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VOLUME 3: USDA

How the U.S. Department of
Agriculture can use its existing
legal authority to reduce
greenhouse gas emissions
and increase clean energy use



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ADDRESSING CLIMATE CHANGE WITHOUT LEGISLATION

HOW THE UNITED STATES DEPARTMENT OF AGRICULTURE CAN USE ITS EXISTING LEGAL AUTHORITY TO REDUCE GREENHOUSE GAS EMISSIONS AND INCREASE CLEAN ENERGY USE

By

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EXECUTIVE SUMMARY

The agricultural industry is currently the fifth largest source of greenhouse gases in the U.S., contributing over eight percent of national emissions in 2012.¹ Reducing the industry’s greenhouse gas emissions will therefore be important to avoid significant temperature increases and other climatic changes in future years. The extent of future climate change can be further minimized by enhancing carbon sequestration on agricultural and forest lands. These lands currently absorb approximately thirteen percent of annual greenhouse gas emissions in the U.S.,² but have the capacity to absorb up to twenty five percent of annual emissions.³

As the federal agency overseeing the agricultural and forestry sectors, the U.S. Department of Agriculture can play an important role in mitigating climate change. The Department has already acted to reduce greenhouse gas emissions from agricultural activities and increase carbon sequestration on agricultural lands. However, its work is far from complete. This report identifies additional actions the Department can take, under existing law, to reduce emissions and increase sequestration.

Table 1 below outlines the key climate change mitigation actions currently being undertaken by USDA across five of its primary operating areas. The table also shows additional mitigation actions USDA could take in each area in the future.

Table 1: Key mitigation actions available to USDA

<u>USDA agency</u>	<u>Current actions to mitigate climate change</u>	<u>Possible future actions to mitigate climate change</u>
<i>National forest management</i>		
Forest Service	<ul style="list-style-type: none"> • Undertake restoration activities to enhance carbon sequestration in national forests • Reforest national forests damaged by fire or other disturbances to maintain carbon sequestration • Conduct hazardous fuel reduction in national forests to reduce the risk of wildfires emitting carbon dioxide • Support the use of forest products in place of fossil 	<ul style="list-style-type: none"> • Continue existing efforts to protect and restore national forests to enhance carbon sequestration • Permit increased use of trees and other plants in national forests as substitutes for fossil fuels in appropriate situations • Encourage the development of wind, solar, and other renewable energy projects in national forests • Limit greenhouse gas emis-

<u>USDA agency</u>	<u>Current actions to mitigate climate change</u>	<u>Possible future actions to mitigate climate change</u>
	fuels	<p>sions from energy projects in national forests</p> <ul style="list-style-type: none"> • Continue to reforest national forests cleared through human or natural processes
<i>Conservation programs</i>		
Forest Service	<ul style="list-style-type: none"> • Fund the protection of private forestland 	<ul style="list-style-type: none"> • Prioritize funding for the protection of forestland with high carbon sequestration potential
Natural Resources Conservation Service	<ul style="list-style-type: none"> • Fund projects aimed at increasing carbon sequestration on private forestland 	<ul style="list-style-type: none"> • Provide additional funding for projects to increase carbon sequestration on forestland • Fund projects to increase carbon sequestration on agricultural lands
<i>Agricultural assistance programs</i>		
Agricultural Research Service	<ul style="list-style-type: none"> • Research strategies to mitigate the climate impacts of agricultural production 	<ul style="list-style-type: none"> • Continue researching climate change mitigation strategies
National Institute of Food and Agriculture	<ul style="list-style-type: none"> • Support research and education programs to help agricultural producers reduce their climate impacts 	<ul style="list-style-type: none"> • Continue supporting research and education on climate-friendly agricultural production
Farm Service Agency	<ul style="list-style-type: none"> • Fund projects to enhance carbon sequestration on agricultural land • Support the production of crops for bioenergy 	<ul style="list-style-type: none"> • Stop funding agricultural projects that make a significant contribution to climate change • Encourage the adoption of climate-friendly agricultural practices
Risk Management	<ul style="list-style-type: none"> • Facilitate the development of 	<ul style="list-style-type: none"> • Continue developing climate

<u>USDA agency</u>	<u>Current actions to mitigate climate change</u>	<u>Possible future actions to mitigate climate change</u>
Agency (Federal Crop Insurance Corporation)	tools to assist agricultural producers to mitigate the risks of climate change	change mitigation tools <ul style="list-style-type: none"> • Encourage the use of mitigation tools by agricultural producers
<i>Consumer education programs</i>		
Center for Nutrition Policy and Promotion		<ul style="list-style-type: none"> • Provide consumers with information on the climate impacts of food production • Support educational programs to promote climate-friendly food choices
Agricultural Marketing Service		<ul style="list-style-type: none"> • Require the promotion of climate-friendly foods
<i>Rural development programs</i>		
Office of Rural Development	<ul style="list-style-type: none"> • Fund renewable energy and energy efficiency projects in rural areas • Support the biofuels industry 	<ul style="list-style-type: none"> • Provide additional funding for renewable energy and energy efficiency projects • Reduce funding for fossil fuel energy projects

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ABBREVIATIONS

AMAP	Agricultural Management Assistance Program
AMS	Agricultural Marketing Service
BLM	Bureau of Land Management
CCC	Commodity Credit Corporation
CEQ	Council on Environmental Quality
CNPP	Center for Nutrition Policy and Promotion
CRP	Conservation Reserve Program
DOE	Department of Energy
EIA	Energy Information Administration
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
FCIC	Federal Crop Insurance Corporation
FSA	Farm Service Agency
FY	Fiscal year
GW	Gigawatt
GWh	Gigawatt hour
MoU	Memorandum of Understanding
MW	Megawatt
MWh	Megawatt hour
NEPA	National Environmental Policy Act
NFS	National Forest System
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
ODPHP	Office of Disease Prevention and Health Promotion
REAP	Rural Energy for America Program
RD	Office of Rural Development
USDA	U.S. Department of Agriculture



Cropland in Monterey County, CA. Courtesy of Etienne Le

1. INTRODUCTION

The National Oceanic and Atmospheric Administration estimates that the concentration of carbon dioxide in the earth's atmosphere has increased by twenty percent over the last forty years, reaching 396.48 parts per million in 2013.⁴ This increase is primarily attributable to the burning of fossil fuels (i.e., coal, oil, and gas) in electricity generation, transportation, and other human activities.⁵ Other large anthropogenic sources of carbon dioxide emissions include manufacturing, agricultural production, and land clearing.⁶ These activities also emit methane, nitrous oxide, and other greenhouse gases.⁷

Significant scientific evidence indicates that greenhouse gas emissions are contributing to rising temperatures and other climatic changes. The third

National Climate Assessment, issued in May 2014, found that average temperatures in the U.S. have risen by 1.3 to 1.9°F since 1895 and could rise a further 10°F by 2100.⁸ Higher temperatures will lead to shifts in the amount, timing, and distribution of precipitation. While total precipitation will increase, regional differences will become more pronounced causing some areas to experience drying.⁹ Additionally, precipitation will increasingly be concentrated into fewer heavy downpours with longer dry periods in between.¹⁰ Thunderstorms and other extreme weather events will also become more frequent and severe.¹¹

These climatic changes will have far reaching consequences for the global environment. Higher temperatures will accelerate the melting of glaciers, leading to sea level rises that threaten to in-

undate coastal areas.¹² Coastal and other land will also be affected by shifts in precipitation, including more severe storms and other extreme events that cause flooding and erosion.¹³ Precipitation changes, together with rising temperatures, will also lead to declines in water quantity and quality.¹⁴

The third National Climate Assessment warned that climate change and resulting environmental damage will have “increasingly adverse impacts on the American economy.”¹⁵ One economic activity at particular risk is agricultural production.¹⁶ Research indicates that warmer temperatures, combined with increased soil erosion and reduced water availability, could adversely affect plant growth and thereby contribute to a decline in crop yields.¹⁷ Livestock output could also decline as higher temperatures alter animal’s behavior and physiology in ways that limit their ability to produce meat, milk, or eggs.¹⁸ Production problems will be exacerbated by extreme weather events, such as droughts, floods, and heat waves, which cause livestock deaths and crop failures.¹⁹ These and other climatic changes will also lead to more disease and pest outbreaks, further increasing the potential for livestock and crop losses.²⁰ The extent of these losses will depend on the severity of future climate change which, in turn, will depend on the amount of future greenhouse gas emissions.²¹

Agricultural producers have been able to adapt to past variations in cli-

mate by, among other things, changing crop rotations, planting times, water use, and pest management.²² Adaptation is likely to become more difficult in the future as climatic variations increase.²³ Nevertheless, agricultural producers are not merely powerless victims of climate change. On the contrary, producers have significant control over climate outcomes.

The agricultural sector currently emits greenhouse gases that cause climate change, primarily as a result of the cultivation of soils, production of livestock, management of waste, and combustion of fossil fuels.²⁴ Research by the U.S. Environmental Protection Agency (“EPA”) indicates that these and other agricultural activities contributed over eight percent of greenhouse gas emissions in the U.S. in 2012.²⁵ Significantly, agriculture was the largest domestic source of nitrous oxide – a greenhouse gas over 300 times more potent than carbon dioxide²⁶ – accounting for almost eighty percent of emissions in 2012.²⁷ In the same year, agriculture accounted for approximately thirty-six percent of national emissions of methane²⁸ – another potent greenhouse gas with a global warming potential²⁹ twenty one times that of carbon dioxide over a 100-year time horizon and even greater relative impacts over shorter periods.³⁰

Consequently, the agricultural sector will be an important source of greenhouse gas emissions reductions. Moreover, it may also enable emissions re-

ductions in other industries. Agriculture provides the feedstocks for renewable biomass that, when substituted for fossil fuels in the right circumstances, can lower greenhouse gas emissions from electricity generation.³¹ Research by the U.S. Department of Agriculture (“USDA”) and Department of Energy (“DOE”) indicates that over 1.3 billion dry tons of biomass could be produced annually on agricultural and forest lands.³² Moreover, these lands also provide ideal sites for wind, solar, and other low-emission generating systems.

Agricultural and forest lands can also play an important role in removing greenhouse gases from the atmosphere. Through the process of terrestrial carbon sequestration, carbon dioxide is absorbed by plants during photosynthesis and stored in biomass and soils.³³ According to the EPA, agricultural and forest lands in the U.S. sequestered 994 million tons of carbon dioxide equivalent in 2012, offsetting over thirteen percent of national emissions.³⁴ The National Farmers Union estimates that, in the future, these lands could absorb up to twenty five percent of annual greenhouse gas emissions in the U.S.³⁵

The Obama Administration has supported efforts to increase carbon sequestration and otherwise mitigate climate change. In his 2013 State of the Union Address, delivered on February 12, President Obama urged Congress to enact legislation providing a “market-based solution to climate change.”³⁶ After Congress failed to respond, the

President issued a new Climate Action Plan on July 25, 2013 outlining executive strategies to address climate change.³⁷ Under the Climate Action Plan, the executive will:

- reduce carbon dioxide and other greenhouse gas emissions by:
 - establishing carbon pollution standards for new and existing power plants;³⁸
 - encouraging electricity generation using renewable energy sources;³⁹
 - providing funding for advanced fossil energy projects;⁴⁰
 - reducing energy waste and enhancing energy efficiency;⁴¹
 - developing fuel economy standards for heavy-duty vehicles;⁴²
 - supporting research into biofuels, electric vehicles, and other low-emission transportation options;⁴³ and
 - controlling releases of methane,⁴⁴ and
- enhance carbon sequestration by ensuring the conservation and sustainable management of forests.⁴⁵

USDA is one of several executive agencies charged with implementing the Climate Action Plan. USDA is a Cabinet-level agency responsible for, among other things, protecting agricultural resources, overseeing agricultural production, supporting agricultural incomes, marketing food and other agricultural products, ensuring food safety, providing nutrition advice, and administering food subsidy programs. Additionally,

USDA is also involved in the management of federal, state, and private forestland.

Consistent with the Climate Action Plan, USDA has recently taken a number of steps to mitigate climate change. To this end, USDA has worked with agricultural producers to plant trees and other vegetation that sequester carbon.⁴⁶ To further increase carbon sequestration, USDA has undertaken projects designed to maintain, restore, and expand forest ecosystems.⁴⁷ At the same time, USDA has also sought to reduce carbon dioxide and other greenhouse gas emissions from forestry and agricultural activities. USDA has funded research and education programs to assist agricultural producers to identify and adopt climate-friendly practices.⁴⁸ For example, seeking to limit emissions from cropland, USDA has supported projects examining the impact of irrigation practices on soil carbon storage and worked with producers to implement practices that maximize storage.⁴⁹ Moreover, in an effort to promote cleaner livestock production, USDA has financed the adoption of bio-digester systems that capture methane emitted during the breakdown of manure and use it to generate electricity.⁵⁰ Additionally, USDA has also supported wind, solar, and other renewable generation projects.⁵¹

Building on progress to date, this report discusses additional actions USDA can take to mitigate climate change. The report identifies actions that can be taken under existing law. The identified

actions each result in reduced greenhouse gas emissions and/or increased carbon sequestration. However, beyond this finding of climate benefits, the report does not assess the merits of each action. Rather, it is left up to USDA to determine whether implementation of each action is a wise policy choice.

Relying on its existing legal authority, USDA could:

- **Reduce fossil fuel energy use and resulting greenhouse gas emissions.** USDA can encourage the use of sustainably-grown wood in place of steel, concrete, and other energy-intensive construction materials. For this purpose, USDA can permit increased harvesting of trees from national forests. USDA can require wood waste from tree harvests in national forests to be made available for use in electricity generation. To further increase electricity generation from woody biomass and other renewable sources, USDA can publish information on national forests' renewable energy potential. Additionally, USDA can also streamline the permitting process for renewable energy facilities in national forests.
- **Promote the sustainable management of forests to enhance carbon sequestration.** USDA can provide funding for activities aimed at protecting, restoring, and expanding tree cover on state and private forestland. Additionally, USDA can also invest in reforesting federally-

owned land cleared through logging and/or other activities.

- **Further expand carbon sequestration on agricultural lands.** USDA can provide agricultural producers with additional funding to plant trees and other vegetation that sequesters carbon.
- **Support additional greenhouse gas emissions reductions in the agricultural sector.** USDA can provide financial assistance for the adoption of climate-friendly practices and/or require the adoption of

such practices as a condition of financing other projects.

- **Encourage the production and consumption of climate-friendly foods.** USDA can report on the greenhouse gas emissions resulting from food production and promote low-emission foods.
- **Advance agricultural use of clean energy sources.** USDA can provide agricultural producers with additional funding to invest in renewable generation and energy efficiency.

2. THE U.S. DEPARTMENT OF AGRICULTURE

USDA is a Cabinet-level department that oversees the agricultural and forestry industries. The department includes seventeen agencies with responsibility for various aspects of agricultural production, food supply, resource management, and community development. These are:

- Agricultural Marketing Service
- Agricultural Research Service
- Animal and Plant Health Inspection Service
- Center for Nutrition Policy and Promotion
- Economic Research Service
- Farm Service Agency
- Food and Nutrition Service
- Food Safety and Inspection Service
- Foreign Agricultural Service
- Forest Service
- Grain Inspection, Packers, and Stockyards Administration
- National Agricultural Library
- National Agricultural Statistics Service
- National Institute of Food and Agriculture
- Natural Resources Conservation Service
- Risk Management Agency
- Rural Development

These agencies perform a wide range of functions designed to, among other things, protect forest and agricultural lands, support increased agricultural production, expand markets for

food and other agricultural products, enhance food safety, and improve health and nutrition.⁵² The agencies' principal activities include undertaking research, conducting education and outreach programs, and providing technical and financial assistance.

Total outlays by all USDA agencies in fiscal year ("FY") 2013 were \$156 billion.⁵³ The majority of outlays are associated with nutrition support programs, which aim to improve health and eliminate hunger by providing consumers with dietary information and increasing their access to food.⁵⁴ In FY 2014, USDA will spend \$79 billion on the Supplemental Nutrition Assistance Program which helps over forty-five million low-income individuals to purchase food.⁵⁵ Another \$7 billion will be spent to provide food and nutrition advice to nine million individuals participating in the Special Supplemental Nutrition Program for Women, Infants, and Children.⁵⁶

Significant expenditures are also made under farm and commodity programs designed to support agricultural incomes.⁵⁷ USDA provides a range of grants, loans, and other financial support to agricultural producers. Since 2009, USDA has made over 164,000 loans, with a combined value of almost \$23 billion, to enable the purchase or expansion of farming operations.⁵⁸ In many cases, the recipients are beginning farmers who do not qualify for commercial credit.⁵⁹ In other cases,

they are existing farmers who have suffered financial setbacks due to natural disasters and/or other unanticipated events.⁶⁰ To further assist such farmers, USDA also operates a number of disaster and emergency assistance programs.⁶¹ One such program is the Federal Crop Insurance Program, which insures agricultural producers against losses due to droughts, floods, and other natural disasters. Over the last five years, USDA has paid out roughly \$48 billion in crop insurance indemnities.⁶²

USDA also oversees a number of conservation programs that assist agricultural producers to address environmental problems, such as high rates of soil erosion and declines in water quantity and quality.⁶³ While each program is different, they typically provide financial and/or technical assistance to agricultural producers to implement conservation practices. For example, the Conservation Reserve Program (“**CRP**”) pays agricultural producers to replace crops on environmentally sensitive land with long-term resource conserving co-

vers.⁶⁴ USDA’s budget for FY 2014 provides over \$2.1 billion in funding for the CRP, making it the largest conservation program.⁶⁵ Other large conservation programs include the Environmental Quality Incentives Program (“**EQIP**”), which promotes the adoption of environmentally-friendly land management practices, and the Conservation Stewardship Program, which supports action to improve the quality of air, water, soil, and other natural resources.⁶⁶

As well as protecting agricultural resources, USDA also works to conserve forestland. USDA operates the world’s largest forest research program, developing practices and technologies to improve the health of forests.⁶⁷ Based on this research, USDA takes steps to restore federally-owned forestland.⁶⁸ Additionally, USDA also supports restoration activities on non-federal forestland.⁶⁹ To this end, USDA provides non-federal landowners with financial and technical assistance to maintain and expand forested areas.⁷⁰

3. NATIONAL FORESTS AND GRASSLANDS

KEY POINTS

- National forests can play an important role in supporting the transition to a low-carbon economy. Forest usage must, however, be sustainable, weaving together the need to protect and enhance the use of forestlands to store carbon as well as the need to use trees and other plants in some situations as a substitute for fossil fuel.
- USDA, through its Forest Service, manages approximately 193 million acres of federally-owned forestland. The Forest Service may permit the use of this land for recreation, tourism, agriculture, logging, energy production, and other activities.
- The Forest Service may permit increased logging in national forests to produce lumber for use in construction and other applications. By reducing reliance on steel, concrete, plastic, and other construction materials produced using fossil fuels, this may help to limit greenhouse gas emissions.
- Fossil fuel use, and resulting greenhouse gas emissions, can be further diminished by increasing electricity generation from woody biomass. To this end, the Forest Service may require wood waste from logging in national forests to be diverted to biomass generators.
- The Forest Service can also encourage the use of other renewable energy sources in national forests. Seeking to achieve this goal, the Forest Service has recently clarified the permitting process for wind energy projects in national forests. In the future, the Forest Service could provide similar guidance on the permitting of solar and other renewable energy projects.
- The Forest Service can further support such projects by maintaining a current inventory of wind, solar, and other renewable energy sources in national forests. This would provide valuable information on national forests' renewable generating potential and encourage the development of generating facilities therein.
- The Forest Service can also influence the production and use of conventional fuels such as oil and gas. The Forest Service could collect and publish information on the greenhouse gas emissions resulting from oil and gas production, transportation, and use. The Forest Service could require oil and gas companies to reduce these emissions by, for example, installing emissions control technologies.

National forests and grasslands can play an important role in the global carbon cycle. Through the process of terrestrial carbon sequestration, atmospheric carbon dioxide is absorbed by trees, grasses, and other plants during photosynthesis and stored in stems, branches, leaves, and roots.⁷¹ When the plants die, the stored carbon is released back into the atmosphere.⁷² Where death is due to fire, the release occurs immediately and rapidly.⁷³ However, in other cases, carbon may first be transferred to the soil (i.e., when dead vegetation is added to the surface) and then released slowly (i.e., as the vegetation decomposes).⁷⁴

Overall, forests generally sequester more carbon dioxide than they release. The rate of carbon sequestration in forests differs depending on local conditions, including climate patterns, vegetative cover, and soil type.⁷⁵ Boreal forests⁷⁶ typically have the highest sequestration rates, storing an average of 182 tons of carbon per acre.⁷⁷ Forests in tropical areas⁷⁸ also store significant carbon, averaging almost 110 tons per acre.⁷⁹ Carbon storage in temperate forests⁸⁰ is lower, averaging just sixty-eight tons per acre.⁸¹

Carbon sequestration rates are also affected by the practices adopted by forest managers in establishing, maintaining, and harvesting trees. While the effects are highly site specific, some management practices are more likely to reduce carbon sequestration than others.⁸² For example, seeking to pro-

tect trees and other vegetation, managers often exclude fire from forest ecosystems.⁸³ This may result in overcrowding in forests, inhibiting tree growth and associated carbon sequestration.⁸⁴ Moreover, by causing a build-up of flammable materials, it may also lead to catastrophic wildfires that emit substantial carbon dioxide.⁸⁵

Recognizing this, USDA's Forest Service has committed to managing national forests so as to minimize net carbon dioxide emissions therefrom.⁸⁶ To that end, the Forest Service seeks to prevent catastrophic wildfires that emit carbon dioxide by using mechanical treatments and prescribed burns to remove hazardous materials from forests.⁸⁷ Where fires and/or other disturbances occur, the Forest Service ensures the prompt replacement of trees to enhance carbon sequestration in forests.⁸⁸ To further increase forests' ability to sequester carbon, USDA also undertakes thinning⁸⁹ and other restoration activities that accelerate tree growth.⁹⁰ Vegetation killed during restoration and other actions is typically removed from the forest and often used as a source of energy and wood products, reducing carbon dioxide emissions due to decomposition.⁹¹

In the future, national forests may be used in ways that reduce economy-wide carbon dioxide emissions. Wood and other forest plants can be substituted for carbon-intensive fossil fuels in the production of energy and materials. However, such use must be balanced

against the need to protect and expand forest cover to increase carbon sequestration.

Currently, much of the energy used in the U.S. is obtained from fossil fuels. According to the U.S. Energy Information Administration (“EIA”), the two most polluting fossil fuels – coal and oil – accounted for almost fifty five percent of national energy consumption in 2013.⁹² The EPA estimates that coal- and oil-fired power plants emit approximately 1.12⁹³ and 0.84⁹⁴ tons of carbon dioxide per megawatt hour (“MWh”) of electricity generated respectively. In addition, electricity generation using coal and oil also emits substantial nitrogen oxides, sulfur dioxide, and methane.⁹⁵

These emissions can be reduced by using wind, solar, and other renewable energy sources to generate electricity. Unlike fossil fuel power plants, most renewable generating systems do not emit carbon dioxide and/or other greenhouse gases. However, notwithstanding this, renewable generation is not a perfect solution to climate change. The production and installation of renewable systems may result in carbon dioxide emissions.⁹⁶ Moreover, land clearing in the area of such installations may destroy vegetation that would otherwise remove carbon dioxide from the atmosphere.⁹⁷ Land clearing may also have other adverse environmental effects, destroying wildlife habitat and thereby reducing biodiversity.⁹⁸ Nevertheless, renewable generating systems typically cause less

environmental damage than fossil fuel power plants.⁹⁹

Significant renewable generating potential exists in national forests and grasslands. A 2005 study by USDA’s Forest Service and DOE’s National Renewable Energy Laboratory (“NREL”) found that 585 gigawatts (“GW”) of solar energy and 139 GW of wind energy could be generated in national forests and grasslands.¹⁰⁰ To put these figures in perspective, total installed generating capacity in the U.S. in 2011 was 1,062 GW.¹⁰¹ Of this, just 0.3% (3.2 GW) was generated from solar energy and 5.5% (59 GW) was generated from wind energy.¹⁰²

National forests and grasslands also contain large amounts of woody biomass that can be used in place of fossil fuels in electricity generation and other applications. Focusing solely on “smokestack” emissions, woody biomass offers a “closed carbon cycle,” meaning that the carbon dioxide released when it is burned can be recaptured by new biomass growing in its place.¹⁰³ Consequently, lifecycle emissions from electricity generation using biomass tend to be lower than those from fossil fuel generation.¹⁰⁴ Research by USDA and DOE indicates that 368 million dry tons of biomass can be sustainably produced on forestland in the contiguous U.S. each year.¹⁰⁵ This could be used to generate approximately 231,000 gigawatt hours (“GWh”) of electricity;¹⁰⁶ enough to meet the annual needs of over twenty one million house-

holds.¹⁰⁷ Generating an equivalent amount of electricity from fossil fuels would require almost 125 million tons of coal and emit almost 260 million tons of carbon dioxide.¹⁰⁸

Woody biomass can also be substituted for fossil fuels in a range of other applications. By way of example, wood can be used instead of plastic and other fossil fuel based materials in construction. Moreover, wood waste can be converted into gaseous or liquid fuels, which can be used to produce chemicals currently derived from fossil fuels.¹⁰⁹ In addition, these biofuels can also be used in the transportation sector.¹¹⁰ However, the climate benefits of some biofuels applications are disputed.¹¹¹

Notwithstanding its potential benefits, increasing the use of wood in electricity generation and other applications may lead to unsustainable rates of tree harvesting. Removing too many trees too quickly can reduce forests ability to sequester carbon. Avoiding this outcome requires care to ensure that wood usage is sustainable, balancing the need to protect and expand forest cover to maintain carbon sequestration and the need to substitute trees and other plants for fossil fuels in appropriate situations.

This chapter discusses ways in which USDA can promote the sustainable use of national forests to support the transition to a low-carbon economy. USDA's authority with respect to the national forest system ("**NFS**") is outlined

in section 3.1 below. Section 3.2 then identifies actions USDA can take, pursuant to its existing authority, to encourage the use of biomass and other fossil fuel alternatives found on NFS land.

3.1. USDA'S AUTHORITY OVER NATIONAL FORESTS AND GRASSLANDS

USDA's Forest Service manages approximately 193 million acres of public land designated as national forests and grasslands (together "**NFS land**").¹¹² These lands conserve natural, cultural, and historical features, protect fish, wildlife, and plant species, and provide water, timber, mineral, and energy resources.

Multiple-Use Sustained-Yield Act, section 1 (16 U.S.C. § 528) requires national forests to be maintained for outdoor recreation, range, timber, watershed, and fish and wildlife purposes. Consistent with this requirement, the Forest Service may permit the use of NFS land for recreation, tourism, agriculture, logging, water transportation, energy production, and other activities.

3.2. ACTIONS AVAILABLE TO USDA TO PROMOTE THE USE OF LOW-CARBON RESOURCES FROM NATIONAL FORESTS

As the federal agency responsible for managing national forests and grasslands, USDA's Forest Service can play an important role in reducing fossil fuel use and resulting carbon dioxide emissions.

National forests and grasslands contain large amounts of wood and other biomass that can be substituted for fossil fuels in a wide range of applications. There are several actions the Forest Service can take, pursuant to its existing legal authority, to increase the use of this material. Specifically, the Forest Service may encourage the sustainable harvesting of wood from forests and grasslands for use in construction. Wood that is unsuitable as a construction material may be used as a fuel for electricity generation, transportation, and other purposes.

The Forest Service can also promote increased use of other low-carbon fuels found in national forests. To this end, the Forest Service could identify wind, solar, and other renewable energy sources on NFS land and research the use thereof in electricity generation. Moreover, the Forest Service could also simplify the permitting process for renewable generating facilities on such land.

In addition to encouraging renewable energy development, the Forest Service can also support cleaner fossil fuel production. The Forest Service may reduce greenhouse gas emissions from oil and gas production directly by, for example, requiring developers to install emissions controls. Similar benefits may also be achieved through more indirect channels, including by reporting on the climate impacts of oil and gas production and options for mitigating those impacts.

3.2.1. ENCOURAGING INCREASED USE OF TIMBER

National forests contain timber that may be used as lumber in the construction industry. Using sustainably-grown lumber in place of steel, aluminum, concrete, and similar materials when constructing buildings and other structures can have a number of climate benefits. The production of lumber uses substantially less fossil fuels than other building materials, resulting in fewer carbon dioxide and other greenhouse gas emissions.¹¹³ Additionally, it can also reduce emissions in other ways. For example, harvesting trees to produce lumber may reduce the risk of catastrophic wildfires that emit significant carbon dioxide.¹¹⁴ Such harvests may also lead to additional carbon sequestration, particularly in mature forests where tree growth is slow.¹¹⁵

Recognizing these benefits, the Forest Service may support the use of timber in construction and other activities. To this end, the Forest Service may increase timber sales in national forests. Section 14(a) of the National Forest Management Act of 1976 (16 U.S.C. § 472a(a)) authorizes the Secretary of Agriculture to sell trees, portions of trees, and other forest products located in national forests. The Secretary of Agriculture has delegated this authority to the Forest Service. Pursuant to this delegation, the Forest Service sells trees through a competitive bidding process.¹¹⁶ The highest bidder, whose bid

is equal to or exceeds the appraised value of the trees,¹¹⁷ is awarded a contract authorizing the harvesting thereof over one or more years.¹¹⁸

Timber harvests in national forests have declined substantially over the last three decades. According to the Forest Service, the volume of timber harvested from national forests peaked in FY 1987 at over 12.7 billion board-feet.¹¹⁹ Harvests have fallen by over eighty percent since this time, with just 2.4 billion board-feet of timber harvested in FY 2013.¹²⁰ This has prompted numerous members of Congress to call for an increase in timber harvests in national forests.¹²¹

Timber harvesting in many national forests is restricted under land management plans. Section 6(a) of the Forest and Rangeland Renewable Resources Planning Act of 1974 (16 U.S.C. § 1604(a)) requires the Forest Service to develop, maintain, and, as appropriate, revise land management plans for each national forest. The land management plan establishes resource goals for the national forest and specifies management practices to achieve those goals.¹²² All activities undertaken in a national forest must be consistent with its land management plan.¹²³

Land management plans establish a framework to guide decision-making on specific activities within national forests, including timber sales.¹²⁴ Under section 6(f)(2) of the Forest and Rangeland Renewable Resources Planning Act of 1974 (16 U.S.C. § 1604(f)(2)), each land

management plan must contain, among other things, details of the timber sale program in the national forest. Many land management plans limit the amount of timber that can be sold and harvested from national forests.

The Forest Service must ensure that timber is only harvested from a national forest where measures are in place to protect soil, water, fish, wildlife, and other resources.¹²⁵ As part of its planning process, the Forest Service identifies areas that are suitable for timber harvesting.¹²⁶ The Forest Service calculates the long-term sustained yield of timber in each area and, based on that calculation, determines the quantity of timber that can be sold and harvested from the national forest (the “**allowable sale quantity**”).¹²⁷

The land management plans for some national forests may preclude substantial increases in timber harvesting therefrom. In addition to these legal impediments, substantially increasing timber harvesting in national forests may engender significant public opposition.¹²⁸ Nevertheless, modest increases are likely to be legally and practically achievable in many areas. The quantity of timber currently harvested from several national forests is lower than that permitted in their land management plans. For example, the land management plan for the Beaverhead-Deerlodge National Forest in southwestern Montana establishes an allowable sale quantity of seventy-two million board-feet of timber per year for the

decade from 2004 to 2014.¹²⁹ However, just five million board-feet of timber was harvested from the Beaverhead-Deerlodge National Forest in FY 2013.¹³⁰

FINDING 1

The Forest Service could explore opportunities for increasing the volume of timber harvested from national forests.

