avoided. Indirectly, these measures also support the objectives of "smart" development by helping to direct more efficient development patterns (see TLU-1a).
- *Beneficial use of forest and agricultural biomass*—Expanded use of biomass energy from residue removed from forested areas during treatments to reduce fire risk, crop residues, or

purpose-grown crops can achieve GHG benefits by offsetting fossil fuel consumption (to produce either electricity or heat/steam).

- *Production of renewable fuels*—Production of renewable fuels, such as ethanol from crops, crop residue, forestry residue, or municipal solid waste, and biodiesel from crop seed oils can produce significant reductions when they are used to offset consumption of fossil fuels (e.g., gasoline and diesel in the transportation and land use (TLU) and RCI sectors). This is particularly true when these fuels are produced using processes and/or feedstocks that emit much lower GHG emissions than those from conventional sources.
- *Enhancement of forest carbon sinks*—Through programs that restore forests on lands that are currently not forested or under-stocked, additional CO_2 can be sequestered and stored in forest biomass. Similarly, in urban settings, expansion and maintenance of urban forests can increase sequestration and reduce energy consumption in buildings through shading and wind protection.
- *Retention of agricultural soil carbon*— Implement programs that incentivize growers to utilize cultivation practices that build soil carbon. By building soil carbon, CO_2 is sequestered from the atmosphere. Some cultivation practices also require the use of lower amounts of fossil fuels which further lowers GHG emissions.
- *Expansion of recycling infrastructure*—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.

Key Challenges and Opportunities

In the agricultural sector, options to promote biodiesel and ethanol production were found to offer substantial GHG reduction potential with an estimated reduction of 7.7 $MMtCO_2e$ by 2020 (combined benefit of Options AFW-2 and AFW-6). This is the benefit from in-state production using North Carolina–grown feedstocks and/or lower GHG production methods. The benefit is incremental to the benefit achieved via the renewable fuels standards incorporated in TLU-6. The benefits for both biodiesel and ethanol are based on production methods and feedstocks that have lower GHG emissions than conventional processes. For ethanol, this means processes that achieve much better GHG reductions than the production from conventional starch-based ethanol (the benefits of using ethanol from starch-based production are already accounted for under TLU-6). These processes could include cellulosic hydrolysis, biomass gasification combined with biofuels production, or alternative starch-based production methods (fermentation processes fueled by renewable fuels). Feedstocks for the fiber needed by this mitigation option could come from crop residue, forestry biomass, animal waste, and municipal solid waste. A major challenge for the success of AFW-6 is the production of a viable commercial-scale cellulosic ethanol industry by 2015.

For biodiesel, crop production should be promoted that results in significantly better vegetable oil yields than soybean oil, which is currently the most prominent feedstock in the United States. Candidates include vegetable oil crops like canola, sunflower, or jatropha that have much higher yields or emerging technologies like algal oil production.

The challenges for biofuels in North Carolina will be to identify and promote appropriate feedstocks for the production of these fuels. Limited analysis by the CAPAG suggests that sufficient feedstock for cellulosic ethanol is available to meet the mitigation option's objectives. There is limited capacity within the state for crop production to support all of the biodiesel production envisioned by the CAPAG's recommendation without the use of cropland that is currently used for other purposes. Hence, careful study is needed to identify available croplands and appropriate crops for seed oil production. Funding and/or incentives will be needed to support the development of alternative biofuels production capacity, including research and development on emerging feedstocks and scale-up of production facilities. The biofuels recommendations assume commercial-scale viability of new technologies (e.g., cellulosic ethanol, algal biodiesel) within the policy period; however, these assumptions are consistent with the timing horizons provided by industry and government experts.

As shown in the mitigation option descriptions in Appendix H, the implementation mechanisms developed for the agricultural sector should focus on methods that avoid conflict with potential future market-based GHG reduction programs. These include GHG credits that could be generated in the agricultural sector through renewable fuels projects, soil carbon projects, and possibly other project types. New regulations that mandate emission reductions or specific agricultural practices could limit North Carolina agriculture from taking part in emerging carbon markets. Implementation mechanisms that are incentive and education based can avoid these conflicts.