Notwithstanding the above, increasing the use of timber in construction and other applications is not a perfect solution to climate problems. In some circumstances, cutting vegetation to harvest timber may emit carbon dioxide and thereby lead to a worsening of climate change. This is because, only some of the cut vegetation can be used to make lumber.¹³¹ Course roots, limbs, leaves, and other unusable materials (together “**wood waste**”) are often left in the forest where they decay, releasing carbon dioxide.¹³² Burning of wood waste is also common and, again, leads to the release of carbon dioxide.¹³³

In the future, more of these materials may be used to generate electricity. As discussed above, electricity generation using wood and other biomass tends to be cleaner than fossil fuel generation.¹³⁴ The carbon dioxide emitted by biomass generators was absorbed during growth of the wood and, as such, does not result in a net increase in atmospheric carbon dioxide levels.¹³⁵ In contrast, fossil fuel generation emits carbon diox-

ide that has not been present in the atmosphere for millions of years.¹³⁶

Recognizing these benefits, the Forest Service has encouraged the use of wood waste removed during forest thinning and other restoration activities in electricity generation.¹³⁷ Building on these efforts, the Forest Service may also support electricity generation using wood waste from timber harvesting operations.

Not all of the wood waste from timber harvesting should be removed from the forest.¹³⁸ Fallen leaves, branches, and other vegetation contribute important nutrients to forest soils.¹³⁹ Consequently, removing such vegetation from forests may negatively impact their long-term productivity.¹⁴⁰ While the extent of these impacts depends on local conditions, they can generally be avoided by leaving a small amount of vegetation in the forest.¹⁴¹

Nevertheless, some wood waste from timber harvesting can be removed without impairing forest productivity. The Forest Service can require persons harvesting trees in national forests to collect wood waste and make it available to biomass generators. Under section 14(h) of the National Forest Management Act of 1976 (16 U.S.C. § 472a(h)), the Forest Service must develop utilization standards and harvesting practices for the removal of trees, portions of trees, and other forest products to ensure “the optimum practical use of the wood materials.” Much of the wood waste from timber harvesting is

not currently put to practical use. A large portion of wood waste is simply burned.¹⁴² Even more is left to decay.¹⁴³ While some of this material serves to replenish soil nutrients, recent research indicates that more wood waste is left in forests than is needed to maintain their productivity.¹⁴⁴ This excess wood waste may be diverted to other uses, including electricity generation.

FINDING 2

The Forest Service could require some of the wood waste from timber harvesting in national forests to be used in biomass electricity generation.

Harvesting trees for use in construction and other activities also leads to a decline in carbon sequestration. However, this decline can be avoided by replacing the harvested trees. In fact, in some circumstances, harvesting and replacing old trees may actually increase carbon sequestration.¹⁴⁵ The amount of carbon absorbed by forests depends on, among other things, the rate of tree growth therein.¹⁴⁶ Since young forests grow more quickly than those that have been established for long periods, they may absorb larger amounts of carbon.¹⁴⁷

The Forest Service has broad authority to plant trees on NSF land cleared through timber harvesting and/or other activities. Under Knutson-Vandenberg Act, section 1 (16 U.S.C. §

576), the Forest Service may take all actions necessary to enable the reforestation of national forests. Such actions may be undertaken without the specific consent of, or funding from, Congress. In Knutson-Vandenberg Act, section 2 (16 U.S.C. § 576a), Congress preauthorized the appropriation of up to \$400,000 each year for use by the Forest Service in establishing and operating tree nurseries, purchasing tree seeds or young trees, planting trees, and doing other things necessary for reforestation. Moreover, under Knutson-Vandenberg Act, section 3(a) (16 U.S.C. § 576b(a)), the Forest Service may require purchasers of timber from national forests to make deposits to cover the cost of, among other things, planting trees and/or sowing tree seeds.

FINDING 3

The Forest Service could reforest areas cleared through timber harvesting and/or other activities.

3.2.2. ASSESSING RENEWABLE ENERGY POTENTIAL IN NATIONAL FORESTS

USDA can also do much to support the development of renewable energy sources in addition to woody biomass. Forest and Rangeland Renewable Resources Planning Act, section 3(a) (16 U.S.C. § 1601(a)) requires the Secretary of Agriculture to undertake an assessment of renewable resources in national forests (the “**Renewable Resource As-**

essment”) every ten years. As part of the Renewable Resource Assessment, USDA may identify wind, solar, and other renewable energy sources on NFS land. This would provide valuable information on the potential for renewable generation in national forests, encouraging the development of generating facilities therein.

Under Forest and Rangeland Renewable Resources Planning Act, section 3(a) (16 U.S.C. § 1601(a)), the Renewable Resource Assessment must include, among other things, an inventory of renewable resources and an analysis of current and future uses, demand for, and supply of, those resources. To ensure that sufficient information is available to prepare the inventory, Forest and Rangeland Renewable Resources Research Act, section 3(b)(1) (16 U.S.C. § 1642(b)(1)) requires the Secretary of Agriculture to maintain a current survey of the present and prospective conditions of, requirements for, and supplies of, renewable resources in forests.

The most recent Renewable Resource Assessment, released in August 2012, included an evaluation of land, water, plant, wildlife, fish, and aquatic resources.¹⁴⁸ However, with the exception of a brief discussion of woody biomass,¹⁴⁹ the assessment did not evaluate renewable energy sources.¹⁵⁰ The assessment concluded that such an evaluation was unnecessary as the DOE “conducts comprehensive analyses of the energy sector.”¹⁵¹

The DOE has undertaken relatively little research on the renewable energy resources in national forests. In 2005, the DOE’s NREL partnered with the Forest Service to conduct an “initial” study of wind and solar energy potential in national forests in the continental U.S.¹⁵² In the almost ten years since this preliminary study was completed, NREL has not undertaken any other analyses of national forests’ wind and/or solar energy resources. Nor has NREL examined any other potential sources of renewable energy in national forests.

NREL’s one-off study is unlikely to provide sufficient information for evaluating renewable energy projects on NFS land. Given the rapid pace of technological development in the industry, the study may significantly understate national forests’ renewable energy potential. This is because, over time, technological advances may enable the development of renewable generating facilities on sites previously considered unsuitable for generation. It is therefore important that any analysis of national forests’ renewable energy resources is updated regularly. To this end, USDA’s Forest Service may prepare and maintain a survey of all wind, solar, and other renewable energy sources in national forests. The Forest Service could also identify and evaluate these resources as part of its decennial Renewable Resource Assessments.

FINDING 4

The Forest Service could keep a current inventory of all renewable energy sources in national forests and include an analysis of these resources in the Renewable Resource Assessment.

USDA's Forest Service may also conduct research on the development of renewable energy sources in national forests. Forest and Rangeland Research Act, section 3(a) (16 U.S.C. § 1642(a)) authorizes the Secretary of Agriculture to undertake, support, and cooperate in investigations, experiments, tests, and other research activities relating to the management and use of renewable resources on forest- and range-land. The research must address, among other things, issues relating to the production of energy from wood and other forest resources.¹⁵³

FINDING 5

The Forest Service could undertake research to identify opportunities for increasing the use of renewable energy sources.

3.2.3. ENCOURAGING RENEWABLE ENERGY DEVELOPMENT IN NATIONAL FORESTS

The Federal Land Policy and Management Act (43 U.S.C. § 1701 et seq.) gives the Forest Service broad authority to permit renewable energy projects on

NFS land. The President's 2001 National Energy Policy directed the Forest Service to facilitate energy production from wind, solar, and other renewable resources in national forests.¹⁵⁴ Similarly, Congress has also urged the Forest Service to support the use of national forests' renewable resources in energy production.¹⁵⁵ However, despite this, the Forest Service has not adopted a comprehensive policy for renewable energy development in national forests. This is likely to have created significant uncertainty for developers, increasing costs and thereby discouraging investment in renewable energy technologies.

Under Federal Land Policy and Management Act, section 501(a)(4) (43 U.S.C. § 1761(a)(4)), the Forest Service may grant rights-of-way on, over, or under NFS land for systems for generating, transmitting, and/or distributing electric energy. Rights-of-way for electric projects are issued in the form of special use authorizations.¹⁵⁶ These authorizations are also used to permit a variety of other activities on NFS land, including tourism, commercial recreation, transportation, and agriculture.¹⁵⁷

The Forest Service has issued regulations outlining general procedures for reviewing all projects undertaken pursuant to special use authorizations¹⁵⁸ and has released more specific guidelines relating to particular types of projects. Relevantly, on August 4, 2011, the Forest Service adopted directives addressing matters specifically associated with the authorization of wind energy pro-

jects.¹⁵⁹ The directives establish, among other things, the procedures for applying for authorization of wind energy projects, the criteria used in reviewing applications, and the standard terms and conditions attached to authorizations. Thus, in this way, the directives ensure that a consistent approach is adopted when issuing special use authorizations for wind energy projects, increasing certainty for project proponents and thereby reducing project costs. Recognizing these benefits, in 2011, the Forest Service announced that it would develop similar directives for solar, geothermal, and hydroelectric projects on NFS land.¹⁶⁰ However, these directives have not yet been issued.

FINDING 6

The Forest Service could issue directives outlining the procedures for issuing special use authorizations for solar, geothermal, and hydroelectric projects in national forests.

3.2.4. MINIMIZING THE CLIMATE IMPACTS OF OIL AND GAS PRODUCTION IN NATIONAL FORESTS

In addition to supporting renewable energy projects, the Forest Service can also influence the development and use of conventional fuels such as oil and natural gas. Significant oil and gas resources underlie NFS land.¹⁶¹ These

resources may be used in generating electricity and for heating, cooking, and other industrial, commercial, and residential applications.

The use of oil and gas in electricity generation and other applications raises unique environmental challenges. Compared to coal, oil and gas are relatively clean-burning fuels. The EPA estimates that oil-fired power plants emit approximately twenty-five percent less carbon dioxide per MWh of electricity generated than coal-based systems.¹⁶² Natural gas-fired power plants have even greater benefits, reducing carbon dioxide emissions by fifty percent compared to coal-based systems.¹⁶³ However, this is only part of the story.

Recent research suggests that upstream greenhouse gas emissions from the extraction, processing, and transportation of oil and gas may offset any savings at the point of combustion.¹⁶⁴ Most of these emissions involve releases of methane from gas leaks and venting during the production process. According to the EPA, natural gas systems¹⁶⁵ were the second largest source of methane in the U.S. in 2012, accounting for over twenty two percent of national methane emissions.¹⁶⁶ Petroleum systems¹⁶⁷ generated almost six percent of methane emissions in 2012, making them the sixth largest emissions source nationally.¹⁶⁸ Recent research suggests that these EPA estimates may significantly understate methane emissions from oil and gas production.¹⁶⁹

Given the above, leaving oil and gas resources undeveloped may be the most effective means of reducing greenhouse gas emissions.¹⁷⁰ However, even without halting development, emissions can still be reduced through improvements in the production, transportation, and use of oil and gas. Recognizing this, numerous environmental groups have called for action to limit the oil and gas industry's climate impacts.¹⁷¹

Consistent with these calls, the Obama Administration has taken steps to limit emissions of methane from oil and gas development. The Administration's 2013 Climate Action Plan committed to developing an interagency strategy for reducing methane emissions.¹⁷² Fulfilling this commitment, in March 2014, the Administration issued its Strategy for Reducing Methane Emissions ("**Methane Strategy**").¹⁷³ Among other things, the Methane Strategy requires the EPA to investigate opportunities for reducing the oil and gas sector's methane emissions.¹⁷⁴ To this end, in April 2014, the EPA published five technical white papers discussing major sources of emissions in the oil and gas sector and identifying techniques for mitigating those emissions.¹⁷⁵

Consistent with these efforts, the Forest Service can take steps to minimize the climate impacts of oil and gas production on NFS land. To this end, the Forest Service may collect and publish information on the oil and gas industry's methane and other greenhouse gas emissions. Additionally, the Forest Ser-

vice may also require industry participants to take steps to minimize such emissions.

(a) Assessing the climate impacts of oil and gas projects

Responsibility for regulating oil and gas production on NFS land is shared between USDA's Forest Service and the Department of the Interior's Bureau of Land Management ("**BLM**"). Under the Mineral Leasing Act for Acquired Lands (16 U.S.C. § 520), the Forest Service is responsible for permitting oil and gas production on lands acquired under the Weeks Law ("**acquired land**"). Mineral Leasing Act, section 14 (30 U.S.C. § 223) authorizes BLM to issue permits for the production of oil and gas resources underlying land reserved from the public domain ("**public land**").

The Forest Service and BLM have entered into a Memorandum of Understanding ("**MoU**") establishing principles for the joint management of oil and gas production on acquired and public lands.¹⁷⁶ Under the MoU, the Forest Service is responsible for identifying areas of NFS land on which oil and gas projects may occur.¹⁷⁷ Once an area of land has been so identified, BLM may lease that land for oil and gas production.¹⁷⁸ Leases are subject to terms and conditions agreed between the Forest Service and BLM.¹⁷⁹

Regulations issued under the Mineral Leasing Act (30 U.S.C. § 181 et seq.) require the Forest Service to undertake a leasing analysis to identify NFS land available for oil and gas production.¹⁸⁰

When completing this leasing analysis, the Forest Service must conduct an environmental review under the National Environmental Policy Act (“NEPA”) (42 U.S.C. § 4321 et seq.).¹⁸¹

NEPA, section 102(2)(C) (42 U.S.C. § 4332(2)(C)) requires federal agencies to prepare an environmental impact statement (“EIS”) for all “major federal actions significantly affecting the quality of the human environment.” The EIS must include a discussion of the environmental impacts of the action, including any adverse impacts that cannot be avoided.¹⁸² Additionally, the EIS must also identify alternative actions that would avoid or minimize the adverse impacts and/or otherwise improve environmental quality.¹⁸³

Preparation of the EIS enables federal agencies to consider the environmental impacts of their decisions.¹⁸⁴ As a result, it can and should provide a means of integrating climate change information into government decision-making. Guidelines issued by the Council on Environmental Quality (“CEQ”) – the federal agency charged with implementing NEPA (42 U.S.C. § 4321 et seq.) – indicate that climate change is a proper subject for analysis in environmental reviews.¹⁸⁵ This has been confirmed by the federal courts.¹⁸⁶

The Forest Service’s NEPA review typically involves two stages. First, before making NFS land available for leasing, the Forest Service conducts a general assessment of the likely environmental impacts of oil and gas production

on that land.¹⁸⁷ Additionally, the Forest Service also conducts a more specific environmental review of individual production activities before a lease is issued therefor.¹⁸⁸

As part of its environmental review, the Forest Service assesses the greenhouse gas emissions resulting “from oil and gas field development.”¹⁸⁹ The Forest Service’s assessment may consider the greenhouse gas emissions caused by development both directly, as a result of construction and operation of oil and gas wells and other production facilities and indirectly, as a result of transportation and consumption of the oil and gas produced thereby.

Regulations issued under NEPA (42 U.S.C. § 4321 et seq.) require federal agencies to consider all direct, indirect, and cumulative impacts of a proposed action.¹⁹⁰ “Direct impacts” are defined as impacts that are caused by the action and “occur at the same time and place.”¹⁹¹ “Indirect impacts” are those that are “later in time or farther removed in distance, but are still reasonably foreseeable.”¹⁹² Thus, the U.S. Supreme Court has held that an agency must consider all impacts that have a “reasonably close causal relationship” to the proposed action.¹⁹³ In determining whether such a relationship exists, the courts will consider the agency’s responsibility for the impact.¹⁹⁴ Where an impact would occur regardless of the agency’s action, it is outside the agency’s responsibility and, as such, need not be considered under NEPA (42

U.S.C. § 4321 et seq.).¹⁹⁵ However, where an agency's action causes up-stream or downstream impacts, those impacts must be taken into account.¹⁹⁶

Mineral leases enable the production of oil and gas resources in national forests. This typically leads to increased oil and gas consumption. Indeed, if a lease were not issued, the oil and gas would remain unavailable for use. Consequently, the greenhouse gas emissions associated with oil and gas use are arguably a "reasonably foreseeable" result of lease issuance that must be considered under NEPA (42 U.S.C. § 4321 et seq.). This was implicitly acknowledged by the Forest Service in its 2013 decision authorizing oil and gas leasing on approximately 1.7 million acres of land in the Fishlake and Dixie National Forests in Utah ("**Fishlake decision**").¹⁹⁷ There, the Forest Service examined the greenhouse gas emissions likely to result from oil and gas exploration, production, refining, transportation, and consumption.¹⁹⁸

Notwithstanding the above, the Forest Service's analysis of the climate impacts of oil and gas projects is typically cursory. The Forest Service's recent environmental reviews have focused on the greenhouse gas emissions resulting from oil and gas production in national forests. The Forest Service has generally been reluctant to analyze downstream emissions from the transportation and use of oil and gas.¹⁹⁹ Indeed, even in the Fishlake decision, the Forest Service concluded that such an analysis

was arguably not required.²⁰⁰ To ensure that such emissions are considered in future reviews, the Forest Service may revise its NEPA policies to require assessment of the total greenhouse gas emissions resulting from oil and gas projects, including those released during transportation and use of the resource.

Various approaches can be used to estimate the greenhouse gas emissions likely to result from oil and gas use. The EPA has developed methodologies for calculating carbon dioxide, nitrogen oxide, and methane emissions associated with the combustion of fossil fuels.²⁰¹ Similarly, the Department of Energy has also established tools for calculating emissions from fossil fuel combustion and other activities.²⁰² The CEQ has recommended that agencies use these tools to assess the impact of proposed actions on greenhouse gas emissions in environmental reviews under NEPA (42 U.S.C. § 4321 et seq.).²⁰³ Consistent with the CEQ's recommendation, the Forest Service could use these and/or other established tools for assessing the impact of oil and gas projects.

FINDING 7

The Forest Service could consider the total greenhouse gas emissions resulting from the production, transportation, and use of oil and gas and options for reducing those emissions in environmental reviews.

While recognizing that oil and gas projects may emit greenhouse gases,

the Forest Service typically negates such emissions by arguing that they represent a trivial proportion of the global greenhouse gas inventory and, as such, are unlikely to noticeably effect climatic conditions. In this regard, the Forest Service has stated that “because the large majority of Forest Service projects are extremely small in the global atmospheric CO₂ [carbon dioxide] context, it is not presently possible to [determine their]...actual climate change effects.”²⁰⁴ On this basis, the Forest Service has concluded that greenhouse gas emissions from oil and gas development and other projects cannot be found to have significant environmental impacts.²⁰⁵

Given the large number of sources emitting greenhouse gases, any single source is unlikely to make a sizable contribution to atmospheric greenhouse gas levels.²⁰⁶ However, this does not mean that such emissions can be dismissed as insignificant. Regulations issued under NEPA (42 U.S.C. § 4321 et seq.) require federal agencies to assess the significance of environmental effects in light of both their context and intensity.²⁰⁷ The “intensity” of an effect refers

to its severity and must be evaluated based on, among other things, whether the effect presents a risk to public health or safety and the extent to which that risk is highly uncertain or unknown.²⁰⁸

Greenhouse gas emissions, and resulting climate changes, pose a serious risk to human health and safety, the full extent of which remains unknown. Recognizing this, several prominent environmental law scholars have argued that any increase in greenhouse gas emissions may have a significant impact. For example, Elizabeth Sheargold and Smita Walavalkar have asserted that “[i]n light of the potentially catastrophic impacts of global climate change, a numerically small contribution to atmospheric concentrations of GHGs [greenhouse gases] could still be considered significant.”²⁰⁹

To ensure a more comprehensive assessment of the climate impacts of oil and gas projects, the Forest Service could revise its NEPA policies to expressly state that even small increases in greenhouse gas emissions may have significant environmental effects.



Oil Well in California. Courtesy of Etienne Le

FINDING 8

The Forest Service could find that any source of greenhouse gas emissions, regardless of its size, has significant environmental impacts.

(b) Limiting greenhouse gas emissions from oil and gas projects

In addition to raising awareness of the oil and gas industry's climate impacts, the Forest Service may also take steps to mitigate those impacts. To this end, the Forest Service may require greenhouse gas emissions reductions as a condition of leasing land for oil and gas production.

Oil and gas producers can substantially reduce greenhouse gas emissions by doing several things, including:

- employing “reduced emission” completions,²¹⁰ whereby gas that would otherwise be vented from wells during drilling, stimulation, and repair is captured and diverted to the collection tank, re-injected into the well, used as an on-site fuel source, or otherwise prevented from release into the atmosphere;²¹¹
- installing completion combustion devices to burn gas that would otherwise be vented during well completion;²¹²
- using plunger or artificial lift systems to bring liquids that accumulate in the bottom of oil and gas wells to the surface rather than opening wells to vent gas and unload liquids;²¹³

- substituting dry-seal systems, which use high-pressure gas as a barrier to prevent leakage, for wet-seals in centrifugal compressors²¹⁴ or, where wet-seals are used, installing equipment to capture and route leaking gas to a collection tank, fuel system, or combustion device;²¹⁵
- limiting leakage from reciprocating compressors by replacing piston rod packing and/or using vapor recovery unit systems to capture leaking gas;²¹⁶
- replacing high-bleed pneumatic controllers, that are designed to vent large amounts of gas while regulating flow and pressure in pipelines, compression stations, and storage facilities, with low-bleed or no-bleed devices;²¹⁷
- adopting monitoring systems and installing leak detection equipment to identify and control fugitive gas emissions;²¹⁸ and
- improving maintenance systems to ensure the timely replacement and repair of worn and damaged equipment.²¹⁹

Financial and other barriers often prevent oil and gas companies from voluntarily investing in these and/or other emissions control technologies.²²⁰ Consequently, regulation mandating their adoption may be needed. In February 2014, the Colorado Air Quality Control Board adopted regulations requiring oil and gas producers to limit their methane emissions.²²¹ Under the regulations, producers must inspect equipment at

natural gas wells and compressor stations for leaks and promptly complete any needed repairs.²²² Additionally, producers must also take steps to reduce natural gas venting by, for example, installing low-bleed pneumatic controllers.²²³

The Forest Service could adopt similar regulations limiting greenhouse gas emissions from oil and gas operations in national forests. Mineral Leasing Act, section 17(g) (30 U.S.C. § 226(g)) authorizes the Secretary of Agriculture to regulate surface disturbing activities associated with oil and gas production on NFS land. The Forest Service, acting on behalf of the Secretary of Agriculture, can require oil and gas leases to include terms and conditions designed to protect surface resources against damage or destruction.²²⁴

Climate change threatens surface resources within national forests. The increased temperatures associated with climate change are accelerating evapo-

ration, leading to a reduction in forest water resources.²²⁵ Moreover, by contributing to more frequent and severe wildfires, higher temperatures may also damage or destroy trees and other plants within national forests.²²⁶ Forest plant and animal resources are also threatened by the increase in insect, pest, and disease outbreaks associated with a warming climate.²²⁷

To minimize damage to surface resources within national forests, the Forest Service may condition leases for oil and gas production on NFS land on the lessee taking appropriate steps to reduce its greenhouse gas emissions.

FINDING 9

The Forest Service could require oil and gas companies operating in national forests to install appropriate emissions controls and other technologies to reduce greenhouse gas emissions.

4. CONSERVATION PROGRAMS

KEY POINTS

- Limiting deforestation and expanding afforestation can often help to mitigate climate change. Through the process of terrestrial carbon sequestration, forests absorb carbon dioxide from the atmosphere and store it in biomass and soil.
- USDA administers several programs affecting the conversion of forestland to and from other uses. Most significant are USDA's conservation programs, which assist landowners to improve natural resource management.
- In recent years, USDA has used its conservation programs to provide financial and other assistance for afforestation. For example, through its Conservation Reserve Program, USDA has financed the planting of trees and other vegetation on land previously used for agricultural and other purposes.
- In the future, USDA may encourage afforestation to increase carbon sequestration through its other conservation programs. For example, USDA may provide increased funding for the planting of vegetative covers that sequester carbon under its Environmental Quality Incentives Program.
- USDA can further support carbon sequestration by encouraging the sustainable management of existing forests. USDA may prevent deforestation by funding the acquisition and maintenance of forestland at risk of conversion to other uses. Additionally, USDA can also provide funds for forest restoration activities that increase carbon sequestration.

Forest lands play an important role in reducing atmospheric carbon dioxide levels. As discussed in Chapter 1, carbon dioxide is absorbed by trees and other plants as they grow and released when they die.

Approximately 750 million acres or thirty three percent of the total land area in the U.S. is covered by forests.²²⁸ This includes boreal forests in Alaska, tropical forests in Hawaii and parts of Florida, and temperate forests in the lower forty-eight states. USDA estimates that these forests sequestered approximately 873 million tons of carbon dioxide equivalent in 2008, offsetting almost thirteen percent of national emissions.²²⁹

Increasing carbon sequestration will require action to maintain, restore, and expand forest ecosystems. The Food and Agriculture Organization of the United Nations estimates that over 320 million acres of forestland were destroyed globally between 2001 and 2010, with most of this land being converted to agricultural uses.²³⁰ Such deforestation may release the carbon already stored in vegetation and decrease future storage potential.²³¹ Avoiding deforestation for agricultural and other purposes is therefore vital for enhancing carbon sequestration.

Carbon sequestration can be further increased by establishing new forests on land currently used for other purposes (e.g., as pasture or cropland). This may take the form of afforestation, in which stands of trees are planted on sites that have been cleared of forests

for many years.²³² Research by the EPA indicates that afforestation of pasture and cropland results in the sequestration of 2.4 to 10.5 tons of carbon dioxide per acre per year.²³³ The EPA estimates that reforestation – where tree stands are established on sites that have recently been cleared through timber harvesting or natural disaster²³⁴ – sequesters between 1.2 and 8.5 tons of carbon dioxide per acre per year.²³⁵

This chapter identifies actions USDA can take to encourage land use changes that increase carbon sequestration. Section 4.1 below outlines USDA programs affecting the use of forest and other land. Section 4.2 then discusses ways in which these programs may be used to reduce deforestation and increase afforestation.

4.1. USDA PROGRAMS INFLUENCING THE USE OF AGRICULTURAL AND FOREST LANDS

The extent of forest cover is influenced by a number of USDA programs and activities. Through its Forest Service, USDA manages almost 193 million acres of forestland²³⁶ owned by the federal government.²³⁷ Additionally, USDA's Forest Service also assists in the management of over 487 million acres of non-federal (mostly state and private) forestland.²³⁸ The Forest Service provides financial and technical assistance to private and other non-federal landowners to protect forested areas against conversion to agricultural and other uses.²³⁹

Numerous federal programs also effect the establishment of new forests in areas currently used as pasture and cropland. Most significant are the agricultural conservation programs designed to assist landowners to improve natural resources management. The first conservation programs – established in the Food Security Act of 1985 (“**1985 Farm Bill**”) – focused on reducing soil erosion on agricultural land and resolving water quality and quantity issues facing agricultural producers.²⁴⁰ Additional conservation programs were enacted in subsequent Farm Bills, passed in 1990, 1996, 2002, 2008, and 2014, to address other environmental problems, such as declining air quality,²⁴¹ loss of wildlife habitat,²⁴² and destruction of wetlands.²⁴³ Under the programs, USDA typically pays producers to implement practices necessary to achieve conservation goals and/or provides technical assistance with implementation.

4.2. ACTIONS AVAILABLE TO USDA TO FACILITATE INCREASED CARBON SEQUESTRATION ON AGRICULTURAL AND FOREST LAND

Changes in land cover have major impacts on carbon sequestration. Maximizing sequestration will require the maintenance, restoration, and expansion of forest cover. USDA can help to maintain existing forests, and support continued carbon sequestration therein, by funding the acquisition and preservation of forestland. Additionally, USDA

can also increase carbon sequestration on existing forestland by providing financial and other assistance for the restoration and improvement of forest health. Finally, USDA can further expand forested areas, and therefore carbon sequestration, by financing tree planting in open areas.

4.2.1. PREVENTING DEFORESTATION TO SUPPORT CONTINUED CARBON SEQUESTRATION

Approximately fifty six percent of forestland in the U.S. is privately owned, with over eleven million landowners controlling over 420 million acres of forest.²⁴⁴ Private forest owners are under significant and increasing pressure to sell their land to enable urban development, agricultural production, and other uses.²⁴⁵ Research by USDA’s Forest Service indicates that approximately twenty three million acres of forestland owned by timber companies and other forest industry participants were sold – primarily for real estate development – between 2000 and 2004.²⁴⁶ Such development is expected to accelerate in coming years, with housing density projected to substantially increase on fifty seven million acres of private forestland by 2030.²⁴⁷

USDA, through the Forest Service, administers several programs aimed at preventing the development of forestland by funding the acquisition and maintenance thereof. These programs have significant climate benefits, reducing deforestation and thereby supporting

carbon sequestration. To maximize these benefits, the Forest Service may focus its funding towards forests that have high sequestration potential, such as boreal and tropical forests.

Cooperative Forestry Assistance Act, section 7A(b) (16 U.S.C. § 2103d(b)) authorizes the Secretary of Agriculture to establish the Community Forest and Open Space Conservation Program (“**Community Forest Program**”) to address the needs of communities to protect and maintain their forest resources. Under Cooperative Forestry Assistance Act, section 7A(c)(1) (16 U.S.C. § 2103d(c)(1)), the Secretary of Agriculture may use the Community Forest Program to provide grants to local governments, Indian tribes, and nonprofit organizations to acquire private forestland that benefits the community and is threatened by development. The acquired land must be used to establish a publicly assessable community forest²⁴⁸ and cannot be sold or converted to non-forest uses.²⁴⁹

The Secretary of Agriculture can also provide financial assistance for the conservation of private forestland through the Forest Legacy Program. Cooperative Forestry Assistance Act, section 7(a) (16 U.S.C. § 2013c(a)) authorizes establishment of the Forest Legacy Program to ascertain and protect environmentally important forest areas threatened by development. Under Cooperative Forestry Assistance Act, section 7(c) (16 U.S.C. § 2103c(c)), the Forest Legacy Program may be used to fund

the acquisition of private forestland or interests therein. In practice, the Forest Legacy Program is typically used to acquire conservation easements; legally binding agreements which transfer certain property rights to the federal or state government, while leaving the land in private ownership.²⁵⁰ These conservation easements generally restrict development on, and require sustainable management of, the forestland.²⁵¹

The Community Forest Program and Forest Legacy Program are administered by the Forest Service on behalf of the Secretary of Agriculture. The Forest Service could use these programs to fund the protection of forestland with high carbon sequestration potential. As discussed in Chapter 1, the rate of carbon sequestration in forests differs depending on local conditions including climate patterns, vegetative cover, and soil type.²⁵² Generally, boreal forests sequester the most carbon (averaging 182 tons per acre), followed by tropical forests (averaging 110 tons per acre) and temperate forests (averaging sixty-eight tons per acre).²⁵³

Under Cooperative Forestry Assistance Act, section 2(c)(3) (16 U.S.C. § 2101(c)(3)), in administering the Community Forest Program and Forest Legacy Program, the Forest Service must focus on “[e]nhancing public benefits from private forests, including air...quality.” Regulations issued under the Cooperative Forestry Assistance Act (16 U.S.C. § 2101 et seq.) require the Forest Service to evaluate the type and

extent of benefits provided by forestland when choosing between competing applications for funding under the Community Forest Program.²⁵⁴ This evaluation must include an assessment of the forest's environmental benefits, including its potential to enhance the quality of air resources.²⁵⁵

Consistent with these requirements, the Forest Service has indicated that it will use the Community Forest Program to support projects that maximize air quality and other environmental benefits for the public.²⁵⁶ Notably however, the Forest Service does not consider a project's potential to enhance carbon sequestration when deciding whether to fund it under the Community Forest Program.

USDA has acknowledged that carbon sequestration is a relevant factor to be taken into account in assessing the environment impacts of forest projects. Relevantly, USDA's Farm Service Agency ("FSA") considers forests' carbon sequestration potential when determining whether to provide financial assistance for the afforestation of pasture and cropland under the CRP.²⁵⁷ Additionally, the Forest Service's Forest Stewardship Program – which provides forest landowners with technical assistance to implement sustainable management practices – also requires consideration of the potential for forests to sequester carbon.²⁵⁸ Similarly, the Forest Service may also consider carbon sequestration when determining whether to fund the conservation of forestland

under the Community Forest Program and Forest Legacy Program. To this end, the Forest Service could adopt a point system similar to that used by USDA's FSA to rank applications for financial assistance to conserve pasture and cropland under the CRP.

FSA assigns each application a point score based on the environmental benefits resulting from conservation and provides funding to the project(s) with the highest score(s).²⁵⁹ Points are awarded for, among other things, enhancement in wildlife habitat (10 to 100 points), increases in water quality (0 to 100 points), reductions in soil erosion (0 to 100 points), and improvements in air quality (3 to 45 points).²⁶⁰ In determining the number of points to award for air quality improvements, FSA assesses the potential for carbon sequestration.²⁶¹ FSA has issued a guidance document specifying the point score it will award for different conservation practices, based on their relative carbon sequestration benefits.²⁶²

Similar to FSA's approach, the Forest Service could assign each application for financial assistance for the protection of forestland a point score based on the carbon sequestration and other benefits resulting therefrom. To assist in the scoring process, the Forest Service could assess the relative carbon sequestration benefits of protecting different forest areas based on their vegetative covers, soil properties, and other characteristics. The Forest Service could use this assessment to develop

guidelines specifying the number of points it would award for different types of forest protection projects.

FINDING 10

When determining whether to provide financial assistance for the protection of forestland that is threatened by conversion to non-forest uses, the Forest Service could assess the potential for terrestrial carbon sequestration on that land.

4.2.2. IMPROVING THE HEALTH OF EXISTING FORESTS TO INCREASE THEIR CARBON SEQUESTRATION POTENTIAL

In some circumstances, improving the health of a forest may increase its ability to sequester carbon. The potential for such increases differs depending on local conditions, including the type and age of the trees and other vegetation in the forest. Additionally, the steps taken to improve forest health also affect carbon sequestration therein.

One practice that can sometimes be beneficial is thinning, whereby vegetation is removed from a forest to reduce competition for space, light, and nutrients.²⁶³ Research suggests that, in young, dense forests, thinning can accelerate tree growth and thereby increase carbon sequestration.²⁶⁴ Moreover, it may also have other climate benefits. For example, forest thinning lessens the risk of catastrophic wildfires that emit substantial carbon dioxide.²⁶⁵

Additionally, it may also reduce emissions from man-made sources. The woody biomass removed during thinning can be used in place of fossil fuels in electricity generation.²⁶⁶ As discussed in Chapter 1, electricity generation using biomass typically produces fewer greenhouse gas emissions than fossil fuel generation.²⁶⁷ Recognizing its potential benefits, USDA uses thinning to reduce vegetative competition in national forests.²⁶⁸ However, such practices are often not used on non-federal forestland. Removing woody biomass from forests results in large labor and transportation costs.²⁶⁹ Since the removed materials typically have little commercial value, forest landowners are often unable to recover their expenditures.²⁷⁰ According to USDA, “[m]any forest landowners cannot afford this sort of large-scale economic investment; thus, far fewer acres are being treated than needed.”²⁷¹ To overcome this barrier, USDA may provide private landowners with financial assistance to conduct thinning and other forest restoration activities where it determines that such activities will increase carbon sequestration.

Healthy Forests Restoration Act, section 501(a) (16 U.S.C. § 6571(a)) authorizes the Secretary of Agriculture to establish the Healthy Forests Reserve Program for the purpose of restoring and enhancing forest ecosystems to promote the recovery of threatened and endangered species, improve biodiversity, and enhance carbon sequestration.

The Healthy Forests Reserve Program is administered by USDA's Natural Resources Conservation Service ("NRCS"),²⁷² which provides financial and technical assistance to forest landowners to develop and implement restoration plans to improve forest ecosystems.²⁷³

The Healthy Forests Restoration Act (16 U.S.C. § 6501 et seq.) does not place any geographic restrictions on the operation of the Healthy Forests Reserve Program. Regulations indicate that NRCS may implement the Healthy Forest Reserve Program nationwide.²⁷⁴ However, to date, the Healthy Forests Reserve Program has only been implemented in Arkansas, California, Georgia, Indiana, Kentucky, Maine, Michigan, Mississippi, Ohio, Oklahoma, Oregon, Pennsylvania, and South Carolina ("funded states").²⁷⁵ Consequently, only persons owning forestland in the funded states can obtain financial and technical assistance from NRCS to undertake forest restoration activities that increase carbon sequestration. The lack of assistance for landowners in other states is likely to have had a chilling effect on forest restoration therein. To remedy this problem, NRCS could implement the Healthy Forests Reserve Program nationwide.

FINDING 11

USDA could make funding available to forest landowners to enable them to undertake restoration activities, where such activities increase carbon sequestration.

4.2.3. ENCOURAGING AFFORESTATION TO ENHANCE CARBON SEQUESTRATION

In addition to maintaining and restoring existing forestland, USDA can also do much to support the creation of new forests on land currently used for agriculture and other purposes. Specifically, USDA can provide agricultural producers with financial and/or technical assistance to plant trees and other vegetation on their land.

USDA currently administers several conservation programs designed to address environmental problems resulting from agricultural production by reducing the amount of land used in such production and improving the management of that land. Only one such program – the Healthy Forests Reserve Program – aims to mitigate climate change by enhancing carbon sequestration.²⁷⁶ Most programs were established to deal with other environmental issues, including high rates of soil erosion, declines in water quality and quantity, destruction of wetlands, and loss of wildlife habitat.²⁷⁷ However, these programs may indirectly influence carbon sequestration and other climate mitigation activities.

In recent years, USDA has used its conservation programs to provide finan-

cial assistance for projects that sequester carbon and/or otherwise mitigate climate change. Most notable is USDA's CRP, which pays agricultural producers to remove environmentally sensitive land from production and plant long-term resource-conserving covers.²⁷⁸ Offers to enroll land in the CRP are ranked based on the environmental benefits likely to result from conservation and funding is provided to those with the greatest benefit.²⁷⁹ Among the environmental benefits USDA considers in ranking and funding projects is the potential for carbon sequestration.²⁸⁰ Thus, in this way, USDA has used the CRP to encourage the planting of trees and other vegetative covers that are highly effective in sequestering carbon. Consequently, as Ross Gorte has observed, the CRP has become "the largest federal tree planting program that has ever existed, even though its primary purpose is to protect soils."²⁸¹ USDA estimates that, in 2011, land enrolled in the CRP sequestered over forty seven million tons of carbon dioxide.²⁸² This offset over eight percent of agricultural greenhouse gas emissions.²⁸³

USDA has also supported projects aimed at establishing trees and other vegetation on agricultural lands through the EQIP.²⁸⁴ Notably however, USDA does not consider such projects' potential to enhance carbon sequestration when providing funding therefor. As a result, these projects may be funded at lower levels than activities directed to achieving other environmental goals.²⁸⁵

To remedy this problem, USDA may provide increased funding for tree planting and other projects to sequester carbon.

The EQIP was established under Chapter 4 of Subtitle D of Title XII of the 1985 Farm Bill (16 U.S.C. § 3839aa et seq.). 1985 Farm Bill, section 1240B (16 U.S.C. § 3839aa-2) authorizes USDA's NRCS to pay agricultural producers to implement conservation practices addressing natural resource concerns on their land. Under 1985 Farm Bill, section 1240B(d)(2) (16 U.S.C. § 3839aa-2(d)(2)), the amount of such payments must not exceed seventy five percent of the costs incurred, and/or 100 percent of the income foregone, by the agricultural producers in implementing conservation practices. 1985 Farm Bill, section 1240B(d)(3) (16 U.S.C. § 3839aa-2(d)(1)) provides that, in determining the amount to pay agricultural producers in respect of lost income, NRCS may accord great significance to conservation practices that promote:

- (A) soil health;
- (B) water quality and quantity improvement;
- (C) nutrient management;
- (D) pest management;
- (E) air quality improvement;
- (F) wildlife habitat development; or
- (G) invasive species management (together the "**payment criteria**").

These payment criteria give NRCS broad authority to consider the extent to which the conservation practices implemented by an agricultural producer en-

hance carbon sequestration. Most obviously, with respect to criteria E, increased sequestration of carbon dioxide – an air pollutant – helps to improve air quality.²⁸⁶ Additionally, by mitigating climate change, it may also promote the other payment criteria. For example, as regards criterion A, climate change will increase the frequency and severity of floods and other extreme weather events that accelerate soil erosion and thereby reduce soil fertility.²⁸⁷ These climatic variations may also lead to deteriorations in water quality and quantity, making them relevant to criterion B.²⁸⁸ Finally, with reference to criteria D and G, the higher temperatures associated with climate change will increase the in-

cidence of pest outbreaks and enhance the growth of invasive species.²⁸⁹

Given the above, NRCS may consider the potential for conservation projects to enhance carbon sequestration when funding such projects under the EQIP. NRCS may provide increased funding for projects with high sequestration potential.

FINDING 12

USDA could consider the extent to which conservation activities increase carbon sequestration and/or otherwise mitigate climate change when determining whether to fund such activities under the Environmental Quality Incentives Program.

5. AGRICULTURAL ASSISTANCE PROGRAMS

KEY POINTS

- The production processes used by farmers and ranchers have a significant influence on climate outcomes. Many currently used processes emit greenhouse gases and limit carbon sequestration, with both results contributing to climate change. However, simple changes in agricultural production could significantly reduce emissions and increase sequestration. USDA is uniquely placed to support such changes.
- USDA has broad authority to provide financial and other assistance to the agricultural industry. Through the Commodity Credit Corporation, USDA can make grants, loans, and other payments to support agricultural prices and incomes. Additionally, USDA's Federal Crop Insurance Corporation may insure, or provide reinsurance for the insurers of, agricultural producers.
- In implementing these assistance programs, USDA may consider the greenhouse gas emissions resulting from agricultural production. By increasing awareness of agriculture's potential climate impacts, this may encourage more climate-sensitive decision-making both within and outside USDA.
- USDA can further encourage climate change mitigation in the agricultural sector by providing grants, loans, and/or other financial assistance for the implementation of climate-friendly production systems. Alternatively, USDA may require agricultural producers to implement such systems as a condition of receiving grants and/or loans for other projects.

The U.S. agricultural industry makes a sizable contribution to national greenhouse gas emissions.²⁹⁰ USDA estimates that approximately fifty percent of agricultural emissions result from livestock production.²⁹¹ Most of these emissions involve releases of methane from enteric fermentation²⁹² by cattle and other livestock.²⁹³ Research by the EPA indicates that enteric fermentation by livestock generated seventy percent of agricultural, and twenty five percent of total, methane emissions nationally in 2012.²⁹⁴ Additionally, livestock waste also emits methane and nitrous oxide.²⁹⁵ Further emissions of nitrous oxide result from the cultivation and fertilization of soils for livestock grazing and crop production.²⁹⁶ Indeed, the EPA estimates that soil management was the largest source of nitrous oxide in the U.S. in 2012, accounting for almost seventy percent of national emissions.²⁹⁷

The greenhouse gas intensity of agricultural production is directly related to the efficiency of producers.²⁹⁸ Research by the Food and Agriculture Organization of the United Nations indicates that enhancing livestock production efficiency, such that the same amount of meat can be produced using fewer animals, through selective breeding and/or improved health can help to mitigate greenhouse gas emissions.²⁹⁹ Similarly,

reducing the inputs used in crop production also has mitigation benefits. For example, because large amounts of energy are required to collect, treat, and move water, improving water efficiency may lead to lower carbon dioxide emissions.³⁰⁰ Carbon dioxide and other greenhouse gas emissions can also be lowered by making more efficient use of nitrogen fertilizer. According to USDA, applying fertilizer in multiple applications and/or using time-released fertilizers can enhance nitrogen uptake by crops and thereby reduce the amount lost to the atmosphere as nitrous oxide.³⁰¹

Other changes in agricultural production can also help to minimize greenhouse gas emissions. USDA has identified several promising options for controlling emissions from livestock production, including increasing the digestibility of livestock feeds and/or using feed additives to inhibit the formation of methane during enteric fermentation.³⁰² Methane emissions can be further reduced by improving livestock waste management, including by using anaerobic digesters to capture gas produced during the breakdown of manure.³⁰³ In the absence of digesters, handling manure as a solid, shortening storage duration, and/or ensuring aerobic conditions can limit methane emissions.³⁰⁴



Holstein dairy cows. Credit: USDA Agricultural Research Service.

Emissions reductions can also be achieved through improvements in land management.³⁰⁵ For example, applying nitrification inhibitors³⁰⁶ to pasture and cropland can slow the oxidation of nitrogen added to the soil in the form of livestock waste and synthetic fertilizers.³⁰⁷ Research by USDA suggests that the use of nitrification inhibitors could reduce nitrous oxide emissions by up to twenty percent, while maintaining or slightly increasing crop yields.³⁰⁸

Another strategy for lowering nitrous oxide emissions from agricultural land is cover cropping, whereby plants are used instead of fertilizers to enhance soil fertility and moisture. The Rodale Institute's Farm Systems Trial – a thirty-

year side-by-side comparison of chemical and organic management systems – found that organic systems which rely on cover crops to maintain soil quality and do not use synthetic fertilizers emit forty percent less greenhouse gases than conventional systems applying nitrogen and other chemicals to soils.³⁰⁹

Using organic management systems can also enhance carbon sequestration in agricultural soils. Research conducted as part of the Rodale Institute's Farm Systems Trial indicates that organically managed soils retain two to three times more carbon than those treated with synthetic chemicals.³¹⁰ Soil carbon storage can be further increased by using hay or pasture in crop rotations,³¹¹

reducing tillage intensity,³¹² and avoiding summer fallow.³¹³

At the time of writing, several research bodies were involved in ongoing projects to identify additional strategies to reduce greenhouse gas emissions and increase carbon sequestration.³¹⁴ Research was also being undertaken to evaluate the financial implications of adopting climate-friendly management systems.³¹⁵

The management systems used by agricultural producers are shaped, in large part, by federal assistance programs. As USDA has recognized, “[f]ederal programs...can influence what producers do, and should be designed to ameliorate, rather than exacerbate, the impacts of climate change on producer, as well as national, well-being.”³¹⁶ Consistent with this goal, USDA has committed to encouraging agricultural practices that mitigate climate change.³¹⁷

USDA has previously undertaken, and continues to undertake, research into climate change mitigation strategies. For example, USDA’s Agricultural Research Service has established a national research program focusing on “climate change, soils, and emissions.”³¹⁸ One of the program’s priorities is to “enable improvements in air quality via management and mitigation of [greenhouse gas] emissions from agricultural operations.”³¹⁹ The Agricultural Research Service is currently involved in over forty research projects examining the impact of different agri-

cultural production systems on atmospheric greenhouse gas concentrations.³²⁰ Similar research, seeking to identify systems that can help to reduce greenhouse gas concentrations, is also being supported by the National Institute of Food and Agriculture.³²¹ As an illustration, the National Institute of Food and Agriculture has recently supported research assessing the impact of various irrigation practices on soil carbon storage on agricultural land. Both the National Institute of Food and Agriculture and the Agricultural Research Service have pledged to continue researching methods for reducing agriculture’s climate impacts.³²²

Based on this research, USDA conducts education and outreach programs to assist agricultural producers to identify mitigation practices appropriate to their operations.³²³ In addition, USDA also provides agricultural producers with financial and technical assistance to adopt such practices. By way of example, USDA has recently supported efforts to reduce methane emissions from livestock manure. In March 2014, the Obama Administration issued its Methane Strategy outlining actions designed to avoid the emission of approximately ninety million metric tons of greenhouse gases in 2020.³²⁴ Among other things, the Methane Strategy requires, USDA to work with EPA and DOE to develop a Biogas Roadmap establishing voluntary programs to stimulate the adoption of advanced manure management practices.³²⁵ Moreover,

USDA must also provide financial and technical assistance for the use of such practices.³²⁶

Consistent with the Methane Strategy, USDA has taken steps to encourage cleaner manure management, including the funding of research and extension programs looking at the environmental impacts of various management practices and technologies.³²⁷ Seeking to minimize any adverse impacts, USDA has financed the deployment of anaerobic digesters and other technologies that capture methane emitted during manure processing.³²⁸ USDA, in cooperation with the EPA and DOE, has also provided education and training on the use of digester systems.³²⁹

In addition to these actions, USDA can also initiate new assistance programs to further support climate change mitigation in the agricultural industry. Section 5.1 below discusses USDA's authority to provide financial and other assistance to industry participants. Section 5.2 then examines ways in which USDA may use its assistance programs to encourage the adoption of climate-friendly agricultural practices.

5.1. USDA'S AGRICULTURAL ASSISTANCE PROGRAMS

USDA provides agricultural producers with a range of financial and other assistance through its farm and foreign agricultural services. Most of these services are provided by the Commodity Credit Corporation ("CCC"). CCC was established under Commodity Credit Corpora-

tion Charter Act, section 2 (15 U.S.C. § 714) as a federal corporation within USDA to stabilize, support, and protect farm prices and incomes. To this end, Commodity Credit Corporation Charter Act, section 5(a)-(c) (15 U.S.C. § 714c(a)-(c)) authorizes CCC to make grants and loans to agricultural producers, purchase agricultural commodities, and provide materials and facilities for agricultural production. CCC performs these functions through USDA's FSA.³³⁰

In addition to providing direct financial assistance to farmers and ranchers, USDA also supports farm incomes indirectly by, for example, encouraging increased consumption of agricultural commodities. Under Commodity Credit Corporation Charter Act, section 5(e) (15 U.S.C. § 714c(e)), CCC may, through FSA, assist in the creation and expansion of domestic agricultural markets. In addition, under Commodity Credit Corporation Charter Act, section 5(f) (15 U.S.C. § 714c(f)), CCC may also aid in the development of export markets for agricultural commodities. These export assistance programs are administered by USDA's Foreign Agriculture Service.

USDA also indirectly supports farm incomes through the federal crop insurance program, which aims to protect farmers against the uncertainties of weather. The federal crop insurance program is overseen by the Federal Crop Insurance Corporation ("FCIC"); a wholly owned government corporation and agency of USDA established in

Federal Crop Insurance Act, section 503 (7 U.S.C. § 1503). Under Federal Crop Insurance Act, section 508(a)(1) (15 U.S.C. § 1508(a)(1)), FCIC may insure, or provide reinsurance for insurers of, agricultural producers for losses due to droughts, floods, and other natural disasters. Today, all crop insurance policies are sold and serviced by private insurance companies. FCIC is responsible for approving insurance policies and premiums,³³¹ reinsuring insurance companies,³³² providing premium and expense subsidies,³³³ and researching insurance and risk management.³³⁴

5.2. ACTIONS AVAILABLE TO USDA TO ENCOURAGE CLIMATE CHANGE MITIGATION BY AGRICULTURAL PRODUCERS

USDA, by virtue of its statutory authority to provide financial and other assistance to agricultural producers, enjoys significant influence over production activities. USDA can encourage the use of climate-friendly production systems directly by, for example, funding the implementation of such systems. Similar benefits may also be achieved through more indirect channels, including by requiring agricultural producers to adopt climate-friendly systems as a condition of receiving funding for other projects.

USDA can also do much to prevent the use of climate-damaging production systems. To this end, USDA can report on the greenhouse gas emissions and other climate change effects of agricultural activities when providing grants,

loans, and other financial assistance for such purposes. Based on this information, USDA may refuse applications for financial assistance for activities that contribute to climate change.

5.2.1. CONSIDERING CLIMATE CHANGE WHEN DEVELOPING AGRICULTURAL ASSISTANCE PROGRAMS

The implementation of most agricultural assistance programs is subject to environmental review under NEPA (42 U.S.C. § 4321 et seq.). As part of this review, USDA may collect and publish information on the greenhouse gas emissions resulting from agricultural activities and options for mitigating those emissions. By increasing awareness of agriculture's potential climate impacts, this may promote more climate-sensitive decision-making both within and outside USDA.

As discussed in Chapter 1, NEPA, section 102(2)(C) (42 U.S.C. § 4332(2)(C)) requires federal agencies to prepare an EIS for all "major federal actions significantly affecting the quality of the human environment." Regulations issued by USDA indicate that, with certain limited exceptions, all actions undertaken by its constituent agencies will be planned and implemented in accordance with the requirements of NEPA (42 U.S.C. § 4321 et seq.).³³⁵ Consistent with these requirements, USDA's regulations provide for environmental review of actions conducted by FSA.³³⁶ However, the regulations exclude actions

performed by the Foreign Agriculture Service and FCIC from review.³³⁷

Under Commodity Credit Corporation Charter Act, section 5(a) (15 U.S.C. § 714c(a)), FSA may provide grants and loans to agricultural producers. Before implementing grant and loan programs, FSA typically undertakes an environmental assessment (“EA”) to determine whether the program will significantly affect the environment.³³⁸ If a program is found to have such effects, FSA then prepares a detailed EIS.³³⁹ In addition, site-specific reviews may also be conducted to assess the likely environmental impacts of individual producers’ participation in grant and/or loan programs.³⁴⁰

As part of its environmental review, FSA seeks to identify potential adverse impacts on air quality.³⁴¹ To date, FSA’s analysis of air quality impacts has been limited to assessing the potential for agricultural activities to cause odor.³⁴² As odor is most commonly associated with livestock production, FSA only considers the air quality impacts of agricultural assistance programs that provide funding for the establishment of, or changes to, concentrated animal feeding operations.³⁴³ FSA does not assess the air quality impacts of other programs.³⁴⁴

FSA’s rules and regulations do not currently require consideration of agriculture’s greenhouse gas emissions as part of the environmental review process. Given this, it is perhaps unsurprising that such emissions are typically not assessed in environmental reviews

conducted by FSA.³⁴⁵ To remedy this deficiency, FSA could revise its policies to expressly provide for consideration of the greenhouse gas emissions resulting from agricultural activities and options for reducing those emissions.

Regulations issued by the CEQ require government agencies to update their NEPA policies “as necessary to ensure full compliance with the purposes and provisions of the Act.”³⁴⁶ Recent scientific and legal developments necessitate the revision of FSA’s NEPA policies. Significantly, in 2007, the Supreme Court held that greenhouse gases are “air pollutants” for the purposes of the Clean Air Act (42 U.S.C. § 7401 et seq.).³⁴⁷ Since this time, a growing body of scientific evidence has documented the potential climate impacts of greenhouse gas emissions.³⁴⁸ In light of these developments, FSA should consider updating its policies to expressly require consideration of climate change in environmental reviews.

This approach is supported by CEQ. On February 18, 2010, CEQ issued a draft guidance memorandum advising federal agencies to consider climate change in environmental reviews under NEPA (42 U.S.C. § 4321 et seq.).³⁴⁹ The memorandum recommends that, when assessing a project’s environmental effects, agencies should quantify cumulative greenhouse gas emissions over the life of the project, discuss the link between emissions and climate change, and identify measures to reduce emissions.³⁵⁰

Consistent with the CEQ's recommendation, FSA may analyze the greenhouse gas emissions and other climate change effects of agricultural activities when making funding decisions. Where this analysis indicates that an agricultural activity will contribute to climate change, FSA may refuse to fund that activity.

Legislation gives FSA broad discretion to decide which agricultural activities to fund.³⁵¹ FSA has declared that it will not provide funding for any activity "that could cause significant air pollution."³⁵² Contrary to this commitment, FSA has funded activities that emit greenhouse gases and/or otherwise contribute to climate change.

FINDING 13

USDA's Farm Service Agency could consider the climate change effects of agricultural activities in environmental reviews.

5.2.2. PROVIDING FINANCIAL AND OTHER ASSISTANCE FOR CLIMATE-FRIENDLY BEHAVIOR

USDA can also do much to encourage the adoption of climate-friendly production systems. To this end, USDA has furnished information to assist agricultural producers to evaluate the climate impacts of their current systems and options for mitigating those impacts.³⁵³ Building on these efforts, USDA could assist agricultural producers to develop and implement mitigation strategies.

Federal Crop Insurance Act, section 522(d)(1) (7 U.S.C. § 1522(d)(1)) authorizes FCIC to enter into partnerships with public and private entities for the purpose of, among other things, increasing agricultural producers' access to loss mitigation and other risk management tools. Consistent with this objective, FCIC can and does use partnerships to develop tools to reduce variations in agricultural output due to adverse weather, pest infestations, and other factors. Under Federal Crop Insurance Act, section 522(d)(3)(A) (7 U.S.C. § 1522(d)(3)(A)), FCIC may establish partnerships to assist agricultural producers to take preventative action to address weather conditions that could negatively impact crop production. Additionally, under Federal Crop Insurance Act, section 522(d)(3)(B) (7 U.S.C. § 1522(d)(3)(B)), partnerships may also be established to assist with pest management.

Increasing atmospheric greenhouse gas levels, and resulting climate change, will have major impacts on agricultural output. Recent research indicates that the rising temperatures associated with climate change will adversely affect crop production, leading to lower yields.³⁵⁴ Crop yields will also be affected by other changes in climate, including increasingly variable precipitation,³⁵⁵ more frequent and severe extreme weather events,³⁵⁶ and enhanced growth of weeds, insects, and other pests.³⁵⁷ Given the above, reducing risks to agricultural production arguably

requires action to mitigate climate change. To this end, USDA's FCIC can partner with public and/or private entities to develop tools to assist agricultural producers to limit greenhouse gas emissions and expand carbon sequestration.

Consistent with this view, USDA has acknowledged that partnerships may be used to research climate change mitigation and adaptation.³⁵⁸ USDA has recently funded partnerships to create tools to help agricultural producers adapt to droughts and other climatic variations.³⁵⁹ For example, USDA has partnered with the University of Oregon to create software to help producers determine the acreage to plant when water supply is reduced.³⁶⁰ Additionally, USDA has also partnered with the University of Nebraska-Lincoln to identify production functions that optimize crop yields under conditions of reduced water supply.³⁶¹ Going forward, USDA should make maximum use of its asserted authority to enter into partnerships with public and private entities to develop climate change mitigation strategies.

FINDING 14

USDA could enter into partnerships with public and private entities to develop tools to assist agricultural producers to reduce greenhouse gas emissions and increase carbon sequestration.

USDA can also provide funding to support improvements in agricultural

production that reduce greenhouse gas emissions, such as increased production efficiency and improved waste management.

Federal Crop Insurance Act, section 524(b) (7 U.S.C. § 1524(b)) requires the Secretary of Agriculture to provide financial assistance to agricultural producers in Connecticut, Delaware, Hawaii, Maryland, Massachusetts, Maine, Nevada, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Utah, Vermont, West Virginia, and Wyoming for, among other things, resource conservation practices including pest management and erosion control. This assistance is provided through the Agricultural Management Assistance Program ("**AMAP**").³⁶²

Under the AMAP, USDA contracts with agricultural producers to pay a share of the costs incurred in undertaking conservation activities.³⁶³ USDA can use the AMAP to fund activities that reduce agricultural greenhouse gas emissions. Such activities contribute to meeting the program's goals of managing pest outbreaks and controlling soil erosion by mitigating climate change. As discussed above, the higher temperatures associated with climate change are expected to lead to an expansion in the population and range of many pest species.³⁶⁴ Moreover, by increasing the severity and frequency of storms, climate change may also contribute to greater soil erosion.³⁶⁵ Recognizing this, USDA has previously supported climate change mitigation as a means of

limiting soil erosion. Relevantly, USDA has used the CRP – which aims to protect and improve soils³⁶⁶ – to fund projects designed to enhance carbon sequestration.³⁶⁷ However, USDA does not currently provide financial assistance for climate change mitigation through the AMAP.³⁶⁸

FINDING 15

USDA can provide agricultural producers with financial assistance to implement climate change mitigation strategies.

5.2.3. REQUIRING CLIMATE CHANGE MITIGATION AS A CONDITION OF PROVIDING FINANCIAL ASSISTANCE FOR OTHER PROJECTS

USDA can further incentivize mitigation activities by requiring agricultural producers to adopt organic management systems and/or other climate-friendly practices as a condition of participating in its assistance programs. By way of example, such conditions could be imposed on participants in USDA’s price loss and agricultural risk coverage, marketing assistance, and federal crop insurance programs.

(a) *Price loss coverage and agricultural risk coverage payments*

Sections 1116 and 1117 of the Agricultural Act of 2014 (“**2014 Farm Bill**”) establish the price loss coverage and agricultural risk coverage programs. Through these programs, the Secretary

of Agriculture makes payments to eligible producers if the price of, or revenue received for, wheat, oats, barley, corn, grain sorghum, long and medium grain rice, soybeans and other oilseeds, pulse crops, or peanuts (together the “**covered commodities**”) in any of the 2014 through 2018 crop years falls below a designated level. Under section 1118(a)(1)(C) of the 2014 Farm Bill, in order to receive such payments, crop producers must agree to, among other things, “effectively control noxious weeds and otherwise maintain [crop] land in accordance with sound agricultural practices, as determined by the Secretary.”

The 2014 Farm Bill does not specify the factors to be considered by the Secretary of Agriculture in determining “sound agricultural practices.” However, there is a good argument that the Secretary of Agriculture can consider executive policy requiring the mitigation of climate change when making this determination. Consistent with this policy, the Secretary of Agriculture may require crop producers to take steps to limit their greenhouse gas emissions by, for example, reducing fertilizer use and increasing cover cropping.

Our research has not identified any relevant administrative decisions or court cases analyzing USDA’s authority to consider executive policy on climate change when formulating sound agricultural practices. However, useful guidance on this issue is provided in judicial opinions regarding the consideration, in

agency decision-making, of factors not expressly identified in the agency's authorizing legislation. The federal courts have repeatedly held that, in such cases, an agency may consider any factor that is logically relevant to its decision unless there is clear congressional intent to preclude consideration of that factor.³⁶⁹ Such intent must be manifest in the text, structure, and/or history of the legislation under which the agency is making decisions.³⁷⁰

Climate change is arguably relevant to USDA's determination of sound agricultural practices to be adopted by participants in the price loss and agricultural risk coverage programs. These programs provide a safety net for producers of covered commodities, protecting their incomes and maintaining their profitability.³⁷¹ Agricultural producers' ongoing profitability will be adversely affected by future climate change, with higher temperatures and more variable precipitation expected to lead to an increase in production costs³⁷² and a decline in revenues.³⁷³ Indeed, one study estimates that a 5°F rise in temperatures and eight percent rise in precipitation could lead to annual losses in the agricultural industry of up to \$5.3 billion.³⁷⁴

In these circumstances, USDA may validly conclude that climate change is a relevant factor to be taken into account in applying section 1118(a)(1)(C) of the 2014 Farm Bill.³⁷⁵ Consistent with this view, other regulatory agencies have considered environmental issues when developing sound agricultural practices.

For example, the New York State Department of Agriculture and Marketing has indicated that, in assessing the soundness of an agricultural practice, it will consider the extent to which the practice adversely affects human health or the environment.³⁷⁶ Nothing in the text, structure, or history of the 2014 Farm Bill suggests that Congress intended to prevent USDA considering similar factors.

Notwithstanding this, some commentators have expressed concern that a recent Supreme Court decision may prevent the consideration of executive policies in agency decision-making.³⁷⁷ In *Massachusetts v. Environmental Protection Agency*, 549 U.S. 497 (2007) ("**Massachusetts v. EPA**"), the U.S. Supreme Court reviewed a decision of the EPA not to regulate greenhouse gas emissions from new motor vehicles under section 202 of the Clean Air Act (42 U.S.C. § 7521). In support of its decision, the EPA asserted that it lacked statutory authority to regulate greenhouse gas emissions and that, even if it had such authority, it would not exercise it at the current time.³⁷⁸ The EPA offered various reasons to show that it should not regulate greenhouse gas emissions, arguing that limiting motor vehicle emissions would reflect an "inefficient, piecemeal approach" to mitigating climate change and may interfere with other executive efforts in this area.³⁷⁹ These arguments were rejected by a majority of the court, which held that the Clean Air Act (42 U.S.C. § 7401

et seq.) does not authorize the EPA to make such policy determinations.³⁸⁰

Massachusetts v. EPA could have the effect of preventing consideration of executive policies in agency decision-making, unless such policies are expressly identified in the legislation under which a decision is made.³⁸¹ As one prominent scholar has observed, the decision suggests that “congressional silence with respect to a decisional factor should be interpreted as congressional rejection of that factor and as a prohibition on agency consideration of that factor in making decisions.”³⁸² However, there is a good argument that the decision should not be interpreted in this way.