Combining the agricultural and forestry land preservation options (AFW-4a and AFW-4b), 4.6 $MMtCO_2e$/year in GHG emissions is estimated to be saved in 2020. To achieve these reductions, the state will need to work closely with local planning agencies, landowners, and nongovernmental organizations to identify lands suitable for acquisition/conservation easements and funding mechanisms. Another benefit to these options, which was not quantified, is the reduction in vehicle miles traveled due to more efficient development patterns (see TLU-1a).

Agricultural Biomass Feedstocks for Electricity or Steam Production (AFW-5) recognizes the need for incentives to build a biomass feedstocks collection and distribution infrastructure within the state. While the estimated emission reductions shown in Table 6-2 appear very small, these reductions account for the GHG reductions associated only with collection and transportation of locally derived biomass fuel compared with sourcing fossil fuel from out-of-state sources (assumed to be Pennsylvania coal). The GHG reductions that occur as a result of combusting biomass versus fossil fuels are captured in the energy supply and RCI sector policy recommendations for renewable energy.

Within the forestry sector, tree planting (afforestation and creating new forests) on non-forested lands (AFW-8) has the potential to deliver an additional 2.4 $MMtCO_2e$/year in 2020. The mitigation option aims at afforestation of lands that are primarily agricultural today. Hence, a key uncertainty in the implementation of this option is whether or not landowners will be willing to accept a new form of land management that has an investment structure different from that of agriculture (e.g., different from the Conservation Reserve Program under the U.S. Farm Bill).

Table 6-2. CAPAG-recommended mitigation options and results for the agriculture, forestry, and waste management sector

Option No.	Mitigation Option Name	GHG Reductions ($MMtCO_2e$)			Net Present Value 2007–2020 (Million $)	Cost-Effectiveness ($/tCO_2e$)	Level of Support*
		2010	2020	Total 2007–2020			
AFW-1	Manure Digesters & Energy Utilization	0.2	0.9	6.4	199	31	UC
AFW-2	Biodiesel Production (Incentives for Feedstocks and Production Plants)	0.2	0.8	5.1	286	56	UC
AFW-3	Soil Carbon Management (Including Organic Production Methods Incentives)	0.2	0.2	3.0	–16	–5	UC
AFW-4a	Preservation of Working Land – Agricultural Land	0.2	0.3	2.6	290	114	UC
AFW-4b	Preservation of Working Land – Forest Land (Formerly AFW-7)	1.7	4.3	36	112	3	UC
AFW-5	Agricultural Biomass Feedstocks for Electricity or Steam Production	0.009	0.02	0.2	10	54	UC
AFW-6	Policies To Promote Ethanol Production	0.9	6.9	38	200	5	UC
AFW-7	*Moved To AFW 4a*						
AFW-8	Afforestation and/or Restoration of Non-Forested Lands	0.2	2.4	15	128	9	UC
AFW-9&10	Expanded Use of Forest Biomass and Better Forest Management	1.5	5.9	48	–639	–13	UC
AFW-11	Landfill Methane and Biogas Energy Programs	1.1	2.9	20	23	1	UC
AFW-12	Increased Recycling Infrastructure and Collection	0.2	0.5	4.1	52	13	UC
AFW-13	Urban Forestry Measures	1.4	4.3	34	–376	–11	UC
	SECTOR TOTAL AFTER ADJUSTING FOR OVERLAPS	7.8	29	212	270	1	
	REDUCTIONS FROM RECENT ACTIONS (none)	0	0	0	0	0	
	SECTOR TOTAL PLUS RECENT ACTIONS	7.8	29	212	270	1	

$MMtCO_2e$ = million metric tons of carbon dioxide equivalent; UC = unanimous consent (all agree).

Expanded Use of Forest Biomass and Better Forest Management (AFW-9&10) are estimated to deliver 5.9 $MMtCO_2e$/year in GHG emissions savings in 2020. The emission savings are offered through additional carbon sequestration in forest ecosystems and durable wood products and through fossil fuel offsets from forest-based energy (GHG benefits of fossil fuel offsets are accounted for in AFW-6 and in the RCI and ES sectors). Success will be achieved through close cooperation between North Carolina, federal agencies (such as USFS), and private industry to identify biomass resources and effective end uses for the resources. Key uncertainties include (1) the unknown willingness of many landowners to increase levels of forest management even with increased incentives and (2) uncertainty in future timber markets.

Also in the forestry sector, AFW-13 (Urban Forestry Measures) has significant potential for GHG benefits (4.3 $MMtCO_2e$/year by 2020). This is a combination of direct benefits (CO_2 sequestration in urban trees) and indirect benefits (lower energy consumption in buildings through shading and wind protection) with the indirect benefits yielding most of the benefit. The biggest challenge confronting the success of this mitigation option is in containing the costs associated with tree planting and maintenance programs. For example, the costs of tree planting programs can vary substantially, depending on whether the labor is paid or unpaid. Hence, strong relationships between all of the related parties are needed (State Department of Forestry, utilities, communities, nongovernment organizations). Also, the ability to implement these programs in smaller and newer communities on previously cleared land may be limited by the administrative capacity of these communities.

Landfill Methane and Biogas Energy Programs (AFW-11) offers the potential for emission savings directly by controlling landfill CH_4 emissions and indirectly through offsetting fossil fuel use (2.9 $MMtCO_2e$/year by 2020). An additional benefit of this option includes reducing landfill gas emissions of volatile organic compounds, including some that are hazardous air pollutants. Challenges of this mitigation option include the location of landfills in very rural areas resulting in a lack of viable local end users for the gas; the possible treatment as a regulated utility can also prevent landfill-gas-to-energy projects from being developed.

Through implementation of AFW-12, additional GHG reductions can be achieved by increasing waste recycling programs in the state (0.5 $MMtCO_2e$/year). Through recycling, emissions are reduced by avoiding future landfill CH_4 and by lower energy consumption in the production of recycled products versus products made from raw materials. Emission reductions were estimated to cost \$13/tCO_2e through developing additional recycling infrastructure.

Overview of Mitigation Option Recommendations and Estimated Impacts

The CAPAG recommends a set of 12 mitigation options for the AFW sector that offer the potential for major emissions savings. As summarized in Table 6-2, the AFW mitigation option recommendations could lead to emissions reductions from reference case projections of 29 $MMtCO_2e$/year by 2020, cumulative reductions of around 213 $MMtCO_2e$ from 2007 through 2020, and a net cost of approximately \$270 million through the year 2020 on a net present value (NPV) basis.[3] The weighted average cost of saved carbon is estimated at \$1/tCO_2e. The CAPAG believes that this represents an extremely low cost to the North Carolina economy in implementing this package of options.

The CAPAG mitigation option recommendations described briefly here (and in more detail in Appendix H) result not only in significant emissions savings but also offer a host of additional benefits. These benefits include but are not limited to (1) support of North Carolina agricultural producers in the production of biofuels crops, development of new markets for agricultural by-products, and training/outreach covering energy production, organic farming, and other areas; (2) creation of jobs in the biomass energy and liquid biofuels feedstock and production

[3] The net cost savings are based on fuel expenditures, operations, maintenance, and administrative costs, and amortized, incremental equipment costs. All NPV analyses here use a 5% real discount rate.

industries; (3) healthier forests with lower fire risk by developing markets for forestry residue; and (4) research and development work to be conducted by North Carolina universities and other in-state organizations to support many of the options for this sector.

Among the important assumptions that have been made to support the development of the estimated benefits and costs are the commercial-scale viability of advanced biofuels feedstock sources and production methods. Additional uncertainties exist in these estimates that could benefit from additional detailed study, including the costs associated with biomass collection and transport and electricity transmission infrastructure needs (costs for grid connection to utilize electricity from renewable sources).

Agriculture, Forestry, and Waste Management Sector Mitigation Option Descriptions

The agriculture, forestry, and waste management sectors include emissions and mitigation opportunities related to the use of biomass energy, protection and enhancement of forest and agricultural carbon sinks, control of agricultural CH_4 emissions, production of renewable fuels, use of methods to increase soil carbon, achievement of afforestation on non-forested lands, and an increase in recycling.

AFW-1. Manure Digesters and Energy Utilization

The CH_4 emissions inherent from the anaerobic (without oxygen) decomposition process of manure and other wastes may be captured and used as an energy source. By doing this, it is possible to both reduce CH_4 emissions and offset fossil-based energy. However, the cost of emission captures and energy production can be higher than the value of the energy collected, making this option cost prohibitive for producers operating in a tight-margin business. This option covers programs to increase the number of CH_4 capture and energy recovery projects using manure or other wastes (including food processor wastes). This is increasingly done in "anaerobic digesters"—containers in which organic wastes break down releasing CH_4. The goal is to capture 20% of available CH_4 from confined animal operations by 2020 for use in energy projects. The mitigation option is designed to apply to hog farms and dairies in the state.