The majority’s decision in Massachusetts v. EPA was based entirely on the wording of section 202 of the Clean Air Act (42 U.S.C. § 7521). The majority held that, under this section, the EPA must determine whether a pollutant causes, or contributes to, air pollution that may reasonably be anticipated to endanger public health or welfare and regulate any pollutant determined to have such effects.³⁸³ The EPA refused to make such a determination with respect to greenhouse gases. Instead, the EPA offered what the majority described as “a laundry list of reasons not to regulate.”³⁸⁴ According to the majority, these reasons were “divorced from the statutory text”³⁸⁵ and had “nothing to do with” whether greenhouse gas emissions contribute to air pollution problems.³⁸⁶ As a result, they could not be relied upon to

justify the EPA’s decision not to regulate greenhouse gas emissions under the Clean Air Act (42 U.S.C. § 7401 et seq.).³⁸⁷

Massachusetts v. EPA did not expressly overrule the previous cases authorizing agencies to consider logically relevant decisional factors not specified in legislation. Since Massachusetts v. EPA, the Supreme Court has upheld agency decisions that were made having regard to factors not specified in the agency’s authorizing legislation. For example, in *Environmental Protection Agency v. EME Homer City Generation L. P.*, 134 S. Ct. 1584 (2014), the Supreme Court held that the EPA could consider the cost of reducing emissions when determining whether the emission of pollutants in upwind states “contributes significantly” to pollution problems in downwind states for the purposes Clean Air Act, section 110(a)(2)(D)(i) (42 U.S.C. § 7410(a)(2)(D)(i)), even though the section does not expressly permit cost consideration.³⁸⁸ The court noted that the Clean Air Act (42 U.S.C. § 7401 et seq.) does not specify how significance is to be determined.³⁸⁹ The court found that, in these circumstances, the EPA may adopt any reasonable approach for making that determination.³⁹⁰ While the Clean Air Act (42 U.S.C. § 7401 et seq.) does not expressly authorize the EPA to base its determination on costs, “nothing in the...text precludes” such an approach.³⁹¹ Thus, the court concluded that the EPA’s approach “is a reasonable way of filling the gap left

open by Congress” (internal quotations omitted).³⁹²

Given the above, there is a good argument that *Massachusetts v. EPA* does not stand for the proposition that congressional silence with respect to a decisional factor precludes agency consideration of that factor when making decisions. Other court decisions – issued both before and after *Massachusetts v. EPA* – indicate that an agency may consider any factor that is logically relevant to its decision, unless there is clear Congressional intent to exclude consideration of that factor.³⁹³ Adopting this approach, USDA could consider executive policies requiring climate change mitigation when determining sound agricultural practices to be implemented by participants in the price loss coverage and agricultural risk coverage programs.

FINDING 16

USDA could explore opportunities for requiring agricultural producers receiving payments under the price loss coverage and agricultural risk coverage programs to adopt climate change mitigation strategies.

(b) Marketing assistance loans

In addition to requiring climate change mitigation by agricultural producers receiving grants under the price loss coverage and agricultural risk coverage programs, USDA may also require such action by producers to whom it provides marketing assistance loans.

Under section 1201(b)(1) of the 2014 Farm Bill, the Secretary of Agriculture may provide, through CCC, marketing assistance loans to eligible agricultural producers for the 2014 to 2018 crops of wheat, corn, grain sorghum, barley, oats, long and medium grain rice, small and large chickpeas, lentils, dry peas, peanuts, soybeans and other oilseeds, honey, upland cotton, extra long staple cotton, graded and non-graded wool, and mohair (together “**loan commodities**”). Section 1201(b)(2) of the 2014 Farm Bill gives the Secretary of Agriculture broad discretion to prescribe the terms and conditions on which marketing assistance loans will be provided. Pursuant to this section, USDA may condition loans on the implementation of climate change mitigation strategies.

Marketing assistance loans provide agricultural producers with interim financing so that they can meet their financial commitments without selling commodities at the time of harvest when prices tend to be lowest.³⁹⁴ This enables producers to delay commodity sales until prices rise, increasing their profitability.³⁹⁵ As discussed above, future agricultural profits will be impacted by changes in temperature and precipitation due to anthropogenic greenhouse gas emissions.³⁹⁶ Human-induced climate change is therefore directly relevant to the provision of marketing assistance loans.

As discussed above, the courts have held that agency decisions may be based on a consideration of all logically

relevant factors that have not been excluded by Congress.³⁹⁷ Adopting this approach, USDA can consider executive policies requiring the mitigation of climate change when issuing marketing assistance loans. Consistent with these executive policies, USDA may require agricultural producers receiving marketing assistance loans to take steps to reduce their greenhouse gas emissions. This could be achieved by, for example, improving the efficiency of fertilizer use, reducing tillage intensity, avoiding summer fallow, and planting non-growing season cover crops.

FINDING 17

As a condition of providing marketing assistance loans, USDA could require agricultural producers to implement climate change mitigation strategies.

(c) Federal crop insurance

USDA may also require agricultural producers to reduce their greenhouse gas emissions as a condition of participating in the federal crop insurance program.

Federal Crop Insurance Act, section 508(k)(1) (7 U.S.C. § 1508(k)(1)) requires FCIC to provide reinsurance to companies that insure producers under an approved crop insurance policy. Under Federal Crop Insurance Act, section 508(h)(1) (7 U.S.C. § 1508(h)(1)), insurance companies may submit crop insurance policies and premiums to the

Board of FCIC for review. Federal Crop Insurance Act, section 508(h)(4) (7 U.S.C. § 1508(h)(4)) requires FCIC to issue regulations governing the submission of crop insurance policies and premiums. Pursuant to this section, FCIC has adopted regulations directing insurance companies to obtain approval for their crop insurance policies and premiums and any changes thereto.³⁹⁸ As part of this approvals process, FCIC may consider whether a crop insurance policy requires agricultural producers to adopt climate change mitigation strategies.

FCIC regulations indicate that, in reviewing crop insurance policies, it will request advice from USDA's Risk Management Agency as to whether a policy meets the department's "public policy goals."³⁹⁹ FCIC may disapprove a policy that is found to be inconsistent with such goals.⁴⁰⁰

FCIC's rules and regulations do not identify the public policy goals it will consider when reviewing crop insurance policies. However, there is a good argument that FCIC may consider the need to reduce greenhouse gas emissions and otherwise mitigate climate change. USDA's Strategic Plan for FY 2014 to FY 2018 identifies climate change mitigation as a goal of the agency.⁴⁰¹ To achieve this goal, USDA has committed to reducing greenhouse gas emissions by encouraging the adoption of climate-friendly agricultural practices.⁴⁰² Given the above, FCIC may identify climate change mitigation as a rele-

vant public policy goal to be taken into account when reviewing crop insurance policies. Adopting this approach, FCIC could disapprove crop insurance policies that do not require agricultural producers to take steps to reduce their greenhouse gas emissions.

FINDING 18

USDA could require agricultural producers to implement climate change mitigation strategies as a condition of receiving crop insurance.

6. CONSUMER EDUCATION PROGRAMS

KEY POINTS

- The production of livestock and other agricultural products emits greenhouse gases that contribute to climate change. Reducing these emissions will require changes in both the agricultural commodities produced and the production systems used. Consumers will play an important role in encouraging these changes.
- Consumers are becoming increasingly aware of the climate and other environmental effects of their food purchasing decisions. Many consumers want to make more climate-friendly choices, but are prevented from doing so by the difficulty of obtaining information on the climate impacts of different food options.
- USDA has broad authority to educate consumers about the national food system. Through its Agricultural Marketing Service, USDA collects and publishes information on food production and consumption. In addition, USDA's Center for Nutrition Policy and Promotion disseminates dietary guidelines and other nutritional information.
- To assist consumers in making climate-sensitive choices, USDA could report on the greenhouse gas emissions and other climate change effects of food production. Moreover, USDA could also require agricultural producers to promote climate-friendly foods.

The commodities produced and the production systems used by agricultural businesses effect their greenhouse gas emissions. Recent research indicates that greenhouse gas emissions from the production of meat and other animal products are substantially higher than those from most plant-based foods.⁴⁰³ The Food and Agriculture Organization of the United Nations estimates that, on average, red meat production emits thirty-five pounds of carbon dioxide equivalent per pound of dressed weight⁴⁰⁴.⁴⁰⁵ Other studies suggest that this estimate may understate the emissions resulting from meat production. Indeed, one study found that over fifty-five pounds of carbon dioxide equivalent is emitted per pound of beef produced.⁴⁰⁶ The same study indicated that, on a per pound basis, the production of wheat emits less than one pound of carbon dioxide equivalent.⁴⁰⁷

While the exact numbers remain disputed, it is generally agreed that individuals' diets have an important impact on greenhouse gas emissions. Numerous studies have assessed the emission reduction potential of various dietary changes.⁴⁰⁸ For example, one study found that a global transition to a no meat diet, in which all meat is replaced by plant protein, would reduce global emissions by approximately 7.1 billion tons of carbon dioxide equivalent per year by 2050.⁴⁰⁹ Removing all other animal products, including milk and eggs, from the diet would reduce global emissions by a further 1.5 billion tons per

year by 2050.⁴¹⁰ Recognizing this, the Chairman of the Intergovernmental Panel on Climate Change has encouraging individuals to reduce their consumption of animal products, stating “[i]n terms of immediacy of action and the feasibility of bringing about reductions in a short period of time, it is clearly the most attractive opportunity.”⁴¹¹ Even without giving up meat, consumers can encourage emissions reductions by demanding that animal and other products be produced using climate-friendly systems.⁴¹² Agricultural producers have numerous opportunities to limit the greenhouse gas emissions and other climate change effects of their operations. As discussed in Chapter 1, greenhouse gas emissions from livestock production can be significantly reduced with simple changes in the production system, including altered feeding patterns and improved waste management.⁴¹³ Similarly, enhancements in cropland management, including reduced application of fertilizers and increased use of cover cropping, can also help to limit greenhouse gas emissions.⁴¹⁴ Additionally, these changes may also lead to enhanced carbon sequestration on cropland.⁴¹⁵

Consumers can play an important role in encouraging these and other changes in the agricultural sector. Through their purchasing decisions, consumers can influence both what and how agricultural commodities are produced. While many consumers want to make more climate-friendly purchases,

they often lack the information needed to do so.

Empowering consumers to make climate-friendly purchases will require action at two levels. Firstly, consumers must be informed that their food purchases affect climate outcomes. Additionally, consumers must also be provided with information on the climate effects related to different foods. USDA is uniquely placed to educate consumers on these issues.

USDA's authority to conduct consumer education and outreach programs is summarized in section 6.1 below. Section 6.2 then discusses ways in which USDA may use this authority to empower consumers to make more climate-friendly food choices.

6.1. USDA'S CONSUMER EDUCATION AND OUTREACH PROGRAMS

As the federal agency overseeing the national food system, USDA has access to significant information on the climate and other environmental impacts of food production. USDA can relay this information to consumers through its agricultural promotion and nutrition advice programs.

The promotion of agricultural products is overseen by USDA's Agricultural Marketing Service ("**AMS**"). AMS was established by the Secretary of Agriculture to support the sale and distribution of agricultural commodities.⁴¹⁶ AMS's primary responsibilities include, among other things, promoting agricultural commodities,⁴¹⁷ researching agricultural

production processes,⁴¹⁸ administering commodity standardization, grading, and inspection programs,⁴¹⁹ and disseminating marketing information and statistics.⁴²⁰

In addition to promoting American food products, USDA also provides nutrition information to American consumers. USDA's Center for Nutrition Policy and Promotion ("**CNPP**"), in cooperation with the Department of Health and Human Services' Office of Disease Prevention and Health Promotion ("**ODPHP**"), publishes nutritional guidelines every five years.⁴²¹ The guidelines provide consumers with information and advice for choosing a healthy diet. In addition, the guidelines are also used by government agencies in designing and implementing nutrition assistance and food subsidy programs, including the Supplemental Nutrition Assistance Program which provides low-income families with monthly benefits to purchase food and the School Lunch Program which delivers meals to school children.

6.2. ACTIONS AVAILABLE TO USDA TO ENCOURAGE CLIMATE-FRIENDLY CHOICES BY CONSUMERS

USDA, by virtue of its role in promoting agricultural products, providing nutritional advice, and managing food subsidy programs, is uniquely placed to encourage climate-friendly food choices. To ensure that consumers appreciate the climate impacts of their purchasing decisions, USDA may report on the greenhouse gas emissions associated

with food production. USDA may encourage consumers to make climate-friendly purchases by promoting low-emitting foods.

6.2.1. CONSIDERING CLIMATE CHANGE WHEN DEVELOPING NUTRITIONAL GUIDELINES

The National Nutrition Monitoring and Related Research Act of 1990 (7 U.S.C. § 5301 et seq.) requires USDA's CNPP, in partnership with the Department of Health and Human Services' ODPHP, to develop dietary guidelines. In developing such guidelines, CNPP and ODPHP arguably can consider the greenhouse gas emissions and other climate change effects of different foods. This may result in CNPP and ODPHP adopting dietary guidelines that recommend increased consumption of climate-friendly foods and/or identify foods that should be limited because their production contributes significantly to climate change. By increasing awareness of the climate impacts of food production, this may encourage more climate-sensitive consumption decisions. As one environmental law scholar has observed:

“While there is no guarantee Americans will follow federal advice about food choices, the size of the government’s megaphone ensures that a significant portion of the population will likely hear its message. That is half the battle. People need recognize there is a problem and their personal food-choices and purch-

asing decisions are important to the solution.”⁴²²

Section 301(a)(1) of the National Nutrition Monitoring and Related Research Act (7 U.S.C. § 5341(a)(1)) requires the Secretaries of Agriculture and Health and Human Services to publish a report containing nutritional information and guidelines for the general public every five years (the “**Dietary Guidelines for Americans**”). The first edition of the Dietary Guidelines for Americans was published in 1980.⁴²³ Every five years, the Secretaries of Agriculture and Health and Human Services appoint a Dietary Guidelines Advisory Committee comprised of experts in nutrition and health to recommend changes to the Dietary Guidelines for Americans.⁴²⁴ Based on the Committee’s recommendations and comments from federal agencies and the public, CNPP and ODPHP prepare an updated edition of the Dietary Guidelines for Americans.⁴²⁵

The Dietary Guidelines for Americans provide advice on the components of a healthy diet.⁴²⁶ The current guidelines, finalized in 2010 (“**2010 Dietary Guidelines**”), contain twenty-three recommendations for the general population and six additional recommendations for specific population groups, such as pregnant women and the elderly.⁴²⁷ The recommendations emphasize the need to balance calories to maintain a healthy weight by reducing calorie consumption, increasing physical activity, and avoiding inactivity.⁴²⁸ The recommendations

identify foods and food components that should be avoided (e.g., sodium, saturated fatty acids, trans fatty acids, solid fats, and added sugars) and encourage increased consumption of nutrient-dense foods, such as vegetables, fruits, nuts, seeds, whole grains, seafood, lean meats, poultry, and eggs.⁴²⁹

Under section 301(a)(2) of the National Nutrition Monitoring and Related Research Act (7 U.S.C. § 5341(a)(2)), the recommendations in the Dietary Guidelines for Americans must “be based on the preponderance of the scientific and medical knowledge which is current at the time...[it] is prepared.” However, beyond this, the National Nutrition Monitoring and Related Research Act (7 U.S.C. § 5301 et seq.) does not provide any guidance on the preparation of the Dietary Guidelines for Americans. Consequently, the precise scope of CNPP and ODPHP’s authority is unclear. However, for the reasons discussed below, CNPP and ODPHP arguably have authority to consider the greenhouse gas emissions and other climate change effects of food production.

In developing past editions of the Dietary Guidelines for Americans, CNPP and ODPHP have considered the impacts of food consumption on human health. The 2010 Dietary Guidelines aimed to improve wellbeing, reduce disease risk, and prevent food-borne illness.⁴³⁰ To this end, the 2010 Dietary Guidelines analyzed the health impacts of consuming different foods and, based

on this analysis, identified healthy consumption patterns. By way of example, the 2010 Dietary Guidelines noted that individuals consuming large amounts of sodium may experience high blood pressure, increasing their risk of cardiovascular disease, congestive heart failure, and kidney problems.⁴³¹ To reduce this risk, the 2010 Dietary Guidelines recommended that individuals limit their sodium intake.⁴³²

In addition to analyzing the direct health effects of food consumption, the 2010 Dietary Guidelines also discussed a number of other factors indirectly affecting human health. For instance, the 2010 Dietary Guidelines considered the impact of environmental factors on individuals’ ability to maintain a healthy weight.⁴³³ Specifically, the 2010 Dietary Guidelines noted that a high crime rate and/or lack of parks may discourage individuals from undertaking outdoor exercise, leading to weight gain and associated health problems.⁴³⁴ To avoid this outcome, the 2010 Dietary Guidelines recommended that individuals increase their physical activity and limit their caloric intake.⁴³⁵

The environmental factors considered in the 2010 Dietary Guidelines affect human health only indirectly (i.e., by reducing opportunities for physical activity and thereby increasing the potential for weight gain). Similar indirect health effects arise from food production. As discussed above, the production of many foods emits greenhouse gases. By contributing to climate change, such

emissions increase the risk of chronic disease, food- and water-borne illness, and other health problems.

The third National Climate Assessment, released in May 2014, warned that the higher temperatures associated with climate change will lead to a rise in ground-level ozone which causes reduced lung function and worsens the effects of emphysema, asthma, and bronchitis.⁴³⁶ Respiratory and other health problems will also result from the increase in extreme heat, precipitation, and other abnormal weather events.⁴³⁷ Indeed, the third National Climate Assessment found that heat waves are associated with increased hospital admissions for respiratory, cardiovascular, and kidney disorders.⁴³⁸ Heat waves can also lead to more wildfires, the smoke from which reduces air quality, leading to increases in respiratory and cardiovascular hospitalizations.⁴³⁹

Climate change will also increase the risk of food- and water-borne illness. Since bacteria grows more quickly in a warm environment, salmonella and other food-borne pathogens will become increasingly common as temperatures rise.⁴⁴⁰ Additionally, water-borne parasites, such as cryptosporidium and giardia, will also occur more frequently as heavy precipitation and other extreme weather events heighten the risk of flooding.⁴⁴¹

Given the above, climate change is arguably a relevant factor to be taken into account in developing dietary guidelines that improve health, reduce dis-

ease risk, and prevent food-borne illness.

FINDING 19

USDA's Center for Nutrition Policy and Promotion could arguably recommend increased consumption of foods whose production does not adversely affect human health.

Regardless of whether this approach is adopted, CNPP and ODPHP can arguably conduct an environmental review under NEPA (42 U.S.C. § 4321 et seq.) when developing the Dietary Guidelines for Americans. As part of this environmental review, CNPP and ODPHP may assess the greenhouse gas emissions and other climate change effects of food production.

As discussed in Chapter 1, NEPA, section 102(2)(C) (42 U.S.C. § 4332(2)(C)) requires federal agencies to prepare an EIS for "all major federal actions significantly affecting the quality of the human environment." Agencies typically conduct an EA to determine whether a proposed action has significant environmental effects. However, where an agency determines that a specified type of action does not normally have such effects, it may categorically exclude that action from NEPA (42 U.S.C. § 4321 et seq.).⁴⁴² The agency may undertake a categorically excluded action without preparing an EA or EIS, unless it determines that the action

could significantly affect the environment.⁴⁴³

USDA has categorically excluded “[e]ducational and informational programs and activities” from environmental review under NEPA (42 U.S.C. § 4321 et seq.).⁴⁴⁴ Seemingly relying on this exclusion, CNPP did not undertake an environmental review during development of the 2010 Dietary Guidelines.

The Dietary Guidelines for Americans do much more than simply inform and educate consumers. In addition, the Dietary Guidelines for Americans also provide the policy foundation for all federal food, nutrition, and health programs.⁴⁴⁵ For example, USDA considers the Dietary Guidelines for Americans in developing and implementing the Supplemental Nutrition Assistance Program, which provides low-income families with monthly benefits to purchase food.⁴⁴⁶ Additionally, the Dietary Guidelines for Americans are also used by the Department of Health and Human Services in formulating national health improvement priorities and targets as part of its Healthy People 2020 initiative.⁴⁴⁷ Given their influence in these and other federal government programs, the Dietary Guidelines for Americans arguably do not fall within the categorical exclusion for “[e]ducational and informational programs and activities.”

Even if the Dietary Guidelines for Americans do enjoy a categorical exclusion, the guidelines arguably have significant environmental impacts requiring assessment under NEPA (42 U.S.C. §

4321 et seq.). Recent research indicates that the recommendation in the 2010 Dietary Guidelines that individuals increase their average weekly seafood intake from 3.5 ounces to over eight ounces will lead to overfishing, habitat destruction, and biodiversity loss.⁴⁴⁸ Other dietary recommendations may have similarly serious environmental consequences. For example, the 2010 Dietary Guidelines’ directive to consume less saturated fat will likely cause individuals to shift their protein intake from beef to leaner meats, such as lamb. As the production of lamb emits fifty percent more greenhouse gases than beef, this is likely to accelerate global climate change.⁴⁴⁹

Given the above, there is a good argument that CNPP and ODPHP must prepare an EIS under NEPA (42 U.S.C. § 4321 et seq.) when developing the Dietary Guidelines for Americans. Even if not legislatively required to do so, CNPP and ODPHP may voluntarily prepare an EIS.

In preparing the EIS, CNPP and ODPHP may collect and publish information on the greenhouse gas emissions resulting from agricultural activities. This would have a number of benefits, increasing awareness of the climate impacts of food production and thereby encouraging more climate-sensitive consumption decisions. However, it should be noted that assessing agriculture’s climate change effects is likely to be both costly and time consuming.

FINDING 20

USDA’s Center for Nutrition Policy and Promotion could conduct an environmental review under the National Environmental Policy Act (42 U.S.C. § 4321 et seq.) when developing nutritional guidelines.

CNPP and ODPHP arguably can consider the climate and other environmental effects of food production, as identified in the EIS, when developing the Dietary Guidelines for Americans. NEPA, section 101(a) (42 U.S.C. § 4331(a)) declares, as the policy of Congress, that the federal government “use all practical means and measures” to protect environmental values. Under NEPA, section 102(1) (42 U.S.C. § 4332(1)), to the fullest extent possible, all laws, regulations, and policies must be interpreted and administered in accordance with that Congressional policy. This has been held to require agencies to consider environmental factors, alongside economic and other matters, when performing their statutory duties.

In *Calvert Cliffs’ Coordinating Committee, Inc. v. U.S. Atomic Energy Com.*, 229 F.2d 1109 (D.C. Cir. 1971) (“**Calvert Cliffs**”), the Court of Appeals for the District of Columbia Circuit (“**D.C. Circuit**”) held that NEPA (42 U.S.C. § 4321 et seq.) “makes environmental protection a part of the mandate of every federal agency.”⁴⁵⁰ Therefore, according to the D.C. Circuit, federal

agencies must consider environmental issues throughout their decision-making processes.⁴⁵¹ This has subsequently been confirmed in numerous court cases.⁴⁵²

The court in *Calvert Cliffs* held that the mandate must be complied with “unless there is a clear conflict of statutory authority.”⁴⁵³ This approach has also been adopted in other circuits. For example, in *Scherr v. Volpe*, 466 F.2d 1027, (7th Cir. Wis. 1972), the U.S. Court of Appeals for the Seventh Circuit held that, “[a]bsent a conflict of statutory authority...federal officials must give full consideration to the environmental consequences” of their decisions.⁴⁵⁴

An agency’s authorizing legislation may expressly exempt it from compliance with NEPA.⁴⁵⁵ Additionally, an agency may also be exempt from compliance on the basis of an implied legislative conflict. Such a conflict has been held to arise where, for example, the agency’s authorizing legislation does not give it any discretion to consider environmental issues when making decisions.⁴⁵⁶ Another example is where the legislation sets a limited time period for decision and an environmental assessment cannot be completed within that period.⁴⁵⁷

The National Nutrition Monitoring and Related Research Act (7 U.S.C. § 5301 et seq.) does not expressly or impliedly preclude CNPP and ODPHP from considering environmental issues when developing the Dietary Guidelines for Americans. As discussed above, the

legislation does not specify the factors to be considered during development of the guidelines.⁴⁵⁸ Consequently, CNPP and ODPHP enjoy significant discretion in this area. There are no legislative time limits that would prevent CNPP and ODPHP from exercising its discretion to consider environmental factors.⁴⁵⁹

Several recent academic works emphasize the importance of considering environmental issues in the Dietary Guidelines for Americans. For example, a 2013 study by Nell Green Nylén found that the Dietary Guidelines for Americans are intended to alter the food choices of hundreds of millions of people.⁴⁶⁰ Green Nylén argues that these alterations will have “significant foreseeable environmental impacts that must be considered when deciding what advice to give and precisely how to frame it.”⁴⁶¹ Similarly, Kate Clancy has also argued that the environmental impacts of food choices should be taken into account in developing the Dietary Guidelines for Americans.⁴⁶²

FINDING 21

In developing nutritional guidelines, USDA’s Center for Nutrition Policy and Promotion could arguably consider the climate and other environmental impacts of food production.

For the reasons discussed above, USDA arguably has authority to assess the greenhouse gas emissions and other climate change effects of food production when developing the Dietary Guidelines for Americans. Based on this assessment, USDA may adopt guidelines that recommend increased consumption of climate-friendly foods and/or identify climate-damaging foods whose consumption should be limited.

Regardless of its broader authority with respect to education,⁴⁶³ USDA may conduct specific outreach programs to advocate the climate-friendly food choices in the Dietary Guidelines for Americans. Section 301(a)(1) of the National Nutrition Monitoring and Related Research Act of 1990 (7 U.S.C. § 5341(a)(1)) gives the Secretary of Agriculture broad authority to promote the Dietary Guidelines for Americans. In addition, USDA can also support state promotional activities. Under section 28(b) of the Food and Nutrition Act of 2008 (7 U.S.C. § 2036a(b)), state agencies may conduct educational programs for low-income individuals to promote healthy food choices consistent with the Dietary Guidelines for Americans. Food and Nutrition Act, section 28(d)(1) (7 U.S.C. § 2036a(d)(1)) requires the Secretary of Agriculture to provide state agencies with funding to assist in the conduct of these programs.

FINDING 22

USDA could conduct educational programs to promote climate-friendly food choices and/or provide funding to state agencies to conduct such programs.

6.2.2. PROMOTING CLIMATE-FRIENDLY FOODS

American consumers are becoming increasingly aware of the climate and other environmental impacts of their food choices.⁴⁶⁴ While many consumers want to make more climate-friendly purchases, they are often prevented from doing so by the difficulty of obtaining information on the climate impacts of different food options.⁴⁶⁵ To remedy this problem, USDA may require agricultural producers to identify and promote climate-friendly foods.

Under Commodity Promotion, Research, and Information Act, section 512(b) (7 U.S.C. § 7411(b)), the Secretary of Agriculture may establish programs providing for the conduct of promotion, research, and information activities in relation to agricultural commodities (“**research and promotion programs**”). These programs must be designed to strengthen the position of agricultural industries in the marketplace, maintain and expand, or develop new, markets for agricultural commodities, and/or assist agricultural producers to meet their conservation objectives (together the “**permitted purposes**”).



Market stall. Courtesy of Etienne Le Sueur.

Research and promotion programs are established through orders issued by AMS. Under Commodity Promotion, Research, and Information Act, sections 514(a) and 515(b)(1) (7 U.S.C. §§ 7413 and 7414(b)(1)), AMS may, on its own motion or upon request, order agricultural producers and other industry participants to conduct research and promotion programs for specified agricultural commodities.

AMS is not directly involved in the development and implementation of promotion and research programs. Rather, each program is conducted by a board of agricultural producers.⁴⁶⁶ Nevertheless, AMS can influence program design in two ways; one proactive and one reactive. First, orders issued by AMS can and do specify the activities to be undertaken by the board as part of its research and promotion programs.⁴⁶⁷

Additionally, AMS must also review research and promotion programs developed by the board.⁴⁶⁸

Eight research and promotion programs are currently operating under the Commodity Promotion, Research, and Information Act (7 U.S.C. § 7411 et seq.).⁴⁶⁹ While some of these programs relate to climate-friendly agricultural commodities, none require promotion of the commodities' environmental benefits. To remedy this deficiency, AMS could order the establishment of programs to promote agricultural commodities whose production results in few greenhouse gas emissions and/or other climate change effects, as climate-friendly.

Regulations issued under the Commodity Promotion, Research, and Information Act (7 U.S.C. § 4711 et seq.) require AMS to order the establishment of research and promotion programs if it determines that such programs will effectuate the permitted purposes in the Act.⁴⁷⁰ Promoting climate-friendly agricultural commodities achieves the permitted purposes by supporting agricultural market development. Recent research suggests that there is significant and growing consumer demand for

“green products” with superior environmental attributes.⁴⁷¹ This is particularly true in the market for food. During the last decade, organic food sales increased by 238 percent from \$8.6 billion in 2002 to \$29 billion in 2011.⁴⁷² Over the same period, organic suppliers' market share more than doubled to 4.2% in 2011.⁴⁷³ This growth is expected to continue over coming years.⁴⁷⁴

Given the above, AMS may validly conclude that identifying climate-friendly agricultural commodities will increase market demand for such commodities. Therefore, AMS may order the establishment of research and promotion programs relating to climate-friendly agricultural commodities, the production of which results in few greenhouse gas emissions and/or other climate change effects, under the Commodity Promotion, Research, and Information Act (7 U.S.C. § 4711 et seq.)

FINDING 23

USDA's Agricultural Marketing Service could establish research and promotion programs relating to climate-friendly agricultural commodities.

7. RURAL ENERGY PROJECTS

KEY POINTS

- The combustion of fossil fuels emits substantial carbon dioxide and other greenhouse gases. These emissions can be reduced by substituting wind, solar, and other renewable energy sources for fossil fuels in energy production. Similar benefits may also be achieved by adopting energy efficiency and other demand management programs that reduce energy use, eliminating the need for fossil fuel combustion and thereby lowering greenhouse gas emissions.
- USDA provides financial assistance for rural energy projects. Rural Electrification Act, section 2 (7 U.S.C. § 902) authorizes USDA to make, insure, and guarantee loans for the development of electric generating systems in rural areas. Additionally, under Farm Security and Rural Investment Act, section 9007 (7 U.S.C. § 8107), USDA may also provide loans and grants for on-farm electricity generation.
- USDA's financial assistance programs aim to, among other things, encourage the development of clean energy sources. To this end, USDA has provided funding for the establishment of wind, solar, and other renewable energy systems. At the same time, USDA has also continued to support fossil fuel based power projects.
- In the future, USDA could give renewable energy developers preferential access to grants and loans. This would ensure that the limited funds available through USDA's financial assistance programs are directed to renewable energy developments before fossil fuel projects.
- USDA could also take steps to reduce energy consumption. To this end, USDA may provide financial assistance for the implementation of energy efficiency and other demand-side management programs. Alternatively, USDA may require the implementation of such programs as a condition of funding other activities.
- To minimize rural energy projects' climate impacts, USDA could report on the greenhouse gas emissions resulting from such projects and options for mitigating those emissions.

The U.S. agricultural industry is highly energy intensive, with over seven units of energy required to produce each unit of food.⁴⁷⁵ Energy is used throughout the agricultural production process to, among other things, manufacture and apply fertilizers and pesticides, pump water, heat and cool buildings, operate equipment and vehicles, and process, package, store, and distribute products.⁴⁷⁶ Much of the energy used for these activities is derived from fossil fuels, which release carbon dioxide and other greenhouse gases when they are burned.⁴⁷⁷ Research by USDA indicates that the use of fossil fuel-based energy in the agricultural sector emitted over seventy-two million metric tons of carbon dioxide equivalent in 2008.⁴⁷⁸ This is comparable to the average annual carbon dioxide emissions of fifteen million passenger vehicles.⁴⁷⁹

The agricultural industry's greenhouse gas emissions can be reduced in a number of ways. Energy efficiency and other demand management programs may be implemented to reduce agricultural energy consumption, avoiding the combustion of fossil fuels and thereby lowering greenhouse gas emissions. Similar benefits may also be achieved by expanding the use of wind, solar, and other renewable fuel sources which produce energy without emitting greenhouse gases.