AFW-2. Biodiesel Production (Incentives for Feedstocks and Production Plants)

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 to offset 12.5% of North Carolina's fossil diesel consumption by 2020.

Note: This option is linked with Transportation and Land Use Option 6 (TLU-6) on Biofuels. AFW-2 seeks to achieve incremental GHG benefits beyond the TLU option by promoting in-state production of biodiesel using feedstocks with greater GHG benefits than the likely business-as-usual national production methods. In addition, North Carolina consumption of biodiesel produced in-state will produce better GHG benefits than biodiesel obtained from a national market because of the lower embedded CO_2 associated with transportation of biodiesel or its feedstocks from distant sources.

AFW-3. Soil Carbon Management (Including Organic Production Methods Incentives

Use of conservation tillage, no-till methods, cover cropping, and other soil management practices can increase the level of organic carbon in the soil, which stores/sequesters CO_2. In addition,

some practices lower fossil fuel consumption through less intensive equipment use. Other practices, such as the application of bio-char (charcoal or bio-mass–derived black carbon), can also increase the level of soil carbon and improve the soil.

Another element of this option is the promotion of certified organic production techniques. A number of studies have found that organic production of row crops results in GHG benefits, including levels of soil organic carbon higher than those from conventional production methods. This option is designed to increase the acreage using soil management and production practices that lead to higher soil carbon content and other GHG benefits. Specific goals include applying soil management practices on 20% of acres that currently do not use these practices by 2010 and increasing that amount to 50% by 2020.

AFW-4a. Preservation of Working Lands – Agricultural Land

This mitigation option seeks to reduce the rate at which existing crop and pasture lands are converted to developed uses. The carbon sequestered in soils and aboveground biomass is much higher in croplands than in developed lands. Policies are needed to preserve working farms and forests (see AFW-4b) from unwise and unplanned development. This option should be seen as a companion measure to TLU-1a (Land Development Planning).

State and national programs have been established to protect farm communities from conversion to development. Funding state farmland preservation programs will help meet goals and act as a needed match to national programs. Programs that help farmers transition lands to new/ beginning farmers are being investigated. The goal is to reduce the rate at which agricultural lands are converted to developed use by 50% by 2020 from current levels.

AFW-4b. Preservation of Working Lands – Forest Land

North Carolina has lost, on average, 61,390 acres of productive forest each year over the last 30 years to development and to a lack of post-harvest regeneration. This amounts to a loss of about 10% of the state's forestland since 1974, or an annually compounded loss of about 0.36%. The goal of this option is to reduce the rate of conversion of forestlands to non-forest lands by 10% by 2010 and 25% by 2020. When converted to developed areas, these areas contain lower amounts of biomass and its associated carbon. These areas also sequester less CO_2 than forested areas. When landowners don't have the incentive to retain their ownership, they often sell not only for development but they also sell for a forested tract as smaller parcels which may then be too small to allow forest management to be practical. On tracts too small and fragmented to be managed, the goals of AFW 9&10 cannot be achieved.

AFW-5. Agricultural Biomass Feedstocks for Electricity or Steam Production

This mitigation option seeks to offset fossil fuel use with agricultural biomass as feedstocks for electricity, steam, or heat generation. Agricultural biomass includes, but is not limited to, poultry litter, livestock manure, and crop residues, as well as energy crops (e.g., switchgrass and hybrid poplar). Offsetting fossil fuel use reduces the GHG emissions associated with these fuels. The

goals are to increase agricultural biomass usage 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.

Note: This option links with AFW-1, which promotes the use of anaerobic digesters and energy utilization. It explores additional opportunities for agricultural biomass energy use. This option also has linkages to ES-1 (Renewable Energy Incentives), ES-2 (Environmental Portfolio Standard), ES-10 (NC GreenPower Renewable Resources Program), and RCI-10 (Distributed Renewable and Clean Fossil Fuel Power Generation).