Agricultural producers can also support the use of renewable energy sources in other sectors of the economy. Agricultural lands contain significant

wind, solar, and geothermal resources that can be harnessed to generate electricity.⁴⁸⁰ Additionally, such lands also provide the feedstocks for biomass that can be utilized in electricity generation and other applications.⁴⁸¹ As discussed in Chapter 1, electricity generation using biomass results in substantially lower carbon dioxide emissions than fossil fuel generation.⁴⁸²

Recognizing these benefits, Congress has encouraged increased use of biomass in electricity generation and other applications. In Title IX of the Food, Conservation, and Energy Act of 2008 ("**2008 Farm Bill**"), Congress provided several million dollars in funding for the production of biofuels from biomass.⁴⁸³ Additional funding was provided in 2014 Farm Bill.⁴⁸⁴ This funding is distributed by USDA.

USDA currently provides a range of financial assistance to the biofuels industry. Through its Advanced Biofuels Payment Program, USDA has financed almost 300 projects aimed at increasing biofuels production.⁴⁸⁵ This has enabled the production of over nine billion gallons of biofuels; enough to generate approximately thirty six million MWh of electricity.⁴⁸⁶ To further expand production, USDA has supported the construction and operation of biorefineries. Since 2009, USDA's Biorefinery Assistance Program has provided loan guarantees in respect of the development of eleven biorefineries using woody materials, perennial grasses, algae, corn and soybean oil, municipal solid waste,

and/or agricultural residues to produce biofuels.⁴⁸⁷

USDA also supports the development of other renewable energy sources. At the direction of Congress, USDA has established the Rural Energy for America Program (“**REAP**”) to provide financial assistance to agricultural producers and rural small businesses to purchase renewable energy systems and make energy efficiency improvements. Since 2009, USDA has funded almost 8000 renewable energy and energy efficiency projects through REAP.⁴⁸⁸

Building on progress to date, this chapter identifies actions USDA can take to further reduce agricultural use of energy derived from fossil fuels. Section 7.1 outlines USDA’s regulatory authority over agricultural energy projects. Section 7.2 then discusses ways in which USDA can use this authority to promote increased investment in renewable energy and demand management programs.

7.1. USDA’S AUTHORITY OVER RURAL ENERGY PROJECTS

The construction and operation of electric generation, transmission, and distribution facilities is regulated by the Federal Energy Regulatory Commission and state regulatory bodies. USDA lacks authority to directly regulate rural energy development. However, USDA may indirectly influence such development through its rural assistance programs.

USDA’s Office of Rural Development (“**RD**”) provides financial and other assistance for energy projects in rural areas.⁴⁸⁹ Under Rural Electrification Act, section 2(a) (7 U.S.C. § 902(a)), the Secretary of Agriculture may make loans to electric suppliers to facilitate rural electrification, enable the provision and improvement of rural electric services, and support the implementation of renewable energy, demand management, and energy efficiency and conservation programs in rural areas. RD provides these loans on behalf of the Secretary of Agriculture. Under the Rural Electrification Act (7 U.S.C. § 901 et seq.), RD may provide loans directly to electric suppliers⁴⁹⁰ or insure⁴⁹¹ or guarantee⁴⁹² loans made to suppliers by third parties.

RD also operates a number of more specific funding programs designed to encourage the development of renewable fuel sources. Most of these programs aim to support the production and use of renewable biomass. Section 9005 of the 2002 Farm Bill (7 U.S.C. § 8105) established the Advanced Biofuels Payment Program under which RD must make payments to producers of advanced biofuels to support and expand the production thereof. To further increase production, RD also provides funding for the construction and operation of biorefineries. Under section 9003 of the 2002 Farm Bill (7 U.S.C. § 8103), RD must guarantee loans made to individuals, entities, Indian tribes, and state and local governments to fund the de-

velopment, construction, and retrofitting of certain commercial-scale biorefineries. To reduce fossil fuel use in biorefineries, section 9004 of the 2002 Farm Bill (7 U.S.C. § 8104) requires RD to provide grants for the installation of systems that use renewable biomass to produce heat and power to operate biorefineries.

RD also supports renewable energy development through REAP established under section 9007(a) of the 2002 Farm Bill (7 U.S.C. § 8107(a)). Under REAP, RD provides grants and loan guarantees to agricultural producers and rural small businesses to enable them to purchase renewable energy systems and make energy efficiency improvements.⁴⁹³ Additionally, RD also provides grants to state, tribal, and local governments, councils, higher education institutions, rural electric cooperatives, public power entities, and other similar organizations to assist agricultural producers and rural small businesses to make greater use of renewable energy resources and become more energy efficient.⁴⁹⁴

7.2. ACTIONS AVAILABLE TO USDA TO REDUCE FOSSIL FUEL USE IN RURAL AREAS

USDA can play an important role in reducing reliance on fossil fuels. To this end, USDA may encourage the development of alternative energy sources. Taking an initial step in this direction, USDA has provided financial support for the production of renewable biofuels. Additionally, USDA has also financed

the development of wind, solar, and other renewable energy systems. However, USDA has also continued to support coal, gas, and other fossil fuel power projects. To ensure that the limited funds available through RD's financial assistance programs are directed to renewable energy developments before fossil fuel projects, RD may give renewable energy developers preferential access to grants and loans.

USDA can further limit fossil fuel use by supporting improvements in energy efficiency. For this purpose, USDA may provide funding for energy efficiency improvements. Alternatively, USDA may require such improvements as a condition of funding other activities.

USDA can also do much to increase awareness of the climate impacts of energy projects. To this end, USDA may report on the greenhouse gas emissions and other climate change effects of energy projects when providing grants, loans, and other financial assistance therefor. This may result in USDA taking steps to mitigate such effects, including by mandating the use of emissions control technologies. Additionally, it may also encourage project proponents to voluntarily adopt these technologies.

7.2.1. CONSIDERING CLIMATE CHANGE WHEN FINANCING RURAL ENERGY PROJECTS

USDA's RD has broad authority to provide loans and other financial assistance for energy development in rural areas.

In exercising this authority, RD may collect and publish information on the greenhouse gas emissions and other climate change effects of such development. This is likely to have a number of benefits, increasing awareness of the climate impacts of energy projects and thereby encouraging more climate-sensitive decision-making both within and outside USDA.

(a) *Financial assistance for the development of rural electric systems*

Under the Rural Electrification Act (7 U.S.C. § 901 et seq.), RD may make, insure, and guarantee loans for the development of electric systems in rural areas. Before providing a loan, RD prepares an EIS under NEPA, section 102(2)(C) (42 U.S.C. § 4332(2)(C)).⁴⁹⁵ To facilitate preparation of the EIS, RD requires electric suppliers to submit a Borrower's Environmental Report with their loan application.⁴⁹⁶ Regulations issued under the Rural Electrification Act (7 U.S.C. § 901 et seq.) require the Borrower's Environmental Report to include information regarding the "effect the construction of [electric] facilities...will have on the environment."⁴⁹⁷ However, beyond this, the regulations provide little guidance on the information to be included in the report. Notably, the regulations do not require the report to assess a project's likely air quality impacts, including its potential to contribute to climate change. To ensure that such impacts are taken into account, RD may revise its policies to re-

quire loan applicants to provide information on the likely greenhouse gas emissions and other climate change effects of rural energy projects.

FINDING 24

USDA's Office of Rural Development could require each loan application in respect of a rural energy project to include information regarding the project's likely climate impacts.

RD's regulations do not currently provide for consideration of the greenhouse gas emissions and other climate change effects of rural energy projects in environmental reviews under NEPA (42 U.S.C. § 4321 et seq.). Nevertheless, climate-related issues have been discussed in each final EIS issued in relation to RD funded rural energy projects over the last five years.⁴⁹⁸ However, this discussion has been cursory at best.

RD's environmental review has generally focused on identifying the causes and effects of climate change. While acknowledging that rural energy projects may impact climatic conditions by increasing or reducing greenhouse gas emissions, RD has tended to downplay such impacts. Approximately sixty percent of the final EIS's issued between 2004 and 2014 quantified the change in emissions resulting from the rural energy project under review.⁴⁹⁹ However, even where emissions increases were identified, they were negated on the basis that they represent a small propor-

tion of the national and international greenhouse gas inventory.

RD's most recent EIS – issued in April 2013 in connection with the financing of Golden Valley Electric Association's proposal to restart operation of a coal-fired power generation facility at the Healy Power Plant in Alaska – is typical of its approach.⁵⁰⁰ In that case, RD found that the facility would emit approximately 0.61 million metric tons of carbon dioxide equivalent annually.⁵⁰¹ While accepting that these emissions would contribute to climatic changes, RD concluded that the facility's climate impacts "would be negligible."⁵⁰² In support of this conclusion, RD noted that emissions from the facility would account for less than one percent of the national greenhouse gas inventory.⁵⁰³ As all individual emissions sources will look small when compared to national emissions, this approach could enable most project proponents to evade responsibility for incremental new emissions.⁵⁰⁴ Arguably, when the objective must be to reduce emissions dramatically, any new source of emissions could have a significant impact.

To ensure a more comprehensive assessment of the climate impacts of rural energy projects, RD could revise its policies to expressly provide for consideration of the resulting greenhouse gas emissions. The revised policies may acknowledge that any increase in greenhouse gas emissions, regardless of its size, is likely to significantly affect the environment.

As part of its environmental review, RD may also identify options for mitigating the greenhouse gas emissions and other climate change effects of rural energy projects. As discussed in Chapter 1, NEPA (42 U.S.C. § 4321 et seq.) requires agencies to analyze reasonable alternatives to proposed actions.⁵⁰⁵ The courts have held that, in undertaking this analysis of alternatives, agencies must consider possible methods for mitigating an action's impacts.⁵⁰⁶ Consistent with this requirement, RD has indicated that, "throughout the assessment process, consideration will be given to incorporating mechanisms into the proposed action for reducing, mitigating, or avoiding adverse impacts."⁵⁰⁷

FINDING 25

USDA's Office of Rural Development could consider the greenhouse gas emissions and other climate change effects of rural energy projects and options for mitigating those effects in environmental reviews.

(b) *Financial assistance for on-farm energy projects*

In addition to supporting rural utility services, RD can also provide financial assistance for on-farm energy projects. Through REAP, RD provides grants and loan guarantees to agricultural producers and rural small businesses to purchase renewable energy systems and/or make energy efficiency improvements.⁵⁰⁸ These activities will have a

significant impact on future climatic conditions.

Unlike fossil fuel power plants, most renewable power systems generate electricity without emitting greenhouse gases or other air pollutants. However, the production, transportation, and installation of such systems may do so. In contrast, energy conservation and other demand management programs eliminate the need for new generating capacity and thereby avoid greenhouse gas emissions.⁵⁰⁹

RD has indicated that, in determining a project's eligibility for funding under REAP, it will "consider environmental quality as equal with economic, social, and other relevant factors."⁵¹⁰ RD has committed to undertaking all "required environmental reviews," including reviews under NEPA (42 U.S.C. § 4321 et seq.), before providing grants or loans for renewable energy projects.⁵¹¹

To facilitate its review, RD requires each application for financial assistance for an on-farm energy project to include information on the project's likely environmental impacts.⁵¹² Relevantly, RD asks applicants to indicate – by answering "yes", "no" or "unknown" – whether the project will affect air quality.⁵¹³ Applicants are not required to provide detailed information on the nature of any such effects, including the types and quantities of greenhouse gas and/or other air emissions resulting from the project. Increasing access to such information is likely to have a number of benefits, raising awareness of the cli-

mate impacts of on-farm energy projects and thereby encouraging more climate-sensitive decision-making by farmers. To this end, RD may require applicants to provide information regarding the project's likely climate impacts.

FINDING 26

USDA's Office of Rural Development could require applications for financial assistance for on-farm energy projects to include information regarding the project's climate impacts.

RD's regulations do not currently provide for consideration of the greenhouse gas emissions and other climate change effects of on-farm energy projects as part of the environmental review process. RD could update its regulations to require an assessment of such effects.⁵¹⁴

FINDING 27

USDA's Office of Rural Development could consider the climate impacts of on-farm energy projects, including the greenhouse gas emissions resulting from construction and operation of renewable energy facilities and options for reducing those emissions, in environmental reviews.

Notwithstanding its benefits, assessing the climate impacts of on-farm renewable energy projects is likely to be

both costly and time consuming. For this reason, requiring such an assessment may discourage the development and use of renewable energy sources. To avoid this outcome, RD could prepare estimates of the greenhouse gas emissions likely to result from different renewable energy projects based on their size and other characteristics. These estimates could then be used in determining the likely climate impacts of individual projects.

FINDING 28

USDA's Office of Rural Development could prepare estimates of the greenhouse gas emissions and other climate change effects likely to result from different categories of energy projects.

7.2.2. SUPPORTING RENEWABLE ENERGY DEVELOPMENT IN RURAL AREAS

USDA's RD can encourage reductions in fossil fuel use by facilitating the development of renewable energy sources. To this end, RD could give renewable energy developers preferential access to loans and other financial assistance. This would ensure that the limited funds available through RD's financial assistance programs are directed to renewable energy developments before fossil fuel projects.

As discussed in section 7.1 above, the Rural Electrification Act (7 U.S.C. § 901 et seq.) authorizes RD to make, insure, and guarantee loans for the provi-

sion of electric services in rural areas. Congress sets the total amount of loans RD may provide to rural electric suppliers each year in annual appropriations Acts.⁵¹⁵ Where insufficient funds are available to satisfy all loan applications, RD is forced to refuse some applications and/or reduce the size of some loans.

The Rural Electrification Act (7 U.S.C. § 901 et seq.) does not specify how RD should allocate funds when the amount sought by electric suppliers exceeds the

amount available for lending. In such cases, RD typically provides reduced funding to all suppliers eligible for loans.⁵¹⁶ This is likely to hamper renewable energy developments, which may find it difficult to obtain additional funding through capital markets. Re-



renewable energy developments often have larger per-unit capital costs than fossil-fuel projects and therefore require higher amounts of financing for the same capacity.⁵¹⁷ As more capital is being risked up front, capital markets may demand a premium in lending rates for financing renewable energy projects.⁵¹⁸

RD could revise its regulations for issuing loans for rural energy projects to expressly state that, where the amount available for lending in any year is less than the total amount sought in loans, preference will be given to loans for renewable energy development.

FINDING 29

USDA's Office of Rural Development could give renewable energy developers preferential access to its loan and other financial assistance programs.

**7.2.3. REDUCING ENERGY CONSUMPTION
IN RURAL AREAS**

USDA can also do much to reduce energy consumption. Seeking to achieve this goal,

USDA has provided financial assistance for energy conservation and efficiency programs.

As discussed above, Rural Electrification Act, section 2(a) (7 U.S.C. § 902(a)) authorizes USDA's RD to make loans for the provision of electric services in rural areas. Under

Rural Electrification Act, section 12 (7 U.S.C. § 912), RD may allow borrowers to defer repayment of such loans in order to fund other projects, including energy conservation improvements. Pursuant to this section, RD has established the Electric Resource Conservation Loan Program allowing borrowers to defer repayment of loans in order to fund weatherization and other activities designed to conserve energy.⁵¹⁹

RD has also provided financial assistance for energy efficiency improvements. Through the Energy Efficiency and Conservation Loan Program, RD loans funds to electric suppliers for use in certain energy efficiency programs.⁵²⁰ The supplier may undertake such programs itself⁵²¹ or relend the funds to its consumers to enable them to do so.⁵²² Programs eligible for funding include energy efficiency conservation measures on consumer premises, demand side management investments, energy audits, and community education and outreach programs.⁵²³

In December 2013, RD announced that it will make \$250 million available under the Energy Efficiency and Conservation Loan Program in FY 2014.⁵²⁴ Since this time, Congress has authorized the appropriation of an additional \$75 million in each FY from 2014 to 2018 for loans to support energy efficiency improvements under the 2014 Farm Bill.⁵²⁵

Section 6205 of the 2014 Farm Bill inserted a new section 6407 into the 2002 Farm Bill (7 U.S.C. § 8107a) es-

establishing the rural energy savings program. Under this program, RD must make interest free loans to eligible public power districts, public utility districts, electric cooperatives, and other entities to enable them to make loans to their consumers to implement energy efficiency measures.⁵²⁶ To date, RD has not made any such loans.

FINDING 30

USDA's Office of Rural Development could provide additional funding for the implementation of energy efficiency measures.

USDA can further encourage reductions in energy use by requiring the adoption of energy efficiency measures as a condition of participation in its agricultural assistance programs. As discussed in Chapter 1 above, USDA has broad authority to provide grants, loans, and other payments to agricultural producers. USDA may require producers receiving such payments to increase their energy efficiency. By way of example, USDA could require such action by producers receiving marketing assistance loans.

Section 1201(b)(1) of the 2014 Farm Bill authorizes the Secretary of Agriculture to provide marketing assistance loans to agricultural producers for the 2014 to 2018 crops of loan commodities.⁵²⁷ Under section 1201(b)(2) of the 2014 Farm Bill, the Secretary of Agriculture can attach terms and conditions to marketing assistance loans. Pursuant to

this section, USDA can condition loans on the recipient taking steps to improve energy efficiency.

The 2014 Farm Bill does not specify the factors to be considered by USDA in issuing marketing assistance loans. As discussed above, the courts have interpreted such congressional silence in other statutes as authorizing the consideration of any logically relevant decisional factor.⁵²⁸ An agency is only prevented from considering a factor that is logically relevant to its decision if there is clear congressional intent to preclude consideration of that factor.⁵²⁹ Such intent must be manifest in the text, structure, and/or history of the legislation authorizing the agency decision.⁵³⁰

There is a good argument that, in providing marketing assistance loans, USDA may consider the efficiency of a recipient's energy use. As discussed above, marketing assistance loans provide interim financing to agricultural producers so that they do not have to sell commodities at low harvest-time prices.⁵³¹ This enables producers to delay commodity sales until prices rise, increasing their profitability.⁵³² Agricultural producers' profitability can be further increased through cost savings. One means of achieving such savings is to increase energy efficiency.

Given the above, USDA may validly conclude that energy efficiency is a relevant factor to be taken into account when issuing marketing assistance loans. Nothing in the text, structure, or history of the 2014 Farm Bill suggests

that Congress intended to prevent USDA from considering this factor.

FINDING 31

USDA could explore opportunities for requiring agricultural producers to

improve their energy efficiency as a condition of receiving marketing assistance loans and other financial support.

8. CONCLUSION

There is now almost universal agreement among scientists that anthropogenic greenhouse gas emissions have caused, and will continue to cause, average global temperatures to rise.⁵³³ Rising temperatures will lead to altered precipitation patterns, reduced snow and ice cover, increased sea levels, and more frequent and severe extreme weather events.⁵³⁴ These effects can be mitigated by limiting the emission of greenhouse gases and/or removing such gases from the atmosphere.

Recognizing the threat posed by climate change, President Obama has repeatedly called on Congress to enact legislation encouraging mitigation.⁵³⁵ In the absence of Congressional action, the President has used existing executive powers to support climate change mitigation. The President's Climate Action Plan requires the executive branch to, among other things, set pollution limits for new and existing power plants, adopt fuel economy standards for heavy-duty vehicles, support the development of renewable fuels and other clean energy and transportation options, and conserve forests to increase carbon sequestration.⁵³⁶

USDA is one of several executive agencies charged with implementing the Climate Action Plan. USDA is the primary agency responsible for overseeing the agricultural industry. The agency has broad ranging authority to, among other things, protect agricultural re-

sources, supervise agricultural production, support agricultural incomes, promote food and other agricultural products, ensure food safety, provide nutrition advice, and administer food subsidy programs. Additionally, USDA is also involved in the management of federal, state, and private forestlands.

USDA, by virtue of its oversight of the agricultural and forestry sectors, can play an important role in mitigating climate change. Specifically, USDA can help to reduce greenhouse gas emissions from agricultural and forestry activities, increase carbon sequestration on agricultural and forest land, and expand the use of renewable fuels in the agricultural, forestry, and other industries.

Recognizing this, USDA has implemented various climate change mitigation strategies. For example, USDA has sought to reduce greenhouse gas emissions by limiting agricultural use of fossil fuels. Since 2009, USDA has financed over 8000 renewable energy and energy efficiency projects.⁵³⁷ Additionally, USDA has also provided financial and other assistance for the production and use of biofuels.⁵³⁸ To offset the remaining emissions, USDA has increased carbon sequestration by protecting and expanding tree cover in national forests and other areas.⁵³⁹

Building on these efforts, USDA can take additional steps to mitigate climate change. USDA could:

- **Reduce fossil fuel energy use and resulting greenhouse gas emissions.** USDA can encourage the use of sustainably-grown wood in place of steel, concrete, and other energy-intensive construction materials. For this purpose, USDA can permit the harvesting of trees from national forests. USDA can require wood waste from tree harvests in national forests to be made available for use in electricity generation. To further increase electricity generation from woody biomass and other renewable sources, USDA can publish information on national forests' renewable energy potential. Additionally, USDA can also streamline the permitting process for renewable energy facilities in national forests.
- **Promote the sustainable management of forests to enhance carbon sequestration.** USDA can provide funding for activities aimed at protecting, restoring, and expanding tree cover on state and private forestland. Additionally, USDA can also invest in reforestation of federally-owned land cleared through logging and/or other activities.
- **Further expand carbon sequestration on agricultural lands.** USDA can provide agricultural producers with additional funding to plant trees and other vegetation that sequesters carbon.
- **Support additional greenhouse gas emissions reductions in the agricultural sector.** USDA can provide financial assistance for the adoption of climate-friendly practices and/or require the adoption of such practices as a condition of financing other projects.
- **Encourage the production and consumption of climate-friendly foods.** USDA can report on the greenhouse gas emissions resulting from food production and promote low-emission foods.
- **Advance agricultural use of clean energy sources.** USDA can provide agricultural producers with additional funding to invest in renewable generation and energy efficiency.



Lettuce crops in Monterey County, CA. Courtesy of Etienne Le

¹ U.S. ENVIRONMENTAL PROTECTION AGENCY, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990 – 2012, ES-5 – ES-7 (2014), *available at* <http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html>.

² *Id.*

³ The Role of Agriculture and Forestry in Global Warming Legislation: Hearing Before the S. Comm. on Agriculture, Nutrition, and Forestry, 111th Cong. 6 (2009) (statement of Roger Johnson, President, National Farmers Union).

⁴ National Oceanic and Atmospheric Administration, Mauna Loa CO₂ Annual Mean Data (last updated May 5, 2014), ftp://aftp.cmdl.noaa.gov/products/trends/co2/co2_annmean_mlo.txt.

⁵ David Victor, Dadi Zhou, Essam Hassan Mohamed Ahmed, Pradeep Kumar Dadhich, Jos Olivier, H-Holger Rogner, Kamel Sheikho, Mitsutsune Yamaguchi, *Introduction*, in CLIMATE CHANGE 2014: MITIGATION OF CLIMATE CHANGE 1, 16 (Ottmar Edenhofer, Ramón Pichs-Madruga, Youba Sokona, Shardul Agrawala, Igor Alexeyevich Bashmakov, Gabriel Blanco, John Broome, Thomas Brucknew, Steffen Brunner, Mercedes Bustamante, Leon Clarke, Felix Creutzig, Shobhakar Dhakal, Navroz K. Dubash, Patrick Eickemeier, Ellie Farahani, Manfred Fischedick, Marc Fleurbaey, Reyer Gerlagh, Luis Gómez-Echeverri, Shreekanth Gupta, Sujata Gupta, Jochen Harnish, Kejun Jiang, Susanne Kadner, Sivan Kartha, Stephan Klasen, Charles Kolstad, Volker Krey, Howard Kunreuther, Oswaldo Lucon, Omar Masera, Howard Kunreuther, Oswaldo Lucon, Omar Masera, Juan Minx, Yacob Mulugetta, Anthony Patt, Nijavalli H. Ravindranath, Keywan Riahi, Joyashree Roy, Roberto Schaeffer, Steffen Schlömer, Karen Seto, Kristin Seyboth, Ralph Sims, Jim Skea, Pete Smith, Eswaran Somanathan, Robert Stavins, Christoph von Stechow, Thomas Sterner, Taishi Sugiyama, Sangwon Suh, Kevin Chika Urama, Diana Ürge-Vorsatz, David Victor, Dadi Zhou, Ji Zou, and Tomm Zwickel eds., 2014), *available at* <http://www.ipcc.ch/report/ar5/wg3/> (indicating that carbon dioxide released from the combustion of fossil fuels accounted for approximately sixty percent of total global greenhouse gas emissions in 2010). See also U.S. ENVIRONMENTAL PROTECTION AGENCY, *supra* NOTE 1, AT ES-5 – ES-7 (indicating that fossil fuel combustion was the largest source of greenhouse gas emissions in the U.S. in 2012).

⁶ Victor et al., *supra* note 5, at 21; U.S. ENVIRONMENTAL PROTECTION AGENCY, *supra* note 1, at ES-5 – ES-7.

⁷ Victor et al., *supra* note 5, at 16; U.S. ENVIRONMENTAL PROTECTION AGENCY, *supra* note 1, at ES-5 – ES-7.

⁸ John Walsh, Donald Wuebbles, Katharine Hayhoe, James Kossin, Kenneth Kunkel, Graeme Stephens, Peter Thorne, Russell Vose, Michael Wehner, Josh Willis, David Anderson, Scott Doney, Richard Feely, Paula Hennon, Viatcheslav Kharin, Thomas Knutson, Felix Landerer, Tim Lenton, John Kennedy, and Richard Somerville, *Ch. 2: Our Changing Climate*, in CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT 19, 29 (Jerry M. Melillo, Terese (T.C.) Richmond, and Gary W. Yohe eds., 2014), *available at* http://s3.amazonaws.com/nca2014/high/NCA3_Full_Report_02_Our_Changing_Climate_HighRes.pdf?download=1

⁹ *Id.* at 33 (stating that, in the future, “the contrast between wet and dry areas will increase both in the U.S. and globally”).

¹⁰ *Id.* at 37 (finding that “the recent trend towards increased heavy precipitation events will increase” in coming years).

¹¹ *Id.* at 39 – 42 (indicating that the frequency, intensity, and duration of extreme weather events are projected to increase as the climate continues to warm).

¹² *Id.* at 44 – 45 (stating that increased temperatures are leading to the “melting of glaciers and ice sheets [which] is...contributing to sea level rise at increasing rates” and finding that rising sea levels, combined with storm surges and high tides, could increase flooding in coastal areas).

¹³ *Id.* at 40 (indicating that, in coming years, the risk of flooding will increase).

¹⁴ *Id.* at 17 (finding that “[w]ater quality and water supply reliability are jeopardized by climate change”).

¹⁵ U.S. Global Change Research Program, *Chapter 1: Overview and Report Findings*, in CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT 7, 12 (Jerry M. Melillo, Terese (T.C.) Richmond, and Gary W. Yohe eds., 2014), *available at*

http://s3.amazonaws.com/nca2014/high/NCA3_Full_Report_01_Overview_Report_Findings_HighRes.pdf?download=1.

¹⁶ Jerry Hatfield, Gene Takle, Richard Grotjahn, Patrick Holden, R. Cesar Izaurralde, Terry Mader, Elizabeth Marshall, and Diana Liverman, *Chapter 6: Agriculture*, in CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT 150, 152 (Jerry M. Melillo, Terese (T.C.) Richmond, and Gary W. Yohe eds., 2014), available at

http://s3.amazonaws.com/nca2014/high/NCA3_Full_Report_06_Agriculture_HighRes.pdf?download=1

(stating that, “[b]y mid-century, when temperature increases are projected to be between 1.8°F and 5.4°F and precipitation extremes are further intensified...farm profits are expected to decline”).

¹⁷ *Id.* at 152 – 157. See also U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, CLIMATE CHANGE AND AGRICULTURE IN THE UNITED STATES: EFFECTS AND ADAPTATION, 2 (2013), available at http://www.usda.gov/oce/climate_change/effects_2012/effects_agriculture.htm.

¹⁸ Hatfield et al., *supra* note 16, at 157; U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, *supra* note 17, at 4.

¹⁹ Hatfield et al., *supra* note 16, at 159; U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, *supra* note 17, at 5 – 6.

²⁰ Hatfield et al., *supra* note 16, at 158. See also U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, *supra* note 17, at 12.

²¹ Walsh et al., *supra* note 8, at 25 (indicating that “choices made now and in the next few decades will determine the amount of additional future warming”).

²² Hatfield et al., *supra* note 16, at 161.

²³ *Id.* at 162.

²⁴ U.S. ENVIRONMENTAL PROTECTION AGENCY, *supra* note 1, at 6-1.

²⁵ *Id.*

²⁶ *Id.* at 1-8 (stating that nitrous oxide has a global warming potential 310 times that of carbon dioxide over a 100 year time horizon).

²⁷ *Id.* at ES-6 and 6-2 (indicating that, in 2012, agricultural nitrous oxide emissions were 324.7 teragrams of carbon dioxide equivalent and total nitrous oxide emissions were 410.1 teragrams of carbon dioxide equivalent).

²⁸ *Id.* (indicating that, in 2012, agricultural methane emissions were 201.5 teragrams of carbon dioxide equivalent and total methane emissions were 567.3 teragrams of carbon dioxide equivalent).

²⁹ “Global warming potential” refers to the ability of a greenhouse gas to trap heat in the earth’s atmosphere, compared to carbon dioxide. *Id.* at 1-7.

³⁰ *Id.* at 1-8.

³¹ Ottmar Edenhofer, Ramón Pichs-Madruga, Youba Sokona, Kristin Seyboth, Dan Arvizu, Thomas Bruckner, John Christensen, Helena Chum, Jean-Michel Devernay, Andre Faaij, Manfred Fischedick, Barry Goldstein, Gerrit Hansen, John Huckerby, Arnulf Jäger-Waldau, Susanne Kadner, Daniel Kammen, Volker Krey, Arun Kumar, Anthony Lewis, Oswaldo Lucon, Patrick Matschoss, Lourdes Maurice, Catherine Mitchell, William Moomaw, José Moreira, Alain Nadai, Lars J. Nilsson, John Nyboer, Atiq Rahman, Jayant Sathaye, Janet Sawin, Roberto Schaeffer, Tormod Schei, Steffen Schlömer, Ralph Sims, Christoph von Stechow, Aviel Verbruggen, Kevin Urama, Ryan Wiser, Francis Yamba, & Timm Zwickel, *Summary for Policymakers*, in RENEWABLE ENERGY SOURCES AND CLIMATE CHANGE MITIGATION 3, 19 (Ottmar Edenhofer, Ramón Pichs-Madruga, Youba Sokona, Kristin Seyboth, Patrick Matschoss, Susanne Kadner, Timm Zwickel, Patrick Eickemeier, Gerrit Hansen, Steffen Schlömer, and Christoph von Stechow eds., 2011), available at <http://srren.ipcc-wg3.de/report> (indicating that, on a lifecycle basis, electric generation from biomass emits an average of thirty-two grams of carbon dioxide equivalent per KWh of electricity generated, while electric generation from coal emits an average of 1001 grams of carbon dioxide equivalent per KWh of electricity generated).

³² ROBERT D. PERLACK, LYNN L. WRIGHT, ANTHONY F. TURHOLLOW, ROBIN L. GRAHAM, BRYCE J. STOKES, AND DONALD C. ERBACH, BIOMASS AS A FEEDSTOCK FOR A BIOENERGY AND BIOPRODUCTS INDUSTRY: THE TECHNICAL FEASIBILITY OF A BILLION-TON ANNUAL SUPPLY, 38 (2005), available at http://feedstockreview.ornl.gov/pdf/billion_ton_vision.pdf.

³³ Ross W. Gorte, *Carbon Sequestration in Forests*, CONGRESSIONAL RESEARCH SERVICE REPORT FOR CONGRESS RL31432, 8-9 (2009).

³⁴ U.S. ENVIRONMENTAL PROTECTION AGENCY, *supra* note 1, at 7-2 and ES-7 (finding that, in 2012, areas remaining as forest land sequestered 866.5 teragrams of carbon dioxide equivalent, areas remaining as cropland sequestered 26.5 teragrams of carbon dioxide equivalent, and areas converted to grassland sequestered 8.5 teragrams of carbon dioxide equivalent, while total greenhouse gas emissions were 6,525.6 teragrams of carbon dioxide equivalent).

³⁵ The Role of Agriculture and Forestry in Global Warming Legislation: Hearing Before the S. Comm. on Agriculture, Nutrition, and Forestry, 111th Cong. 6 (2009) (statement of Roger Johnson, President, National Farmers Union).

³⁶ President Barack Obama, Remarks by the President in the State of the Union Address (Feb. 12, 2013) [hereinafter 2013 State of the Union Address].

³⁷ EXECUTIVE OFFICE OF THE PRESIDENT, THE PRESIDENT'S CLIMATE ACTION PLAN (2013), *available at* <http://www.whitehouse.gov/sites/default/files/images/president27climateactionplan.pdf>.

³⁸ *Id.* at 6.

³⁹ *Id.* at 6 – 7.

⁴⁰ *Id.* at 7.

⁴¹ *Id.* at 9 – 10.

⁴² *Id.* at 8.

⁴³ *Id.*

⁴⁴ *Id.* at 10 – 11.

⁴⁵ *Id.* at 11.

⁴⁶ U.S. DEPARTMENT OF AGRICULTURE FARM SERVICE AGENCY, FACT SHEET: CONSERVATION RESERVE PROGRAM SIGN-UP 45 ENVIRONMENTAL BENEFITS INDEX (EBI) (2013), *available at* http://www.fsa.usda.gov/Internet/FSA_File/su45ebifactsheet.pdf (indicating that USDA may provide funding for projects that increase carbon sequestration by, for example, expanding vegetative covers). See *infra* section 4.2.3.

⁴⁷ For example, USDA has removed vegetation from overcrowded forests to increase their ability to sequester carbon. See, for example, U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, FOREST THINNING: BEYOND FUELS REDUCTION, *available at* https://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5408117.pdf. See *infra* section 4.2.2

⁴⁸ U.S. Department of Agriculture Agricultural Research Service, National Program 212: Climate Change, Soils, and Emissions and NP214: Agricultural and Industrial Byproducts (last updated May 28, 2013), http://www.ars.usda.gov/research/programs/programs.htm?NP_CODE=212 (discussing research undertaken by USDA's Agricultural Research Service to, among other things, identify climate-friendly agricultural practices that can help to reduce greenhouse gas emissions and enhance terrestrial carbon sequestration); U.S. Department of Agriculture National Institute of Food and Agriculture, Research, Education, Extension: Global Change & Climate (last updated Sep. 24, 2013), <http://www.nifa.usda.gov/ProgViewOverview.cfm?prnum=19803> (outlining research and education programs undertaken by USDA's National Institute of Food and Agriculture with respect to the mitigation of, and adaptation to, climate change).

⁴⁹ U.S. Department of Agriculture National Institute of Food and Agriculture, Research, Education, Extension: Global Change & Climate (last updated Sep. 24, 2013), <http://www.nifa.usda.gov/ProgViewOverview.cfm?prnum=19803>.

⁵⁰ THE WHITE HOUSE, CLIMATE ACTION PLAN: STRATEGY TO REDUCE METHANE EMISSIONS, 7 (2014), *available at* http://www.whitehouse.gov/sites/default/files/strategy_to_reduce_methane_emissions_2014-03-28_final.pdf.

⁵¹ Press Release, U.S. Department of Agriculture, Agriculture Secretary Announces Funding to Support Small Socially Disadvantaged Producers and Renewable Energy Projects (Apr. 15, 2014), <http://www.usda.gov/wps/portal/usda/usdahome?contentid=2013/09/0191.xml> (stating that, since 2009, USDA has funded over 8000 energy efficiency and renewable energy projects through its Rural Energy for America Program). See *infra* Chapter 1.

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- ⁵² U.S. Department of Agriculture, About USDA: Mission Statement (last updated Apr. 14, 2014), http://www.usda.gov/wps/portal/usda/usdahome?navid=MISSION_STATEMENT.
- ⁵³ U.S. DEPARTMENT OF AGRICULTURE, FY 2014: BUDGET SUMMARY AND ANNUAL PERFORMANCE PLAN, 2 (2013), available at <http://www.obpa.usda.gov/budsum/FY14budsum.pdf>.
- ⁵⁴ *Id.* at 3 (indicating that seventy two percent of USDA outlays are associated with nutrition support programs).
- ⁵⁵ *Id.* at 53.
- ⁵⁶ *Id.*
- ⁵⁷ *Id.* at 3 (indicating that fifteen percent of USDA outlays are associated with farm and commodity programs).
- ⁵⁸ *Id.*
- ⁵⁹ U.S. DEPARTMENT OF AGRICULTURE FARM SERVICE AGENCY, FARM LOANS, 1 (2014), available at http://www.fsa.usda.gov/Internet/FSA_File/loanprograms2014.pdf.
- ⁶⁰ *Id.*
- ⁶¹ U.S. Department of Agriculture Farm Service Agency, Disaster Assistance Programs (last updated Jun. 17, 2014), <http://www.fsa.usda.gov/FSA/webapp?area=home&subject=diap&topic=landing>.
- ⁶² U.S. DEPARTMENT OF AGRICULTURE, FY 2015: BUDGET SUMMARY AND ANNUAL PERFORMANCE PLAN, 14 (2013), available at <http://www.obpa.usda.gov/budsum/FY15budsum.pdf>.
- ⁶³ Megan Stubbs, *Agricultural Conservation: A Guide To Programs*, Conservation Research Service Report for Congress R40763, 1 (2013).
- ⁶⁴ *Id.* at 10.
- ⁶⁵ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 53, at 24.
- ⁶⁶ *Id.* at 65 (indicating that the FY 2014 budget provides \$1.35 billion in funding for the EQIP and \$989 million in funding for the Conservation Stewardship Program).
- ⁶⁷ *Id.* at 73.
- ⁶⁸ *Id.* at 74.
- ⁶⁹ *Id.*
- ⁷⁰ See, for example, U.S. Department of Agriculture Forest Service, Community Forest Program (last updated Apr. 3, 2014), <http://www.fs.fed.us/spf/coop/programs/loa/flp.shtml> (outlining the Community Forest and Open Space Conservation Program which provides financial assistance to local and tribal governments and non-profit organizations to acquire and maintain forestland).
- ⁷¹ Gorte, *supra* note 33, at 2.
- ⁷² *Id.* at 3.
- ⁷³ *Id.*
- ⁷⁴ *Id.*
- ⁷⁵ *Id.* at 4.
- ⁷⁶ The term “boreal forests” refers to forests that are located in northern latitudes and contain predominantly conifers such as spruce, fir and larch, with scattered birch and aspen stands. *Id.* at 6.
- ⁷⁷ *Id.*
- ⁷⁸ The term “tropical forests” refers to forests located between the Tropic of Cancer and the Tropic of Capricorn which contain a wide variety of hardwood tree species. *Id.* at 5.
- ⁷⁹ *Id.*
- ⁸⁰ The term “temperate forests” refers to forests located in the mid-latitudes that contain a variety of hard and softwood trees. *Id.* at 6.
- ⁸¹ *Id.*
- ⁸² U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, FOREST SERVICE STRATEGIC FRAMEWORK FOR RESPONDING TO CLIMATE CHANGE, 3 and 10 (2008), available at <http://www.fs.fed.us/climatechange/documents/strategic-framework-climate-change-1-0.pdf> (finding that poor management of forests and grasslands has contributed to increased greenhouse gas emissions and reduced carbon sequestration).
- ⁸³ U.S. Department of Agriculture Forest Service, Fire & Aviation Management (last visited May 15, 2014), <http://www.fs.fed.us/fire/> (indicating that, in the past, the Forest Service sought to eliminate fire from national forests).
- ⁸⁴ *Id.*

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- ⁸⁵ U.S. Department of Agriculture Forest Service, Managing Wildland Fires (last visited May 15, 2014), <http://www.fs.fed.us/fire/management/rx.html>.
- ⁸⁶ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, *supra* note 82, at 7 (indicating that the Forest Service will “[p]romote the management of forests and grasslands to reduce the buildup of greenhouse gases, while sustaining the multiple benefits and services of these ecosystems”).
- ⁸⁷ U.S. Department of Agriculture Forest Service, Mechanical Treatment of Hazardous Fuels (last visited May 15, 2014), <http://www.fs.fed.us/fire/management/mechanical.html>; U.S. Department of Agriculture Forest Service, Prescribed Fire (last visited May 15, 2014), <http://www.fs.fed.us/fire/management/rx.html>.
- ⁸⁸ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, THE U.S. FOREST SERVICE AND CLIMATE CHANGE (2012), available at http://www.usda.gov/oce/climate_change/fact_sheets/FS_FactSheet.pdf.
- ⁸⁹ Thinning refers to the process of removing vegetation from forests to reduce competition for space, light, and nutrients. Further information on thinning undertaken by USDA is provided in Chapter 1 below.
- ⁹⁰ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, *supra* note 88. See also U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, *supra* note 82, at 10.
- ⁹¹ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, WOODY BIOMASS UTILIZATION STRATEGY, 10 (2008), available at <http://www.fs.fed.us/woodybiomass/strategy/index.shtml>.
- ⁹² U.S. ENERGY INFORMATION ADMINISTRATION, MONTHLY ENERGY REVIEW: MARCH 2014, Table 1.3 (2014), available at <http://www.eia.gov/totalenergy/data/monthly/#summary> (indicating that coal consumption in the U.S. in 2013 was approximately 17.997 quadrillion British thermal units (“Btu”), petroleum consumption in the U.S. in 2013 was approximately 35.099 quadrillion Btu, and total energy consumption in the U.S. in 2013 was approximately 97.337 quadrillion Btu).
- ⁹³ Environmental Protection Agency, Clean Energy: Coal (last updated Sep. 25, 2013), <http://www.epa.gov/cleanenergy/energy-and-you/affect/coal.html> (indicating that coal-fired power plants emit, on average, 2,249 pounds of carbon dioxide per MWh of electricity generated).
- ⁹⁴ Environmental Protection Agency, Clean Energy: Oil (last updated Sep. 25, 2013), <http://www.epa.gov/cleanenergy/energy-and-you/affect/oil.html> (indicating that oil-fired power plants emit, on average, approximately 1672 pounds of carbon dioxide per MWh of electricity generated).
- ⁹⁵ Environmental Protection Agency, Clean Energy: Coal (last updated Sep. 25, 2013), <http://www.epa.gov/cleanenergy/energy-and-you/affect/coal.html>; Environmental Protection Agency, Clean Energy: Oil (last updated Sep. 25, 2013), <http://www.epa.gov/cleanenergy/energy-and-you/affect/oil.html>.
- ⁹⁶ Edenhofer et al., *supra* note 31, at 18.
- ⁹⁷ U.S. Environmental Protection Agency, Clean Energy: Non-Hydroelectric Renewable Energy (last updated Sep. 25, 2013), <http://www.epa.gov/cleanenergy/energy-and-you/affect/non-hydro.html>.
- ⁹⁸ *Id.*
- ⁹⁹ Environmental Protection Agency, Clean Energy: Natural Gas (last updated Sep. 25, 2013), <http://www.epa.gov/cleanenergy/energy-and-you/affect/natural-gas.html> (outlining the environmental effects of natural gas-fired electricity generation); Environmental Protection Agency, Clean Energy: Coal (last updated Sep. 25, 2013), <http://www.epa.gov/cleanenergy/energy-and-you/affect/coal.html> (outlining the environmental effects of coal-fired electricity generation); Environmental Protection Agency, Clean Energy: Oil (last updated Sep. 25, 2013), <http://www.epa.gov/cleanenergy/energy-and-you/affect/oil.html> (outlining the environmental effects of oil-fired electricity generation).
- ¹⁰⁰ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE AND U.S. DEPARTMENT OF ENERGY NATIONAL RENEWABLE ENERGY LABORATORY, ASSESSING THE POTENTIAL FOR RENEWABLE ENERGY ON NATIONAL FOREST SYSTEM LANDS, C-14 – C-21 (2005), available at <http://www.nrel.gov/docs/fy05osti/36759.pdf>.
- ¹⁰¹ U.S. ENERGY INFORMATION ADMINISTRATION, OPERABLE GENERATING UNITS IN THE UNITED STATES BY STATE AND ENERGY SOURCE (2011), available at <http://www.eia.gov/electricity/capacity/>.
- ¹⁰² *Id.*
- ¹⁰³ *Id.*
- ¹⁰⁴ Edenhofer et al., *supra* note 31, at 19 (indicating that, on a lifecycle basis, electric generation from bio-fuels emits an average of thirty-two grams of carbon dioxide equivalent per KWh of electricity generated, while electric generation from coal emits an average of 1001 grams of carbon dioxide equivalent per kilowatt hour (“KWh”) of electricity generated).

¹⁰⁵ This estimate includes fifty two million dry tons of fuel wood harvested from forests, sixty four million dry tons of residues from logging and site clearing operations, sixty million dry tons of biomass from fuel treatment operations, forty seven million dry tons of urban wood residues, and 145 dry tons of residues from secondary sources (e.g., wood processing and pulp and paper mills). To prepare this estimate, USDA and DOE assessed the total amount of biomass capable of being produced on all private, state, and federal forestland that has not been reserved from timber harvesting, except environmentally sensitive areas and other areas that are not currently accessibly by roads. PERLACK ET AL., *supra* note 32, at 17.

¹⁰⁶ *Id.*

¹⁰⁷ U.S. Energy Information Administration, Frequently Asked Questions: How Much Electricity Does an American Home Use? (last visited May 15, 2014), <http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3> (indicating that, on average, residential utility customers use approximately 10,837 KWh of electricity annually).

¹⁰⁸ U.S. Energy Information Administration, Frequently Asked Questions: How much coal, natural gas, or petroleum is used to generate a kilowatt of electricity? (last visited May 15, 2014), <http://www.eia.gov/tools/faqs/faq.cfm?id=667&t=6> (indicating that 0.00054 tons of coal is required to generate one KWh of electricity); U.S. Environmental Protection Agency, Clean Energy: Coal (last updated Sep. 25, 2013), <http://www.epa.gov/cleanenergy/energy-and-you/affect/coal.html> (estimating that coal-fired power plants produce, on average, 2,249 pounds of carbon dioxide per MWh of electricity generated).

¹⁰⁹ *Id.*

¹¹⁰ PERLACK ET AL., *supra* note 32, at 1.

¹¹¹ See, for example, Adam J. Liska, Haishun Yang, Maribeth Milner, Steve Goddard, Humberto Blanco-Canqui, Matthew P. Pelton, Xiao X. Fang, Haitao Zhu, and Andrew E. Suyker, *Biofuels from crop residue can reduce soil carbon and increase CO₂ emissions*, 4 NATURE CLIMATE CHANGE 398 (2014) (finding that the production of biofuels from corn residues average generates approximately 100 grams of carbon dioxide per megajoule, which is seven percent greater than gasoline emissions).

¹¹² U.S. Forest Service, History (last updated May 15, 2014), <http://www.fs.fed.us/aboutus/history/>.

¹¹³ Gorte, *supra* note 33, at 19 (finding that the production of wood uses approximately seventy five percent less energy than concrete production and ninety-five percent less energy than steel and aluminum production).

¹¹⁴ *Id.* at 11 (noting that, as wood and other biomass fuel wildfires, reducing such biomass may reduce the risk of wildfires).

¹¹⁵ *Id.* at 15 (finding that “harvesting timber from ‘over-mature’ forests can sequester substantial additional carbon, because (a) the forest is currently sequestering little additional carbon... (b) the timber can continue to store carbon for decades in long-term solid wood products, and (c) the newly established stand can sequester large amounts of carbon through its vigorous growth”).

¹¹⁶ National Forest Management Act of 1976 § 14(d); 16 U.S.C. § 472a(d) (2014) (requiring the Secretary of Agriculture to advertise proposed tree sales unless he/she determines that extraordinary conditions exist or that the appraised value of the trees is less than \$10,000); National Forest Management Act of 1976 § 14(e); 16 U.S.C. § 472a(e) (2014) (requiring the Secretary of Agriculture to determine the bidding process to be used in selling trees). See also U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, FOREST SERVICE HANDBOOK FSH 2409.18, Chapter 50 (2013), available at http://www.fs.fed.us/cgi-bin/Directives/get_dirs/fsh?2409.18.

¹¹⁷ National Forest Management Act of 1976 § 14(a); 16 U.S.C. § 472a(a) (2014) (requiring the Secretary of Agriculture to sell trees, portions of trees, and other forest products “at not less than the appraised value”).

¹¹⁸ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, *supra* note 116, at Chapter 50.

¹¹⁹ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, FY 1905 – 2013 NATIONAL SUMMARY CUT AND SOLD DATA AND GRAPHS, 2 (2013), available at <http://www.fs.fed.us/forestmanagement/products/sold-harvest/index.shtml>.

¹²⁰ *Id.*

¹²¹ Phil Taylor, *Forest Service: Bipartisan House Coalition Calls on Landrieu to Lead on Logging Reform*, E&E NEWS PM (Apr. 17, 2014).

¹²² JOHN RUPE AND REGIS TERNEY, U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, LAND MANAGEMENT PLANNING 101, 1 (2009), *available at* http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5110094.pdf.

¹²³ Forest and Rangeland Renewable Resources Planning Act of 1974 § 6(i); 16 U.S.C. § 1604(i) (2014) (requiring all resource plans, permits, contracts and other instruments for the use and occupancy of a national forest to be consistent with the land management plan applying thereto); 36 C.F.R. § 219.15(b) (providing that projects and activities authorized after approval of a land management plan or amendment or revision thereto must be consistent with the plan). See also RUPE ET AL., *supra* note 122, at 2 (stating that, while a land management plan does not compel or authorize specific activities, all activities undertaken in national forests must be consistent with the plan).

¹²⁴ 36 C.F.R. § 219.2(b)(1) (stating that “[a] land management plan provides a framework for guiding project and activity decisionmaking on a national forest, grassland, prairie, or other administrative unit”).

¹²⁵ Forest and Rangeland Renewable Resources Planning Act of 1974 Act § 6(g)(3)(D); 16 U.S.C. § 1604(g)(3)(D) (requiring the Secretary of Agriculture promulgate regulations setting out the process for developing and revising land management plans, including guidelines that insure timber will only be harvested from NFS lands where (i) soil, slope, or other watershed conditions will not be irreversibly damaged, (ii) there is assurance that such lands can be adequately restocked within five years after harvest; and (iii) protection is provided for streams, streambanks, lakes, wetlands, and other bodies of waters from detrimental changes in water temperature, blockages of water courses, and deposits of sediment, where harvests are likely to seriously and adversely affect water conditions or fish habitat); 36 C.F.R. § 219.11(d) (2014) (stating that each land management plan developed by the Forest Service must ensure that timber harvest would occur only where soil, slope, or other watershed conditions would not be irreversible damaged and be carried out in a manner consistent with the protection of soil, watershed, fish, wildlife, recreation, and aesthetic resources).

¹²⁶ 36 C.F.R. § 219.11(a) (2014) (requiring land management plans developed by the Forest Service to identify land within the plan area as being unsuited for timber production if certain requirements are met).

¹²⁷ 36 C.F.R. § 219.11(d)(6) (2014) (stating that the quantity of timber that may be sold from a national forest is limited to an amount equal to or less than that which can be removed from such forest annually in perpetuity on a sustained yield basis). See also RUPE ET AL., *supra* note 122, at 3.

¹²⁸ In addition, substantially increasing timber harvesting may also be politically difficult. This is because, such increases may create unfavorable public opinion. PERLACK ET AL., *supra* note 32, at 34.

¹²⁹ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, BEAVERHEAD-DEERLODGE NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN, 9 (2009), *available at* <http://www.fs.usda.gov/detailfull/bdnf/landmanagement/planning/?cid=stelprdb5052938&width=full>.

¹³⁰ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, CUT AND SOLD (NEW) – CUTS203F CUMULATIVE FY 2013 Q1 TO FW 2013 Q4 REGION R1 NORTHERN REGION, 1 (2013), *available at* http://www.fs.fed.us/forestmanagement/documents/sold-harvest/reports/2014/2014_Q1_CandS_R01.pdf.

¹³¹ Mark E. Harmon, William K. Ferrell, and Jerry F. Franklin, *Effects on Carbon Storage of Conversion of Old-Growth Forests to Young Forests*, 247 SCIENCE 699, 699 (1990) (finding that at least fifteen percent of wood fiber on a site is typically “broken or defective”).

¹³² Gorte, *supra* note 33, at 10.

¹³³ *Id.*

¹³⁴ Edenhofer et al., *supra* note 31, at 19 (indicating that, on a lifecycle basis, electric generation from bio-fuels emits an average of thirty-two grams of carbon dioxide equivalent per KWh of electricity generated, while electric generation from coal emits an average of 1001 grams of carbon dioxide equivalent per KWh of electricity generated).

¹³⁵ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, FOREST SERVICE GLOBAL CHANGE RESEARCH STRATEGY 2009 – 2019, 11 (2009), *available at* <http://www.fs.fed.us/research/climate-change/> (indicating that the combustion of biomass for electricity generation “use[s] carbon already present in the global carbon cycle, rather than obtaining new carbon from fossil fuels”).

¹³⁶ *Id.*

¹³⁷ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 91.

¹³⁸ PERLACK ET AL., *supra* note 32, at 9 and 13.

¹³⁹ *Id.* at 9.

¹⁴⁰ *Id.* at 13.

¹⁴¹ *Id.* at 9.

¹⁴² Gorte, *supra* note 33, at 10.

¹⁴³ *Id.*

¹⁴⁴ *Id.* (noting that only “some portion” of the forty nine million dry tons of wood waste produced by logging on private, state, and federal forestland in the U.S. “should be left on site to replenish nutrients and maintain soil productivity”).

¹⁴⁵ Gorte, *supra* note 33, at Summary (indicating that harvesting and replacing old-growth forests may increase net carbon storage).

¹⁴⁶ *Id.* at 3 (finding that the amount of carbon stored in a forest increases as woody biomass on the site increases).

¹⁴⁷ *Id.* (finding that the growth of woody biomass in trees “generally follows an S shaped curve, with the volume growing at an increasing rate for many years...and then growing at a decreasing rate for many more years”).

¹⁴⁸ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, FUTURE OF AMERICA’S FORESTS AND RANGELANDS: FOREST SERVICE 2010 RESOURCE PLANNING ACT ASSESSMENT, 1 (2012), *available at* <http://www.treesearch.fs.fed.us/pubs/41976/>.

¹⁴⁹ *Id.* at 13.

¹⁵⁰ *Id.* at 2.

¹⁵¹ *Id.*

¹⁵² U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE ET AL., *supra* note 100.

¹⁵³ Forest and Rangeland Renewable Resources Research Act § 3(a)(1); 16 U.S.C. § 1642(a)(1) (2014) (requiring the Secretary to conduct research related to managing, reproducing, planting, and growing vegetation on forests and rangelands for, among other things, energy production); Forest and Rangeland Renewable Resource Research Act § 3(a)(4); 16 U.S.C. § 1642(a)(4) (2014) (requiring the Secretary of Agriculture to undertake research relating to, among other things, producing and conserving energy).

¹⁵⁴ NATIONAL ENERGY POLICY DEVELOPMENT GROUP, NATIONAL ENERGY POLICY: RELIABLE, AFFORDABLE, AND ENVIRONMENTALLY SOUND ENERGY FOR AMERICA’S FUTURE (2011), *available at* <http://www.netl.doe.gov/publications/press/2001/nep/nep.html>.

¹⁵⁵ See, for example, Healthy Forests Restoration Act of 2004 § 203; 16 U.S.C. § 6531 (2014) (authorizing the Secretary of Agriculture to provide grants for the use of biomass for electricity generation and other commercial purposes); Energy Policy Act of 2005 § 210; 42 U.S.C. § 15855 (2014) (authorizing the Secretary of Agriculture to provide grants for the use of biomass for electricity generation and other commercial purposes).

¹⁵⁶ 36 C.F.R. § 251.53(l)(4) (2014) (providing for the issuance of special use authorizations for rights-of-way for systems and facilities for the generation, transmission, and distribution of electric energy).

¹⁵⁷ Final Directives for Forest Service Wind Energy Special Use Authorizations, 76 Fed. Reg. 47353, 47345 (Aug. 4, 2011). See also 36 C.F.R. § 251.53 (2014) (outlining the uses of NFS land that may be permitted under special use authorizations).

¹⁵⁸ 36 C.F.R. Part 251 (2014).

¹⁵⁹ Final Directives for Forest Service Wind Energy Special Use Authorizations, 76 Fed. Reg. 47353, 47345 (Aug. 4, 2011). See also 36 C.F.R. § 251.53 (2014) (outlining the uses of NFS land that may be permitted under special use authorizations).

¹⁶⁰ Final Directives for Forest Service Wind Energy Special Use Authorizations, 76 Fed. Reg. 47,353 (Aug. 4, 2011).

¹⁶¹ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, U.S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT, AND STATE OF UTAH, RECORD OF DECISION AND FINAL ENVIRONMENTAL IMPACT STATEMENT: OIL AND GAS LEASING ANALYSIS FISHLAKE NATIONAL FOREST UTAH, S-1 (2013).

¹⁶² U.S. Environmental Protection Agency, *Clean Energy: Oil* (last updated Sep. 25, 2013), <http://www.epa.gov/cleanenergy/energy-and-you/affect/oil.html> (indicating that oil-fired generation emits, on average, 1,672 pounds of carbon dioxide per MWh of electricity generated); U.S. Environmental Protection Agency, *Clean Energy: Coal* (last updated Sep. 25, 2013), <http://www.epa.gov/cleanenergy/energy-and-you/affect/coal.html> (indicating that coal-fired generation emits, on average, 2,249 pounds of carbon dioxide per MWh of electricity generated).

¹⁶³ U.S. Environmental Protection Agency, *Clean Energy: Natural Gas* (last updated Sep. 25, 2013), <http://www.epa.gov/cleanenergy/energy-and-you/affect/natural-gas.html> (indicating that natural gas-fired

generation emits, on average, 1,135 pounds of carbon dioxide per MWh of electricity generated); U.S. Environmental Protection Agency, *Clean Energy: Coal* (last updated Sep. 25, 2013), <http://www.epa.gov/cleanenergy/energy-and-you/affect/coal.html> (indicating that coal-fired generation emits, on average, 2,249 pounds of carbon dioxide per MWh of electricity generated).

¹⁶⁴ Robert W. Howarth, Renee Santoro, and Anthony Ingraffea, *Methane and the Greenhouse-Gas Footprint of Natural Gas from Shale Formations*, 106 CLIMATIC CHANGE 679 (2011) (finding that, on a life cycle basis, greenhouse gas emissions from shale gas are 100% higher than coal over a 20 year time frame); Mohan Jiang, W Michael Griffin, Chris Hendrickson, Paulina Jaramillo, Jeanne Van Mriesen, and Aranya Venkatesh, *Life cycle greenhouse gas emissions of Marcellus shale gas*, 6 ENVIRONMENTAL RESEARCH LETTERS 034014 (2011) (finding that life cycle greenhouse gas emissions from shale gas-fired power plants are 20-50% higher than coal-fired plants); Andrew Burnham, Jeongwoo Han, Corrie E. Clark, Michael Wang, Jennifer B. Dunn, and Ignasi Palou-Rivera, *Life cycle greenhouse gas emissions of shale gas, natural gas, coal and petroleum*, ENVIRON. SCI. TECHNOL. 619 (2011) (finding that life cycle emissions of greenhouse gas emissions from compressed natural gas vehicles are comparable to gasoline vehicles over a 100 year time horizon, but 20-30% higher over a 20 year time horizon).

¹⁶⁵ The EPA defines “natural gas systems” as including the gas wells, processing facilities, and transmission and distribution pipelines used to produce, store, and transport natural gas. U.S. ENVIRONMENTAL PROTECTION AGENCY, *supra* note 1, at 3-61 – 3-62.

¹⁶⁶ *Id.* at ES-5 – ES-7.

¹⁶⁷ For the purposes of the EPA’s analysis, “petroleum systems” include those facilities used for crude oil production, transportation, and refining. *Id.* at 3-54 – 3-55.

¹⁶⁸ *Id.* at ES-5 – ES-7

¹⁶⁹ Scott M. Miller, Steven C. Wofsy, Anna M. Michalak, Eric A. Kort, Arlyn E. Andrews, Sebastien C. Biraud, Edward J. Dlugokencky, Janusz Eluzkiewicz, Marc L. Fischer, Greet Janssens-Maenhout, Ben R. Miller, John B. Miller, Stephen A. Montzka, Thomas Nehrkorn, and Colm Sweeney, *Anthropogenic Emissions of Methane in the United States*, PNAS EARLY EDITION (2013) (finding that current inventories from the EPA substantially underestimate methane emissions from fossil fuel extraction and refining).

¹⁷⁰ For a discussion of this issue see INTERNATIONAL ENERGY AGENCY, WORLD ENERGY OUTLOOK 2012, 25 (2012), available at http://www.iea.org/publications/freepublications/publication/WEO2012_free.pdf (indicating that “[n]o more than one-third of proven reserves of fossil fuels can be consumed prior to 2050 if the world is to achieve the” goal of limiting temperature increases to 2°C).

¹⁷¹ Lenny Bernstein, *Groups Call for Federal Regulations to Curb Methane Leaks*, WASHINGTON POST (Dec. 5, 2013), available at http://www.washingtonpost.com/national/health-science/groups-demand-regulations-to-cut-methane-leak/2013/12/04/eba5b128-5d3e-11e3-95c2-13623eb2b0e1_story.html.

¹⁷² EXECUTIVE OFFICE OF THE PRESIDENT, *supra* note 37, at 10.

¹⁷³ THE WHITE HOUSE, *supra* note 50.

¹⁷⁴ *Id.* at 8.

¹⁷⁵ U.S. ENVIRONMENTAL PROTECTION AGENCY OFFICE OF AIR QUALITY PLANNING AND STANDARDS, OIL AND NATURAL GAS SECTOR COMPRESSORS (2014), available at <http://www.epa.gov/airquality/oilandgas/pdfs/20140415compressors.pdf> [hereinafter U.S. ENVIRONMENTAL PROTECTION AGENCY, COMPRESSORS]; U.S. ENVIRONMENTAL PROTECTION AGENCY OFFICE OF AIR QUALITY PLANNING AND STANDARDS, OIL AND NATURAL GAS SECTOR HYDRAULICALLY FRACTURED OIL WELL COMPLETIONS AND ASSOCIATED GAS DURING ONGOING PRODUCTION (2014), available at <http://www.epa.gov/airquality/oilandgas/pdfs/20140415completions.pdf> [hereinafter U.S. ENVIRONMENTAL PROTECTION AGENCY, WELL COMPLETIONS]; U.S. ENVIRONMENTAL PROTECTION AGENCY OFFICE OF AIR QUALITY PLANNING AND STANDARDS, OIL AND NATURAL GAS SECTOR LEAKS (2014), available at <http://www.epa.gov/airquality/oilandgas/pdfs/20140415leaks.pdf> [hereinafter U.S. ENVIRONMENTAL PROTECTION AGENCY, LEAKS]; U.S. ENVIRONMENTAL PROTECTION AGENCY OFFICE OF AIR QUALITY PLANNING AND STANDARDS, OIL AND NATURAL GAS SECTOR LIQUIDS UNLOADING (2014), available at <http://www.epa.gov/airquality/oilandgas/pdfs/20140415liquids.pdf> [hereinafter U.S. ENVIRONMENTAL PROTECTION AGENCY, LIQUIDS UNLOADING]; U.S. ENVIRONMENTAL PROTECTION AGENCY OFFICE OF AIR QUALITY PLANNING AND STANDARDS, OIL AND NATURAL GAS SECTOR PNEUMATIC DEVICES (2014), available at <http://www.epa.gov/airquality/oilandgas/pdfs/20140415pneumatic.pdf> [hereinafter U.S. ENVIRONMENTAL PROTECTION AGENCY, PNEUMATIC DEVICES].