AFW-6. Policies to Promote Ethanol Production

Offset fossil fuel use (gasoline) with production and use of starch-based (e.g., corn) and cellulosic (plant fiber) ethanol. Offsetting gasoline use with ethanol can reduce GHGs to the extent that the ethanol is produced with lower GHG content. Provide incentives for the production of ethanol from crops, forest sources, animal waste, and municipal solid waste. 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. These goals are based on cellulosic ethanol being commercially viable by 2015.

Note: This option is linked to TLU-6, biofuels option, which focuses on mechanisms to increase biofuels consumption in North Carolina. The quantification of benefits and costs for each option takes into account the anticipated GHG reductions to be achieved by each.

AFW-8. Afforestation and/or Restoration of Non-Forested Lands

Afforestation, the planting of trees on lands that have not recently supported forests, has both carbon sequestration and other environmental benefits—storing more than one ton of carbon per acre each year (on-site, not including off-site storage and offsets in products). Afforestation delivers other important benefits such as improved wildlife habitat, reduced soil erosion and fertilizer runoff, and new recreational opportunities. Existing afforestation programs are underfunded for the task of this afforestation; typically, there is a long waiting list for landowner forestation projects. This option covers the provision of additional incentives to increase the rate of afforestation and restoration (e.g., increased stocking on poorly managed stands). The goals are to achieve afforestation projects on 40,000 acres of land by 2010 and a total of 540,000 acres by 2020.

AFW-9&10. Expanded Use of Forest Biomass and Better Forest Management

This mitigation option seeks to expand the production and use of wood products for solid wood products, fiber, and fuel. Such use offsets fossil fuel burning in the production of substitute materials (e.g., cement or steel for solid wood products and plastic for wood fiber). Wood can be substituted for fossil fuels directly in the case of biomass for energy. However, these GHG

benefits are not explicitly included in the analysis, which focuses on direct carbon sequestration in forests and in wood products. Having a market for relatively low-value biomass products enables forest management for higher value solid wood products. The increase in growth and yield of production from sustainably managed forest resources can be done through site preparation, competition control, thinning, fertilization, and improved genetics. The goal is to increase forest productivity by 100% on half of North Carolina timberlands by 2020.

AFW-11. Landfill Methane and Biogas Energy Programs

Provide incentives that will result in an increase in the recovery of landfill CH_4 for use as an energy source. Increasing recovery of landfill CH_4 reduces emissions of GHG and offsets the use of fossil fuels for commercial and industrial heat/steam generation or electricity production. Of approximately 130 open and closed landfills in the state, only about 15 sites are currently recovering landfill CH_4 for energy use. The aim of this mitigation option is to increase the number of uncontrolled municipal solid waste landfills recovering CH_4 as an energy source, such that 50% of the landfill gas being generated is controlled by 2020. This can be done through the development of additional LFGTE projects. For sites where LFGTE is not feasible, the aim is to implement flaring controls—burning the methane on-site to reduce GHG emissions.

Note: This option has linkages to ES-1 (Renewable Energy Incentives), ES-2 (Environmental Portfolio Standard), ES-10 (NC GreenPower Renewable Resources Program), and RCI-10 (Distributed Renewable and Clean Fossil Fuel Power Generation).

AFW-12. Increased Recycling Infrastructure and Collection

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 put in landfills reduces the potential for future landfill CH_4 emissions, while recycling reduces emissions associated with the manufacturing of products from raw materials. The aim of this mitigation option is to increase per capita recovery in the state by 25% by 2020.

AFW-13. Urban Forestry Measures

Urban forest cover protection and management offers a potentially cost-effective mechanism to reduce energy use, to store/sequester carbon, and to mitigate land use change (conversion of forest and agricultural lands to residential sites). Strategic planting of trees to shade houses and air conditioning units can yield energy savings of 15% to 50% on cooling costs. Planting shade trees can reduce summer cooling costs, with only marginal increases in winter heating costs, particularly in mild climates. In addition, depending on local conditions, tree planting can reduce wind speed and further reduce energy costs. The net direct impacts of tree planting are estimated to be positive, taking these factors into account.

Specifically, this mitigation option aims to increase urban tree cover by planting three additional trees (i.e., three more than planned) on all new construction sites starting in 2008 and by planting three new trees on 25% of existing housing units in 2007 by 2020, with the aim of achieving a 25% reduction in annual heating and cooling costs.