¹⁷⁶ Memorandum of Understanding between U.S. Department of the Interior Bureau of Land Management and U.S. Department of Agriculture Forest Service Concerning Oil and Gas Leasing and Operations (Apr. 14, 2006), *available at* http://www.fs.fed.us/geology/MOU_BLM_Oil_Gas.pdf.

¹⁷⁷ *Id.* at 3.

¹⁷⁸ *Id.* at 2.

¹⁷⁹ *Id.* at 10.

¹⁸⁰ 36 C.F.R. § 228.102(c) (2014) (requiring the Forest Service to conduct a leasing analysis to identify land that will be open to development subject to the terms and conditions of the standard oil and gas lease form, open to development but subject to constraints that will require the use of lease stipulations, and closed to development).

¹⁸¹ 36 C.F.R. § 228.102(a) (2014) (requiring the Forest Service to comply with NEPA when analyzing lands for leasing).

¹⁸² National Environmental Policy Act § 102(2)(C)(i)-(ii); 42 U.S.C. § 4332(2)(C)(i)-(ii) (2014) (requiring federal agencies to prepare, for each major federal action significantly affecting the quality of the human environment, a detailed statement on the environmental impact of the proposed action and any adverse environmental effects which cannot be avoided should the proposal be implemented).

¹⁸³ National Environmental Policy Act § 102(2)(C)(iii); 42 U.S.C. § 4332(2)(C)(iii) (2014) (requiring federal agencies to prepare, for each major federal action significantly affecting the quality of the human environment, a detailed statement on alternatives to the proposed action).

¹⁸⁴ *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349 (1989) (finding that NEPA aims to ensure that agency decision-makers “have available, and will carefully consider, detailed information concerning significant environmental impacts”).

¹⁸⁵ COUNCIL ON ENVIRONMENTAL QUALITY, CONSIDERING CUMULATIVE EFFECTS UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT (1997), *available at* <http://ceq.hss.doe.gov/nepa/ccenepa/ccenepa.htm>.

¹⁸⁶ See, for example, *Border Power Plant Working Group v. Department of Energy*, 206 F.Supp. 2d 997 (S.D. Cal. 2003) (requiring the DOE and Bureau of Land Management to consider the greenhouse gas emissions resulting from the operation of a natural-gas fired power plant when assessing the environmental impacts of construction of a transmission line to connect the power plant to the California power grid). See also Michael B Gerrard, *Climate Change and the Environmental Impact Review Process*, 22 NAT. RESOURCES & ENV'T 20 (2008) (indicating that none of the federal courts hearing challenges under NEPA (42 U.S.C. § 4321 et seq.) have expressed any doubt as to the legality of considering climate change in the EIS).

¹⁸⁷ Memorandum of Understanding between U.S. Department of the Interior Bureau of Land Management and U.S. Department of Agriculture Forest Service Concerning Oil and Gas Leasing and Operations (Apr. 14, 2006), *available at* http://www.fs.fed.us/geology/MOU_BLM_Oil_Gas.pdf (indicating that the Forest Service is the lead agency responsible for undertaking environmental reviews for oil and gas leasing availability analyses and decisions).

¹⁸⁸ *Id.* at 4 (stating that, following receipt of a lease application, the Forest Service will conduct an environmental review to assess the likely environmental impacts of the lessee’s actions).

¹⁸⁹ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, CLIMATE CHANGE CONSIDERATIONS IN PROJECT LEVEL NEPA ANALYSIS, 2 (2009), *available at* http://www.fs.fed.us/emc/nepa/climate_change/.

¹⁹⁰ 40 C.F.R. § 1508.25(c) (2014).

¹⁹¹ 40 C.F.R. § 1508.8(a) (2014).

¹⁹² 40 C.F.R. § 1508.8(b) (2014).

¹⁹³ *Metropolitan Edison Co. v. People Against Nuclear Energy*, 470 U.S. 766, 774 (1983).

¹⁹⁴ *Dep’t of Transp. v. Pub. Citizen*, 541 U.S. 752, 767 (2004) (indicating that, in assessing whether an impact has a close causal relationship to an agency action, the court will “look to the underlying policies or legislative intent to draw a manageable line between those causal changes that may make an actor responsible for an effect and those that do not”).

¹⁹⁵ *Id.*

¹⁹⁶ ELIZABETH SHEARGOLD AND SMITA WALAVALKAR, NEPA AND DOWNSTREAM GREENHOUSE GAS EMISSIONS OF U.S. COAL EXPORTS, 9 – 12 (2013), *available at* <http://web.law.columbia.edu/sites/default/files/microsites/climate-change/files/Publications/Fellows/NEPA%20and%20Review%20of%20Coal%20Exports.pdf>.

¹⁹⁷ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE ET AL., *supra* note 161.

¹⁹⁸ *Id.* at 169.

¹⁹⁹ For example, in its 2012 EIS regarding Berry Petroleum Company's proposal to develop oil and gas resources in the South Unit of the Ashley National Forest, the Forest Service quantified the greenhouse gas emissions likely to result from oil and gas production. However, the Forest Service did not assess likely emissions from the transportation and use of that oil and gas. See U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, FINAL ENVIRONMENTAL IMPACT STATEMENT: SOUTH UNIT OIL AND GAS DEVELOPMENT PROJECT, 81 (2012).

²⁰⁰ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE ET AL., *supra* note 161, at 169.

²⁰¹ 40 C.F.R. § 98.33 (2014). See also 40 CFR Parts 86, 87, 89 et al. Mandatory Reporting of Greenhouse Gases; Final Rule 74 Fed. Reg. 56,260 (Oct. 30, 2009).

²⁰² U.S. Energy Information Administration, Voluntary Reporting of Greenhouse Gases Program: Reporting Tools (last visited Jul. 8, 2014), http://www.eia.gov/oiaf/1605/reporting_tools.html.

²⁰³ Memorandum from Nancy H. Sutley, Chair, Council on Environmental Quality, to the Heads of Federal Departments and Agencies (Feb. 18, 2010), *available at* <http://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance>.

²⁰⁴ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, *supra* note 189, at 5.

²⁰⁵ *Id.* at 7 (stating "it is not possible and it is not expected that climate change effects can be found to be "significant" under NEPA").

²⁰⁶ Michael P. Vandenbergh and Kevin Stack, *The One Percent Problem*, 111 COLUMBIA L. REV. 1385, 1388 (2011).

²⁰⁷ 40 C.F.R. § 1508.27 (2014).

²⁰⁸ 40 C.F.R. § 1508.27(b) (2014).

²⁰⁹ SHEARGOLD ET AL., *supra* note 196, at 19. See also, Madeline Kass, *A NEPA Climate Paradox: Taking Greenhouse Gases Into Account in Threshold Significant Determinations*, 42 IND. L. REV. 47, 54 (2009) (concluding that, given greenhouse gases' potential to cause environmental devastation, even small emissions thereof may be found to have significant impacts); Amy L. Stein, *Climate Change Under NEPA: Avoiding Cursory Consideration of Greenhouse Gases*, 81 U. COLO. L. REV. 473, 529 (arguing that the significance of a project's greenhouse gas emissions should not be assessed by comparing those emissions to local, state, national, or global emissions).

²¹⁰ After a well is drilled and completed, it is standard practice to flow the well to remove debris from the wellbore. This is referred to as "wellbore cleanup". Ordinarily, during wellbore cleanup, liquid hydrocarbons are moved to an open pit or tank and associated methane gas is sent to a gas vent or flare. In a reduced emission or green completion, processing equipment is used to separate and recover gas and gas condensate for sale. SUSAN HARVEY, VIGNESH GOWRISHANKAR, AND THOMAS SINGER, LEAKING PROFITS: THE U.S. OIL AND GAS INDUSTRY CAN REDUCE POLLUTION, CONSERVE RESOURCES, AND MAKE MONEY BY PREVENTING METHANE WASTE, 18 – 19 (2012), *available at* <http://www.nrdc.org/energy/files/Leaking-Profits-Report.pdf>.

²¹¹ *Id.* at 18 – 23. See also U.S. ENVIRONMENTAL PROTECTION AGENCY, WELL COMPLETION, *supra* note 175, at 23 – 27.

²¹² U.S. ENVIRONMENTAL PROTECTION AGENCY, WELL COMPLETIONS, *supra* note 175, at 27 – 29.

²¹³ HARVEY ET AL., *supra* note 210, at 23 – 25. See also U.S. ENVIRONMENTAL PROTECTION AGENCY, LIQUIDS UNLOADING, *supra* note 175, at 20 – 23.

²¹⁴ HARVEY ET AL., *supra* note 210, at 30 – 32. See also U.S. ENVIRONMENTAL PROTECTION AGENCY, COMPRESSORS, *supra* note 175, at 36 – 39.

²¹⁵ U.S. ENVIRONMENTAL PROTECTION AGENCY, COMPRESSORS, *supra* note 175, at 39 – 42.

²¹⁶ *Id.* at 29 – 35.

²¹⁷ HARVEY ET AL., *supra* note 210, at 34 – 36. See also U.S. ENVIRONMENTAL PROTECTION AGENCY, PNEUMATIC DEVICES, *supra* note 175, at 41 – 44.

²¹⁸ HARVEY ET AL., *supra* note 210, at 42 – 44. See also U.S. ENVIRONMENTAL PROTECTION AGENCY, LEAKS, *supra* note 175, at 36 – 54.

²¹⁹ HARVEY ET AL., *supra* note 210, at 32 – 34. See also U.S. ENVIRONMENTAL PROTECTION AGENCY, LEAKS, *supra* note 175, at 45 – 54; U.S. ENVIRONMENTAL PROTECTION AGENCY OFFICE OF AIR QUALITY PLANNING AND STANDARDS, PNEUMATIC DEVICES, *supra* note 175, at 50.

²²⁰ HARVEY ET AL., *supra* note 210, at 5.

²²¹ 5 C.C.R. § 1001-9 (2014).

²²² *Id.*

²²³ *Id.*

²²⁴ Memorandum of Understanding between U.S. Department of the Interior Bureau of Land Management and U.S. Department of Agriculture Forest Service Concerning Oil and Gas Leasing and Operations (Apr. 14, 2006), available at www.fs.fed.us/geology/MOU_BLM_Oil_Gas.pdf (indicating that the Forest Service must “[d]evelop lease stipulations for NFS lands that are only as restrictive as necessary to protect the resources for which they are applied”). See also U.S. Department of Agriculture Forest Service Manual, § 2822.04 (indicating that the Forest Service may “specify terms and conditions under which a lease will be issued to protect the surface resources”).

²²⁵ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, *supra* note 148, at 5.

²²⁶ *Id.* at 4.

²²⁷ *Id.*

²²⁸ U.S. Environmental Protection Agency, *Forestry* (last updated Aug. 13, 2013), <http://www.epa.gov/agriculture/forestry.html#Facts%20and%20Figures>.

²²⁹ U.S. DEPARTMENT OF AGRICULTURE, U.S. AGRICULTURE AND FORESTRY GREENHOUSE GAS INVENTORY: 1990 – 2008, 68 (2011) available at http://www.usda.gov/oce/climate_change/greenhouse.htm (finding that forestlands in the U.S. sequestered approximately 792 teragrams of carbon dioxide equivalent in 2008).

²³⁰ FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, GLOBAL FORESTS RESOURCES ASSESSMENT 2010: MAIN REPORT, 10 (2010), available at <http://www.fao.org/docrep/013/i1757e/i1757e.pdf>. (finding that approximately thirteen million hectares (thirty two million acres) of forestland were converted to other uses or lost through natural causes each year between 2001 and 2010).

²³¹ Gorte, *supra* note 33, at 8.

²³² *Id.* at 12.

²³³ U.S. ENVIRONMENTAL PROTECTION AGENCY, GREENHOUSE GAS MITIGATION POTENTIAL IN US. FORESTRY AND AGRICULTURE, Table 2-1 (2005), available at <http://www.epa.gov/sequestration/pdf/greenhousegas2005.pdf> (finding that the afforestation of land previously used as pasture or cropland sequesters 2.2 to 9.5 metric tons of carbon dioxide equivalent per acre per year).

²³⁴ Gorte, *supra* note 33, at 12.

²³⁵ U.S. ENVIRONMENTAL PROTECTION AGENCY, *supra* note 233, at Table 2-1 (finding that reforestation sequesters 1.1 to 7.7 metric tons of carbon dioxide equivalent per acre per year).

²³⁶ The term “forestland” refers to an area of land that is at least one acre in size and ten percent covered by forest trees of any size or formerly having had such tree cover and not currently developed for non-forest use. U.S. Environmental Protection Agency, *Forestry* (last updated Aug. 13, 2013), <http://www.epa.gov/agriculture/forestry.html>.

²³⁷ *Id.*

²³⁸ *Id.*

²³⁹ For example, through the Community Forest and Open Space Conservation Program, USDA’s Forest Service provides financial assistance to local and tribal governments and non-profit entities to purchase forestland threatened with development. Similarly, USDA’s Forest Legacy Program provides funding for government acquisition of private forestland threatened with development or interests therein. For further information on the Community Forest and Open Conservation Program and Forest Legacy Program, see *infra* section 4.2.1.

²⁴⁰ For example, section 1231 of the Food Security Act of 1985 (16 U.S.C. § 3831) required the Secretary of Agriculture to develop and implement the CRP to assist the owners and operators of highly erodible land to conserve and improve soil and water resources thereon. For further information on the CRP, see *infra* section 4.2.3.

²⁴¹ For example, section 2301 of the Food, Conservation, and Energy Act of 2008 inserted a new Subchapter B into Chapter 2 of Subtitle D of Title XII of the Food Security Act of 1985 (16 U.S.C. § 3838 et seq.) requiring the Secretary of Agriculture to carry out the Conservation Stewardship Program to promote the conservation and improvement of air and other resources on agricultural and forest land.

²⁴² For example, Title V of the Healthy Forests Restoration Act (16 U.S.C. § 6572 et seq.) required the Secretary of Agriculture to establish the Healthy Forests Reserve Program for the purpose of restoring

and enhancing forest ecosystems to, among other things, promote the recovery of threatened and endangered species. For further information on the Healthy Forests Reserve Program, see *infra* section 4.2.2.

²⁴³ For example, section 1438 of the Food, Agriculture, Conservation, and Trade Act of 1990 inserted a new Subchapter C into Chapter 4 of Subtitle D of Title XII of the Food Security Act of 1985 (16 U.S.C. § 3837 et seq.) requiring the Secretary of Agriculture to carry out the Wetlands Reserve Program to assist landowners to restore and protect wetlands.

²⁴⁴ SUSAN M. STEIN, RONALD E. MCROBERTS, LISA G. MAHAL, MARY A. CARR, RALPH J. ALIG, SARA J. COMAS, DAVID M. THEOBALD, AND AMANDA CUNDIFF, U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, PRIVATE FORESTS, PUBLIC BENEFITS: INCREASED HOUSING DENSITY AND OTHER PRESSURES ON PRIVATE FOREST CONTRIBUTIONS, 3 (2009), available at http://www.fs.fed.us/openspace/fote/benefits_files/pnw-gtr795_pt1.pdf.

²⁴⁵ *Id.* at 5.

²⁴⁶ *Id.* at 6.

²⁴⁷ *Id.* at 13.

²⁴⁸ Cooperative Forestry Assistance Act § 7A(d); 16 U.S.C. § 2103d(d) (2014) (requiring grant recipients to provide public access to, and manage, the forestland acquired under the Community Forest Program).

²⁴⁹ Cooperative Forestry Assistance Act § 7A(e)(1); 16 U.S.C. § 2103d(e)(1) (2014) (prohibiting grant recipients from selling or converting to non-forest use land acquired under the Community Forest Program).

²⁵⁰ U.S. Department of Agriculture Forest Service, Forest Legacy Program (last updated Dec. 16, 2013), <http://www.fs.fed.us/spf/coop/programs/loa/aboutflp.shtml>.

²⁵¹ *Id.*

²⁵² *Id.* at 4.

²⁵³ *Id.* at 5 – 6.

²⁵⁴ 36 C.F.R. § 230.5(b)(1) (2014) (indicating that the Forest Service will evaluate applications received under the Community Forest Program and award grants based on the type and extent of community benefits provided).

²⁵⁵ 36 C.F.R. § 230.2 (2014) (defining “community benefits” to mean “environmental benefits including clean air”)

²⁵⁶ U.S. Department of Agriculture Forest Service, 36 CFR Part 230 RIN 0596-AC84 Community Forest and Open Space Conservation Program Final Rule, 76 Fed. Reg. 65121, 65121 (Oct. 20, 2011).

²⁵⁷ Food Security Act of 1985 § 1234(c)(3)(A); 16 U.S.C. § 3834(c)(3)(A) (2014) (providing that, in assessing offers to enroll land in the CRP, the Secretary of Agriculture may consider “the extent to which enrollment of the land that is the subject of the...offer would improve soil resources, water quality, wildlife habitat, or provide other environmental benefits”); U.S. DEPARTMENT OF AGRICULTURE FARM SERVICE AGENCY, *supra* note 46, at 2 (indicating that, in assessing the environmental benefits likely to result from the enrollment of land in the CRP, USDA will consider the potential for carbon sequestration). For further information on the CRP see *infra* section 4.2.3.

²⁵⁸ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, FOREST STEWARDSHIP PROGRAM NATIONAL STANDARDS AND GUIDELINES, 4 (2009), available at <http://www.fs.fed.us/spf/coop/programs/loa/fsp.shtml> (identifying “carbon storage” as a potential benefit of trees and forests).

²⁵⁹ U.S. DEPARTMENT OF AGRICULTURE FARM SERVICE AGENCY, *supra* note 46, at 1.

²⁶⁰ *Id.* at 1 – 3.

²⁶¹ *Id.* at 2.

²⁶² *Id.* at 7.

²⁶³ Gorte, *supra* note 33, at 13.

²⁶⁴ Paul Schroeder, *Can Intensive Management Increase Carbon Storage in Forests?* 15 ENVTL. MGMT. 475, 477 (1991).

²⁶⁵ *Id.*

²⁶⁶ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, *supra* note 91, at 1.

²⁶⁷ *Id.*

²⁶⁸ See, for example, U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, *supra* note 47 (discussing thinning treatments conducted in the Stanislaus National Forest).

²⁶⁹ U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE, *supra* note 91, at 1.

²⁷⁰ *Id.*

²⁷¹ *Id.*

²⁷² U.S. Department of Agriculture Natural Resources Conservation Service, Healthy Forest Reserve Program (last visited Jul. 8, 2014)

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/forests/>.

²⁷³ Healthy Forests Restoration Act § 503; 16 U.S.C. § 6573 (2014) (providing that land enrolled in the Healthy Forests Reserve Program is subject to a restoration plan, developed jointly by the landowner and the Secretary of Agriculture, providing for the conduct such restoration practices as are necessary to restore and enhance habitat for endangered and threatened species and other species before they reach endangered or threatened status); Healthy Forests Restoration Act § 504; 16 U.S.C. § 6574 (2014) (requiring the Secretary of Agriculture to provide financial assistance to the owners of land enrolled in the Healthy Forests Reserve Program to conduct restoration practices); Healthy Forests Restoration Act § 505; 16 U.S.C. § 6575 (2014) (requiring the Secretary of Agriculture to provide technical assistance to the owners of land enrolled in the Healthy Forests Reserve Program to comply with restoration plans).

²⁷⁴ 7 C.F.R. § 625.1(d) (2014) (indicating that the Chief of NRCS may implement the Healthy Forests Reserve Program in any of the fifty states, the District of Columbia, American Samoa, the Commonwealth of the Northern Mariana Islands, the Commonwealth of Puerto Rico, Guam, and the Virgin Islands).

²⁷⁵ U.S. Department of Agriculture Natural Resources Conservation Service, Healthy Forests Reserve Program (last visited Jul. 8, 2014),

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/forests/>.

²⁷⁶ Healthy Forests Restoration Act § 501(a); 16 U.S.C. § 6571(a) (2014) (directing the Secretary of Agriculture to establish the Healthy Forests Reserve Program for the purpose of restoring and enhancing forest ecosystems to, among other things, enhance carbon sequestration). For further information on the Healthy Forests Reserve Program, see *supra* section 4.2.2.

²⁷⁷ Stubbs, *supra* note 63, at 1.

²⁷⁸ Food Security Act of 1985 § 1231(a); 16 U.S.C. § 3831(a) (2014) (directing the Secretary of Agriculture to develop and implement the CRP “to assist owners and operators of [eligible] land...to conserve and improve the soil, water, and wildlife resources of such land and to address issues raised by State, regional, and national conservation initiatives”); Food Security Act of 1985 § 1232(a); 16 U.S.C. § 3832(a) (2014) (requiring the owner or operator of land enrolled in the CRP to cease using the land for agricultural production and to plant vegetative cover, such as trees, shrubs, or grass, on that land); Food Security Act of 1985 § 1233; 16 U.S.C. § 3833 (2014) (requiring the Secretary of Agriculture to pay the owner or operator of land enrolled in the CRP annual rental payments to compensate for the conversion of land normally devoted to agricultural production and part of the cost of carrying out conservation practices on that land).

²⁷⁹ Food Security Act of 1985 § 1234(c)(3)(A); 16 U.S.C. § 3834(c)(3)(A) (2014) (providing that, in assessing offers to enroll land in the CRP, the Secretary of Agriculture may consider “the extent to which enrollment of the land that is the subject of the...offer would improve soil resources, water quality, wildlife habitat, or provide other environmental benefits”).

²⁸⁰ U.S. DEPARTMENT OF AGRICULTURE FARM SERVICE AGENCY, *supra* note 46, at 2 (indicating that, in ranking offers, USDA will consider “the benefits of sequestering greenhouse gases”).

²⁸¹ Gorte, *supra* note 33, at 12.

²⁸² U.S. DEPARTMENT OF AGRICULTURE FARM SERVICE AGENCY, FARM SERVICE AGENCY AND CLIMATE CHANGE (2010), available at http://www.usda.gov/oce/climate_change/fact_sheets/FSA_FactSheet.pdf (indicating that land enrolled in the CRP sequestered 43.8 teragrams of carbon dioxide in 2011).

²⁸³ U.S. ENVIRONMENTAL PROTECTION AGENCY, *supra* note 1, at 6-2 (finding that the agricultural sector emitted over 528.3 teragrams of carbon dioxide equivalent in 2011).

²⁸⁴ Claudia Copeland, Megan Stubbs, and Kelsi Bracmort, *Agriculture and Greenhouse Gases*, CONGRESSIONAL RESEARCH SERVICE REPORT FOR CONGRESS R41530, 15-16 (2010).

²⁸⁵ *Id.* at 16 (noting that the criteria against which USDA assesses projects affects the amount of funding provided therefor).

²⁸⁶ In *Massachusetts v. EPA*, the U.S. Supreme Court held that carbon dioxide is an “air pollutant” subject to regulation under the Clean Air Act (42 U.S.C. § 7401 et seq.). Given that the Clean Air Act (42 U.S.C. § 7401 et seq.) is intended to protect and enhance the quality of air resources, this finding strongly sug-

gests that carbon dioxide negatively impacts air quality. Consequently, removing carbon dioxide from the atmosphere through carbon sequestration will enhance air quality.

²⁸⁷ Hatfield et al., *supra* note 16, at 159; U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, *supra* note 17, at 53 – 54.

²⁸⁸ Walsh et al., *supra* note 8, at 17.

²⁸⁹ Hatfield et al., *supra* note 16, at 158; U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, *supra* note 17, at 12.

²⁹⁰ U.S. ENVIRONMENTAL PROTECTION AGENCY, *supra* note 1, at 6-1 (indicating that agricultural activities accounted for over eight percent of greenhouse gas emissions in the U.S. in 2012).

²⁹¹ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 229 at 10 (finding that livestock production is responsible for approximately fifty five percent of the agricultural sector's greenhouse gas emissions).

²⁹² Enteric fermentation refers to the fermentation of feed as part of the digestive process of livestock. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, GLOBAL IMPACT DOMAIN: METHANE EMISSIONS (2000), available at <http://www.fao.org/wairdocs/lead/x6116e/x6116e00.htm#Contents>.

²⁹³ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 229, at 10.

²⁹⁴ U.S. ENVIRONMENTAL PROTECTION AGENCY, *supra* note 1, at 6-1 – 6-2.

²⁹⁵ *Id.* (finding that livestock waste emitted 58 gigagrams of nitrous oxide in 2012).

²⁹⁶ *Id.* (finding that the management of agricultural soils resulted in the emission of 989 gigagrams of nitrous oxide in 2012). See also U.S. DEPARTMENT OF AGRICULTURE, *supra* note 229, at 2 and 39 (estimating that approximately one third of the agricultural sector's greenhouse gas emissions are due to crop production, with most of these emissions coming from the application of fertilizers and the cultivation and management of soils).

²⁹⁷ U.S. ENVIRONMENTAL PROTECTION AGENCY, *supra* note 1, at 6-1.

²⁹⁸ P.J. GERBER, H. STEINFELD, B. HENDERSON, A. MOTTET, C. OPIO, J. DIJKMAN, A. FALCUCCI, AND G. TEMPIO, TACKLING CLIMATE CHANGE THROUGH LIVESTOCK: A GLOBAL ASSESSMENT OF EMISSIONS AND MITIGATION OPPORTUNITIES, xiii (2013), available at <http://www.fao.org/publications/card/en/c/030a41a8-3e10-57d1-ae0c-86680a69ccea/> (stating that “[t]here is a direct link between GHG [greenhouse gas] emission intensities and the efficiency with which producers use natural resources. For livestock production systems, nitrous oxide (N₂O), methane (CH₄) and carbon dioxide (CO₂) emissions...are losses of nitrogen (N), energy and organic matter that undermine efficiency”). See also U.S. DEPARTMENT OF AGRICULTURE, *supra* note 229, at 33 (indicating that methane emissions from enteric fermentation represent a loss of energy from the perspective of the livestock).

²⁹⁹ GERBER ET AL., *supra* note 298, at 64.

³⁰⁰ Morgan Bazilian, Holger Rogner, Mark Howells, Sebastian Hermann, Douglas Arent, Dolf Gielen, Pasquale Steduto, Alexander Mueller, Paul Komor, Richard S.J. Tol, and Kandeh K. Yumkella, *Considering the Energy, Water, and Food Nexus: Towards an Integrated Modelling Approach*, 39 ENERGY POLICY 7896 (2011),

³⁰¹ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 229, at 52.

³⁰² *Id.* at 33. See also GERBER ET AL., *supra* note 298, at 48.

³⁰³ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 229, at 52; GERBER ET AL., *supra* note 298, at 48.

³⁰⁴ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 229, at 33 – 34; GERBER ET AL., *supra* note 298, at 48.

³⁰⁵ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 229, at 52.

³⁰⁶ Nitrification is the process in which soil micro-organisms convert ammonium to nitrate through aerobic oxidation. Nitrification inhibitors inhibit this process. *Id.* at 41.

³⁰⁷ *Id.* at 35 and 52.

³⁰⁸ *Id.* at 52.

³⁰⁹ RODALE INSTITUTE, THE FARMING SYSTEMS TRIAL: CELEBRATING 30 YEARS, 4 (2011), available at <http://rodaleinstitute.org/our-work/farming-systems-trial/farming-systems-trial-30-year-report/>.

³¹⁰ Paul Hepperly, Rita Seidel, David Pimentel, James Hanson, and David Douds Jr., *Organic Farming Enhances Soil Carbon and Its Benefits*, in SOIL CARBON MANAGEMENT: ECONOMIC, ENVIRONMENTAL, AND SOCIETAL BENEFITS 129, 145 (John M. Kimball et al. eds., 2007).

³¹¹ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 229, at 67 (stating that “including hay or pasture in rotations...increases carbon inputs, and carbon losses are lower because the land is not tilled during the hay or pasture phase of the rotation”)

³¹² *Id.* at 11 and 67 (finding that tillage disturbs soil aggregates and warms soil, both of which accelerate the decomposition of organic matter and thereby increase carbon dioxide emissions).

³¹³ *Id.* at 67 (indicating that summer fallow, whereby cropland is purposely kept out of production during the regular growing season, results in lower carbon sequestration “because during a large part of the growing season plants are not present to provide carbon inputs but decomposition of soil carbon by microbes continues”).

³¹⁴ See, for example, U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, CLIMATE CHANGE RESEARCH, 1 (2014), *available at* http://www.usda.gov/oce/climate_change/fact_sheets/ARS_FactSheet.pdf (indicating that, over the next five years, USDA’s Agricultural Research Service will continue “research to develop methods for reducing greenhouse gas (GHG) emissions from agricultural systems”).

³¹⁵ See, for example, U.S. Department of Agriculture Agricultural Research Service, Research Project: Managing Farms for Environmental Stewardship and Profit (last updated Jul. 10, 2014) (discussing an ongoing research project being supported by the Agricultural Research Service to evaluate, among other things, the effect of different agricultural management strategies on the profitability of agricultural operations).

³¹⁶ U.S. DEPARTMENT OF AGRICULTURE, CLIMATE CHANGE ADAPTATION PLAN, 38 (2012), *available at* http://www.usda.gov/oce/climate_change/adaptation/adaptation_plan.htm.

³¹⁷ U.S. DEPARTMENT OF AGRICULTURE, STRATEGIC PLAN: FY 2014 – 2018, 15 (2014), *available at* <http://www.ocfo.usda.gov/usdasp/sp2014/usda-strategic-plan-fy-2014-2018.pdf>.

³¹⁸ U.S. Department of Agriculture Agricultural Research Service, National Program 212: Climate Change, Soils, and Emissions and NP214: Agricultural and Industrial Byproducts (last updated May 28, 2013), http://www.ars.usda.gov/research/programs/programs.htm?NP_CODE=212.

³¹⁹ *Id.*

³²⁰ *Id.*

³²¹ U.S. Department of Agriculture National Institute of Food and Agriculture, Research, Education, Extension: Global Change & Climate (last updated Sep. 24, 2013), <http://www.nifa.usda.gov/ProgViewOverview.cfm?prnum=19803>.

³²² U.S. DEPARTMENT OF AGRICULTURE NATIONAL INSTITUTE OF FOOD AND AGRICULTURE, INVESTING IN SCIENCE: SECURING OUR FUTURE, 1 (2014), *available at* http://www.usda.gov/oce/climate_change/fact_sheets/NIFA_FactSheet.pdf (stating that USDA’s National Institute of Food and Agriculture is committed to undertaking research to develop strategies to “[r]educe atmospheric greenhouse gas emissions in agricultural...production systems and optimize carbon sequestration potential” in agricultural lands); U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, *supra* note 314, at 1 (indicating that, over the next five years, USDA’s Agricultural Research Service will continue “research to develop methods for reducing greenhouse gas (GHG) emissions from agricultural systems”).

³²³ For example, education is provided by cooperative extension experts who provide research-based information to agricultural producers to assist them to improve their production systems. U.S. Department of Agriculture, Cooperative Research and Extension Services (last updated Feb. 19, 2013), http://www.usda.gov/wps/portal/usda/usdahome?contentid=cooperative_research_extension_services.xml&contentidonly=true

³²⁴ THE WHITE HOUSE, *supra* note 50.

³²⁵ *Id.* at 7.

³²⁶ *Id.* at 6.

³²⁷ U.S. Department of Agriculture National Institute of Food and Agriculture, Research, Education, Extension: Agricultural Systems (last updated Mar. 18, 2009), http://www.nifa.usda.gov/nea/ag_systems/ag_systems_all.html.

³²⁸ THE WHITE HOUSE, *supra* note 50, at 7.

³²⁹ U.S. Environmental Protection Agency, AgSTAR: An EPA Partnership Program (last updated Apr. 17, 2014), <http://www.epa.gov/agstar/about-us/index.html>.

³³⁰ U.S. Department of Agriculture Farm Service Agency, About the Commodity Credit Corporation (last updated Aug. 20, 2008), <https://www.fsa.usda.gov/FSA/webapp?area=about&subject=landing&topic=sao-cc>.

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- ³³¹ Federal Crop Insurance Act § 508(h); 7 U.S.C. § 1508(h) (2014) (allowing insurance companies to submit crop insurance policies and premiums to FCIC for approval).
- ³³² Federal Crop Insurance Act § 508(k); 7 U.S.C. § 1508(k) (2014) (directing FCIC to provide reinsurance to approved insurance companies that insure agricultural producers under an approved crop insurance policy).
- ³³³ Federal Crop Insurance Act § 508(e); 7 U.S.C. § 1508(e) (2014) (requiring FCIC to pay part of the premiums charged to agricultural producers for crop insurance).
- ³³⁴ Federal Crop Insurance Act § 522; 7 U.S.C. § 1522 (2014) (authorizing FCIC to conduct research and development on risk management).
- ³³⁵ 7 C.F.R. § 1B.2(a) (2014) (providing that “[a]ll policies and programs of the various USDA agencies shall be planned, developed, and implemented so as to achieve the goals and to follow the procedures declared by NEPA [42 U.S.C. § 4321 et seq.]”).
- ³³⁶ 7 C.F.R. § 799.9(b)(2)-(3) (2014) (indicating that the implementation and revision of FSA programs will generally have significant environmental impacts).
- ³³⁷ 7 C.F.R. § 1B.4 (2014) (indicating that actions undertaken by FCIC and Foreign Agriculture Service are categorically excluded from preparation of an environmental assessment or environmental impact statement under NEPA (42 U.S.C. § 4321 et seq.)).
- ³³⁸ 7 C.F.R. § 799.10(a) (2014) (indicating that FSA will undertake an environmental evaluation of initial program implementations and program changes to determine whether preparation of an EIS is required). See also U.S. DEPARTMENT OF AGRICULTURE, FSA HANDBOOK: ENVIRONMENTAL QUALITY PROGRAMS 1-EQ (REVISION 2), 2-11 (2009), available at http://www.fsa.usda.gov/Internet/FSA_File/1-eq_r02_a01.pdf (indicating that FSA prepares a programmatic EA for each farm program to determine whether an EIS is required).
- ³³⁹ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 338, at 2-1 (stating that, where the EA indicates that a farm program will have significant impacts, an EIS will be prepared).
- ³⁴⁰ 7 C.F.R. § 799.9(d) (2014) (indicating that individual farm participation in FSA programs will normally not require review under NEPA (42 U.S.C. § 4321 et seq.)). However, where the implementation of a program on an individual farm basis might significantly affect the environment, FSA will undertake an environmental evaluation. If the environmental evaluation shows that individual farm participation in a program will significantly affect the environment, FSA will prepare a more detailed EIS). See also U.S. DEPARTMENT OF AGRICULTURE, *supra* note 338, at 2-4 (indicating that, while individual farm participation in FSA programs does not normally require review, a site-specific environmental evaluation may be needed in some circumstances).
- ³⁴¹ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 338, at 4-2 – 4-3 (identifying “air quality” as a protected resource that must be addressed in NEPA documents).
- ³⁴² *Id.* at 4-62 – 4-63 (indicating that, in assessing an action’s potential air quality impacts, FSA will consider only whether the action involves the establishment of, or changes to, a concentrated animal feeding operation that could cause odor).
- ³⁴³ *Id.*
- ³⁴⁴ *Id.*
- ³⁴⁵ See, for example, U.S. DEPARTMENT OF AGRICULTURE, FINAL CLASS I ENVIRONMENTAL ASSESSMENT FOR MINN-DAK FARMER’S COOPERATIVE SUGAR LOAN APPLICATION (2012), available at https://www.fsa.usda.gov/Internet/FSA_File/finalsugarea101812.pdf (considering the environmental impacts of providing a non-recourse loan to fund the construction of two new storage tanks at an existing sugar beet processing facility in Wahpeton, North Dakota. The Environmental Assessment only considered the impact of construction on water resources. The Environmental Assessment did not consider the greenhouse gas emissions and/or other air quality impacts of construction).
- ³⁴⁶ 40 C.F.R. § 1507.3(a) (2014).
- ³⁴⁷ *Mass. v. Env’tl. Prot. Agency*, 549 U.S. 497 (2007).
- ³⁴⁸ See, for example, THOMAS F. STOCKER, DAHE QIN, GIAN-KASPER PLATTNER, MELINDA M.B. TIGNOR, SIMON K. ALLEN, JUDITH BOSCHUNG, ALEXANDER NAUELS, YU XIA, VINCENT BEX, PAULINE M. MIDGLEY, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS (2013), available at <https://www.ipcc.ch/report/ar5/wg1/>.

³⁴⁹ Memorandum from Nancy H. Sutley, Chair, Council on Environmental Quality, to the Heads of Federal Departments and Agencies (Feb. 18, 2010), *available at* <http://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance>.

³⁵⁰ *Id.* at 3.

³⁵¹ See, for example, Commodity Credit Corporation Charter Act § 5(a); 15 U.S.C. § 714c(a) (2014) (indicating that USDA is authorized to support the prices of agricultural commodities (other than tobacco) through loans, purchases, payments, and other operations).

³⁵² U.S. DEPARTMENT OF AGRICULTURE, *supra* note 338, at 4-61.

³⁵³ See, for example, U.S. DEPARTMENT OF AGRICULTURE, SCIENCE-BASED METHODS FOR ENTITY-SCALE QUANTIFICATION OF GREENHOUSE GAS SOURCES AND SINKS FROM AGRICULTURE AND FORESTRY PRACTICES: PUBLIC REVIEW DRAFT (2013), *available at* http://www.usda.gov/oce.climate_change/techguide/USDA_CCPO_GHG_draft_082213.pdf (outlining methods landowners can use to estimate the greenhouse gas emissions and other climate change effects of their management decisions); ICF INTERNATIONAL, GREENHOUSE GAS MITIGATION OPTIONS AND COSTS FOR AGRICULTURAL LANDS AND ANIMAL PRODUCTION WITHIN THE UNITED STATES (2013), *available at* http://www.usda.gov/oce/climate_change/mitigation_technologies/GHG_Mitigation_Options.pdf (identifying practices and technologies agricultural producers can adopt to reduce net greenhouse gas emissions).

³⁵⁴ Hatfield et al., *supra* note 16, at 152; U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, *supra* note 17, at 2.

³⁵⁵ Hatfield et al., *supra* note 16, at 154; U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, *supra* note 17, at 5.

³⁵⁶ Hatfield et al., *supra* note 16, at 159; U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, *supra* note 17, at 5 – 6.

³⁵⁷ Hatfield et al., *supra* note 16, at 158; U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, *supra* note 17, at 12.

³⁵⁸ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 316, at 97.

³⁵⁹ U.S. DEPARTMENT OF AGRICULTURE, THE RISK MANAGEMENT AGENCY AND CLIMATE CHANGE, 1 (2006), *available at* http://www.usda.gov/oce/climate_change/across_usda.htm.

³⁶⁰ *Id.*

³⁶¹ *Id.*

³⁶² U.S. Department of Agriculture Natural Resources Conservation Service, Agricultural Management Assistance Program (last visited Jul. 8, 2014), <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/ama/>.

³⁶³ Stubbs, *supra* note 63, at 6.

³⁶⁴ Hatfield, *supra* note 16, at 158; U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, *supra* note 17, at 44 – 45.

³⁶⁵ Hatfield, *supra* note 16, at 159; U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, *supra* note 17, at 54.

³⁶⁶ Food Security Act of 1985 § 1231(a); 16 U.S.C. § 3831(a) (2014) (directing the Secretary of Agriculture to develop and implement the CRP “to assist owners and operators of [eligible] land...to conserve and improve the soil, water, and wildlife resources of such land and to address issues raised by State, regional, and national conservation initiatives”).

³⁶⁷ U.S. DEPARTMENT OF AGRICULTURE FARM SERVICE AGENCY, *supra* note 46, at 2 (indicating that, in assessing the environmental benefits likely to result from the enrollment of land in the CRP, USDA will consider the potential for carbon sequestration). For further information on the CRP, see *supra* section 4.2.3.

³⁶⁸ It should be noted that USDA has provided, through the AMAP, financial assistance for projects involving the planting of trees and other vegetation. This has been justified on the basis that that expanding vegetative cover helps to limit erosion by protecting soil from rain and wind. Additionally, it may also have the indirect effect of increasing carbon sequestration and thereby help to mitigate climate change.

³⁶⁹ See, for example, *Envtl. Prot. Agency v. EME Homer City Generation L. P.* 134 S.Ct. 1584, 1606 – 1607 (2014) (holding that, in determining the amount by which an upwind state must reduce emissions contributing to air pollution problems in downwind states under the Clean Air Act (42 U.S.C. § 7401 et seq.), the EPA may consider the magnitude of the upwind states’ contribution to downwind problems and the cost associated with reducing emissions in that state, even though such considerations are not expressly identified in the Act); *Mich. v. U.S. Env’tl. Prot. Agency*, 213 F.3d 663 (D.C. Cir. 2000) (holding that

the EPA could consider the cost of reducing pollution in determining whether the emission of pollutants in one state “significantly” contributes to air pollution problems in another state under the Clean Air Act (42 U.S.C. § 7401 et seq.), where the Act is silent with respect to the issue of cost consideration); *Grand Canyon Air Tour Coal. v. Fed. Aviation Admin.*, 154 F.3d 455 (D.C. Cir. 1998) (holding that the Federal Aviation Administration could consider costs to the air tourism industry in deciding how to implement a statute requiring “substantial restoration of the natural quiet” in the Grand Canyon Area, even though such considerations are not expressly identified in the statute); and *George E. Warren Corp. v. Env’tl. Prot. Agency*, 159 F.3d 616 (D.C. Cir. 1998) (holding that the EPA could consider the effects of regulation on the price and supply of gasoline when implementing legislation designed to improve air quality and reduce air pollution, even though such consideration are not expressly permitted in the legislation).

³⁷⁰ *Mich. v. U.S. Env’tl. Prot. Agency*, 213 F.3d 663, 678 - 679 (D.C. Cir. 2000).

³⁷¹ U.S. Department of Agriculture Farm Service, 2014 Farm Bill (last updated Mar. 21, 2014), <http://www.fsa.usda.gov/FSA/fbapp?area=home&subject=landing&topic=landing>.

³⁷² U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, *supra* note 17, at 103 (finding that production costs will rise as changing temperature and precipitation patterns intensify weed, pest, and disease pressures).

³⁷³ *Id.* at 103 – 104 (indicating that, in the near term, modest changes in temperature and precipitation will increase crop yields causing a in crop prices, while, in the longer term, larger climatic changes will cause crop yields to fall).

³⁷⁴ W. Schlenker, W.M. Hanemann, and A.C. Fisher, *Will U.S. Agriculture Really Benefit from Global Warming? Accounting for Irrigation in the Hedonic Approach*, 95 *ECON. REV.* 395 (2005).

³⁷⁵ As discussed above, section 1118(a)(1)(c) of the 2014 Farm Bill requires agricultural producers receiving payments under the price loss coverage and agricultural risk coverage programs to maintain their land in accordance with sound agricultural practices determined by the Secretary of Agriculture.

³⁷⁶ New York State Department of Agriculture and Markets, *Sound Agricultural Practices Guidelines* (last visited May 13, 2014), <http://www.agriculture.ny.gov/AP/agsservices/sapo.html>.

³⁷⁷ See, for example, Richard J. Pierce, *What Factors can an Agency Consider in Making a Decision?* *MICH. ST. L. REV.* 67 (2009).

³⁷⁸ *Mass. v. Env’tl. Prot. Agency*, 549 U.S. 497, 511 (2007) (summarizing the EPA’s argument).

³⁷⁹ *Id.* at 533 (summarizing the EPA’s argument).

³⁸⁰ *Id.* (concluding that, under the Clean Air Act (42 U.S.C. § 7401 et seq.), the EPA can only decline to regulate greenhouse gas emissions if it determines that such emissions do not contribute to climate change or provides some reasonable explanation as to why it cannot or will not exercise its discretion to determine whether they do and holding that “[t]o the extent that this constrains agency discretion to pursue other priorities of the Administrator or the President, this is the congressional design”).

³⁸¹ Pierce, *supra* note 377, at 81.

³⁸² *Id.*

³⁸³ *Mass. v. Env’tl. Prot. Agency*, 549 U.S. 497, 533 (2007).

³⁸⁴ *Id.*

³⁸⁵ *Id.* at 532.

³⁸⁶ *Id.* at 533.

³⁸⁷ *Id.* at 532 – 535.

³⁸⁸ *Env’tl. Prot. Agency v. EME Homer City Generation L. P.*, 134 S. Ct. 1584, 1607 (2014).

³⁸⁹ *Id.* at 1606.

³⁹⁰ *Id.*

³⁹¹ *Id.* at 1607.

³⁹² *Id.* at 1607.

³⁹³ See, for example, *Grand Canyon Air Tour Coal. v. Fed. Aviation Admin.*, 154 F.3d 455 (D.C. Cir. 1998); *George E. Warren Corp. v. Env’tl. Prot. Agency*, 159 F.3d 616 (D.C. Cir. 1998); *Mich. v. U.S. Env’tl. Prot. Agency*, 213 F.3d 663 (D.C. Cir. 2000); and *Env’tl. Prot. Agency v. EME Homer City Generation L. P.*, 134 S. Ct. 1584 (2014).

³⁹⁴ U.S. DEPARTMENT OF AGRICULTURE FARM SERVICE AGENCY, FACT SHEET: NOCOURSE MARKETING ASSISTANCE LOANS / LOAN DEFICIENCY PAYMENTS, 1 (2011), *available at* http://www.fsa.usda.gov/Internet/FSA_File/mal_ldp.pdf.

³⁹⁵ *Id.*

³⁹⁶ U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE, *supra* note 17, at 103 – 104.

³⁹⁷ *Mich. v. U.S. Env'tl. Prot. Agency*, 213 F.3d 699 (2000). See *infra* section 5.2.3(a).

³⁹⁸ 7 C.F.R. § 400.704(a) (2014) (requiring insurers to submit to the Board of FCIC for approval: (1) any policy or plan of insurance not currently reinsured by FCIC; (b) any proposed revision(s) to a policy or plan of insurance; and (3) the premium for any policy or plan of insurance); 7 C.F.R. § 400.704(b) (2014) (requiring insurers to submit any significant changes to a previous submission to the Board of FCIC for approval).

³⁹⁹ 7 C.F.R. § 400.706(b)(4) (2014).

⁴⁰⁰ 7 C.F.R. § 400.706(h)(5) (2014).

⁴⁰¹ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 317, at 15.

⁴⁰² *Id.*

⁴⁰³ See, for example, Pete Smith, Helmut Haberl, Alexander Popp, Karl-Heinz Erb, Christian Lauk, Richard Harper, Fancesco N. Tubiello, Alexandre De Sigueira Pinto, Mostafa Jafari, Suran Sohi, Omar Maserà, Hannes Böttcher, Göran Berndes, Mercedes Bustamante, Helal Ahammad, Harry Clark, Hongmin Dong, Elnour A. Elsiddig, Cheikh Mbow, Nijaralli H. Ravindranath, Charles W. Rice, Carmenza Robledo Abad, Anna Romanovskaya, Frank Sperling, Mario Herrero Joanna I. House, and Steven Rose, *How Much Land-Based Greenhouse Gas Mitigation can be Achieved Without Compromising Food Security and Environmental Goals?* 19 *Global Change Biology* 2285, 2291 (2013) (finding lower greenhouse gas emissions “for most plant based food than for animal products, with the exception of vegetables grown in heated greenhouses or transported via air freight”); Barry Brode and Geoff Russel, *Meat’s Carbon Hoofprint*, 28 *AUSTRALASIAN SCIENCE* 37 (2007) (finding that, on a per kilogram basis, greenhouse gas emissions from the production of rice and wheat are significantly lower than those from meat); GERBER ET AL., *supra* note 298, at 1 (stating that the production of animal protein typically emits more greenhouse gases than the production of equivalent amounts of plant protein).

⁴⁰⁴ “Dressed weight” (also referred to as “carcass weight”) refers to the weight of an animal after it has been partially butchered to remove the internal organs and often the head and inedible portions of the tail and legs.

⁴⁰⁵ GERBER ET AL., *supra* note 298, at 23 and 31 (indicating that, on average, 46.2 kilograms of carbon dioxide equivalent are emitted per kilogram of carcass weight for beef and 23.8 kilograms of carbon dioxide equivalent are emitted per kilogram of carcass weight for small ruminant (i.e., goat and sheep) meat).

⁴⁰⁶ Brode et al., *supra* note 403.

⁴⁰⁷ *Id.*

⁴⁰⁸ See, for example, Elke Stehfest, Lex Bouwman, Detlef .P. van Vuuren, Michel G. J. den Elzen, Bas Eickhout, and Pavel Kabat, *Climate Benefits of Changing Diet*, 95 *CLIMATE CHANGE* 83 (2009); A Popp, H Lotze-Campen, and B Bodirsky, *Food Consumption, Diet Shifts and Associated Non-CO2 Greenhouse Gases from Agricultural Production*, 20 *GLOBAL ENVIRONMENTAL CHANGE* 451 (2010); Smith et al., *supra* note 403.

⁴⁰⁹ Stehfest et al., *supra* note 408, at 93 (estimating that, compared to the ‘business as usual’ scenario, switching to a no meat diet would reduce global emissions by approximately 1.4 billion metric tons of carbon per year by 2050). See also Smith et al., *supra* note 403, at 2292 (converting the estimated emissions reductions into carbon dioxide equivalent by multiplication with 3.66667).

⁴¹⁰ Stehfest et al., *supra* note 408, at 93 (estimating that, compared to the ‘business as usual’ scenario, switching to a no animal products diet would reduce global emissions by approximately 2.1 billion metric tons of carbon per year by 2050). See also Smith et al., *supra* note 403, at 2292 (converting the estimated emissions reductions into carbon dioxide equivalent by multiplication with 3.66667).

⁴¹¹ Juliett Jowit, *UN Says Eat Less Meat to Curb Global Warming*, *THE OBSERVER* (Sep. 6, 2008), <http://www.theguardian.com/environment/2008/sep/07/food.foodanddrink> (quoting Dr Rajendra Pachaurie, Chairman of the Intergovernmental Panel on Climate Change).

⁴¹² KARI HAMERSCHLAG, ENVIRONMENTAL WORKING GROUP, MEAT EATER’S GUIDE TO CLIMATE CHANGE AND HEALTH, Footnote 13 (2011), available at <http://www.ewg.org/meateastersguide/a-meat-eaters-guide-to-climate-change-health-what-you-eat-matters/> (finding that, as more consumers buy climate-friendly products, more producers will choose climate-friendly production processes); HENNING STEINFELD, PIERRE GERBER, TOM WASSENAAR, VINCENT CASTEL, MAURICIO ROSALES, AND CEES DE HAAN, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, LIVESTOCK’S LONG SHADOW: ENVIRONMENTAL ISSUES AND OPTIONS, 282 (2006), available at <http://www.fao.org/docrep/010/a0701e/a0701e00.HTM> (concluding

that consumers can exert commercial pressure on agricultural producers to adopt climate-friendly practices).

⁴¹³ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 229, at 33.

⁴¹⁴ *Id.* at 52 and 67. See also RODALE INSTITUTE, *supra* note 309, at 4.

⁴¹⁵ Hepperly et al., *supra* note 310, at 145.

⁴¹⁶ National Archives and Records Administration, Federal Register, Agricultural Marketing Service (last visited Jul. 8, 2014), <https://www.federalregister.gov/agencies/agricultural-marketing-service>.

⁴¹⁷ Commodity Promotion, Research, and Information Act § 512(b); 7 U.S.C. § 7411(b) (2014) (authorizing the Secretary of Agriculture to administer programs for the joint promotion of agricultural commodities by producers and other industry participants).

⁴¹⁸ Agricultural Marketing Act § 203(a); 7 U.S.C. § 1622(a) (2014) (authorizing the Secretary of Agriculture to undertake research to determine the best methods of processing, preparing, packaging, handling, storing, transporting, distributing and marketing agricultural products); Agricultural Marketing Act § 203(m); 7 U.S.C. § 1622(m) (2014) (authorizing the Secretary of Agriculture to undertake research to determine the most efficient and practical means of processing, handling, storing, preserving, protecting, and distributing agricultural commodities); Agricultural Marketing Act § 203(o); 7 U.S.C. § 1622(o) (2014) (authorizing the Secretary of Agriculture to conduct such other research as will facilitate the marketing, distribution, processing, and utilization of agricultural products through commercial channels).

⁴¹⁹ Agricultural Marketing Act § 203(c); 7 U.S.C. § 1622(c) (2014) (authorizing the Secretary of Agriculture to develop quality standards for agricultural commodities); Agricultural Marketing Act § 203(h)(1); 7 U.S.C. § 1622(h)(1) (2014) (authorizing the Secretary of Agriculture to inspect agricultural commodities and certify that they meet specified quality standards).

⁴²⁰ Agricultural Marketing Act § 203(g); 7 U.S.C. § 1622(g) (2014) (authorizing the Secretary of Agriculture to collect and publish marketing information); Agricultural Marketing Act § 203(k); 7 U.S.C. § 1622(k) (2014) (authorizing the Secretary of Agriculture to collect and publish statistics on the marketing of agricultural products).

⁴²¹ National Nutrition Monitoring and Related Research Act of 1990 § 301(a); 7 U.S.C. § 5341(a) (2014) (requiring the Secretaries of Agriculture and Health and Human Services to publish nutritional information and guidelines for the general public every five years).

⁴²² Nell Green Nylen, *Why Federal Dietary Guidelines Should Acknowledge the Food-Choice / Environment Nexus: Examining the Recommendation to Eat More Seafood*, 40 *ECOLOGY L. Q.* 759, 784 (2013).

⁴²³ U.S. DEPARTMENT OF AGRICULTURE CENTER FOR NUTRITION POLICY AND PROMOTION, 2010 DIETARY GUIDELINES FOR AMERICANS BACKGROUNDER: HISTORY AND PROCESS, 2 (2010), *available at* <http://www.cnpp.usda.gov/Publications/DietaryGuidelines/2010/PolicyDoc/Backgrounder.pdf>

⁴²⁴ *Id.*

⁴²⁵ *Id.* at 4.

⁴²⁶ *Id.* at 2.

⁴²⁷ U.S. DEPARTMENT OF AGRICULTURE AND U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, DIETARY GUIDELINES FOR AMERICANS 2010, x – xi (2010), *available at* <http://www.cnpp.usda.gov/DGAs2010-PolicyDocument.htm>.

⁴²⁸ *Id.* at 9.

⁴²⁹ *Id.* at 21 and 34.

⁴³⁰ *Id.* at ix.

⁴³¹ *Id.* at 21.

⁴³² *Id.*

⁴³³ *Id.* at 10 – 11.

⁴³⁴ *Id.* at 11.

⁴³⁵ *Id.* at 9.

⁴³⁶ George Lumber, Kim Knowlton, John Balbus, Howard Frumkin, Mary Hayden, Jeremy Hess, Michael McGeehin, Nicky Sheats, Lorraine Backer, C. Ben Beard, Kristie L. Ebi, Edward Maibach, Richard S. Ostfeld, Christine Wiedinmyer, Emily Zielinski-Gutiérrez, and Lewis Ziska, *Ch. 9: Human Health*, in *CLIMATE CHANGE IMPACT IN THE UNITED STATES: THIRD NATIONAL CLIMATE ASSESSMENT* 220, 222 (Jerry M. Melillo, Terese (T.C.) Richmond, and Gary W. Yohe eds., 2014), *available at* http://s3.amazonaws.com/nca2014/high/NCA3_Full_Report_09_Human_Health_HighRes.pdf?download=

1. See also, U.S. Environmental Protection Agency, Ground Level Ozone: Health Effects (last updated Nov. 1, 2012), <http://www.epa.gov/groundlevelozone/health.html>.

⁴³⁷ Lumber et al., *supra* note 436, at 224 – 225.

⁴³⁸ *Id.* at 224.

⁴³⁹ *Id.* at 223.

⁴⁴⁰ JANET L. GAMBLE, KRISTIE L. EBI, ANNE E. GRAMBSCH, FRANCES G. SUSSMAN, AND THOMAS J. WILBANKS, U.S. GLOBAL CHANGE RESEARCH PROGRAM, ANALYSES OF THE EFFECTS OF GLOBAL CHANGE ON HUMAN HEALTH AND WELFARE AND HUMAN SYSTEMS, 54 – 55 (2008), *available at* <http://library.globalchange.gov/products/assessments/2004-2009-synthesis-and-assessment-products/sap-4-6-analyses-of-the-effects-of-global-change-on-human-health-and-welfare-and-human-systems>.

⁴⁴¹ *Id.* at 57.

⁴⁴² 40 C.F.R. § 1501.4(a)(2) (2014) (indicating that, in determining whether to prepare an EIS for a particular action, agencies must consider whether the action has been categorically excluded from assessment under NEPA); 40 C.F.R. § 1508.4 (2014) (defining a “categorical exclusion” as “a category of actions which do not individually or cumulatively have a significant effect on the human environment and...for which, therefore, neither an environmental assessment nor an environmental impact statement is required”).

⁴⁴³ 40 C.F.R. § 1508.4 (2014) (requiring agencies to “provide for extraordinary circumstances in which a normally excluded action may have a significant environmental affect”).

⁴⁴⁴ 7 C.F.R. § 1b.3(a) (2014).

⁴⁴⁵ U.S. DEPARTMENT OF AGRICULTURE ET AL., *supra* note 427, at 6.

⁴⁴⁶ *Id.*

⁴⁴⁷ *Id.*

⁴⁴⁸ See, for example, Green Nylén, *supra* note 422, at 764; Alison Ashton, *The (Fairly) Simple Message in the 2010 Dietary Guidelines*, NOURISH NETWORK (Feb. 7, 2011),

<http://www.nourishnetwork.com/2011/02/07/the-fairly-simple-message-in-the-2010-dietary-guidelines/>.

⁴⁴⁹ HAMERSCHLAG, *supra* note 412, at 6 (finding that the production of lamb generates 39.2 kilograms of carbon dioxide equivalent per kilogram consumed and the production of beef generates 27.0 kilograms of carbon dioxide equivalent per kilogram consumed).

⁴⁵⁰ *Calvert Cliffs' Coordinating Committee, Inc. v. U.S. Atomic Energy Com.*, 449 F.2d 1109, 1112 (D.C. Cir. 1971).

⁴⁵¹ *Id.* (stating that “[p]erhaps the greatest importance of NEPA [42 U.S.C. § 4321 et seq.] is to require... agencies to consider environmental issues just as they consider other matters within their mandates”).

⁴⁵² See, for example, *Greene County Planning Bd. v. Federal Power Com.*, 455 F.2d 412, 420 (2d Cir. 1972) (holding that NEPA (42 U.S.C. § 4321 et seq.) requires each federal agency to consider “environmental values at every distinctive and comprehensive stage of the [decision-making] process” (internal quotations omitted)); *Arlington Coalition on Transp. v. Volpe*, 458 F.2d 1323, 1332 (4th Cir. Va. 1972) (holding that, under NEPA (42 U.S.C. § 4321 et seq.), a federal agency must not only prepare an EIS for each major federal action significantly affecting the environment but must also “take into account the information contained therein” when deciding whether to act); *Scherr v. Volpe*, 466 F.2d 1027 (7th Cir. Wis. 1972) (holding that, in NEPA (42 U.S.C. § 4321 et seq.), “Congress has not only permitted but has compelled...federal agencies to take environmental values into account”); *Iowa Citizens for Environmental Quality, Inc. v. Volpe*, 487 F.2d 849 (8th Cir. Iowa 1973) (holding that NEPA (42 U.S.C. § 4321 et seq.) requires “agencies of the federal government...[to] consider all the environmental consequences of their decisions”); *Shiffler v. Schlesinger*, 548 F.2d 96, 100 (3d Cir. N.J. 1977) (holding that NEPA (42 U.S.C. § 4321 et seq.) imposes “a substantive obligation upon all federal agencies to balance environmental considerations” against other issues when making decisions and that, to this end, federal agencies must consider the findings of an EIS prepared under NEPA (42 U.S.C. § 4321 et seq.)); *Detroit Edison Co. v. United States Nuclear Regulatory Com.*, 630 F.2d 450 (6th Cir. 1980) (holding that, under NEPA (42 U.S.C. § 4321 et seq.), each federal agency “is not only permitted, but compelled, to take environmental values into account in carrying out its regular functions” (internal quotations omitted)).

⁴⁵³ *Calvert Cliffs' Coordinating Committee, Inc. v. U.S. Atomic Energy Com.*, 449 F.2d 1109, 1115 (D.C. Cir. 1971).

⁴⁵⁴ Scherr v. Volpe, 466 F.2d 1027, 1031 (7th Cir. Wis. 1972). See also Public Service Co. v. U.S. Nuclear Regulatory Com., 582 F.2d 77, 81 (1st Cir. 1978) (holding that “[u]nless there are specific statutory provisions which necessarily collide with NEPA [42 U.S.C. § 4321 et seq.],” an agency must consider environmental issues when making decisions).

⁴⁵⁵ See, for example, Energy Supply and Environmental Coordination Act of 1974 § 7(c); 15 U.S.C. 793(c)(1) (exempting actions undertaken by the U.S. Environmental Protection Agency pursuant to the Clean Air Act (42 U.S.C. § 7401 et seq.) from the requirements of NEPA (42 U.S.C. § 4321 et seq.).

⁴⁵⁶ See, for example, Department of Transportation v. Public Citizen, 541 U.S. 752 (2004) (holding that the Federal Motor Carrier Safety Administration was not required to prepare an EIS under NEPA (42 U.S.C. § 4321 et seq.) in circumstances where it had no discretion to act on the information therein).

⁴⁵⁷ See, for example, Flint Ridge Dev. Co. v. Scenic Rivers Assn. of Oklahoma, 426 U.S. 776 (1976) (holding that NEPA (42 U.S.C. § 4321 et seq.) did not require the U.S. Department of Housing and Urban Development to prepare an environmental statement for an action that was legislatively required to be taken within thirty days as a “statement cannot possibly be prepared within” such a short period of time).

⁴⁵⁸ As discussed above, section 301(a)(2) of the National Nutrition Monitoring and Related Research Act (7 U.S.C. § 5341(a)(2)) requires the Dietary Guidelines for Americans to “be based on the preponderance of the scientific and medical knowledge which is current at the time” of their development. However, beyond this, the National Nutrition Monitoring and Related Research Act (7 U.S.C. § 5301 et seq.) does not specify the information to be considered in developing the Dietary Guidelines for Americans.

⁴⁵⁹ As discussed above, section 301(a)(1) of the National Nutrition Monitoring and Related Research Act (7 U.S.C. § 5341(a)(1)) requires CNPP and ODPHP to publish the Dietary Guidelines for Americans every five years. This provides ample time in which to conduct an environmental review under NEPA (42 U.S.C. § 4321 et seq.).

⁴⁶⁰ Green Nysten, *supra* note 422, at 792 (concluding that the Dietary Guidelines for Americans “while nonbinding, is a policy vehicle *intended* to have specific, significant effects on the food choices of several hundred million people”).

⁴⁶¹ *Id.*

⁴⁶² LESLIE PRAY, SUSTAINABLE DIETS: FOOD FOR HEALTH PEOPLE AND A HEALTHY PLANET, 94 – 95 (National Academies Press 2014) (reporting Kate Clancy’s view, as expressed at the Institute of Medicine’s Food Forum and Roundtable on Environmental Health Sciences, Research, and Medicine on May 7-8, 2013, that agencies developing federal dietary guidance should consider the environmental implications of food choices).

⁴⁶³ As discussed in Chapter 1, USDA can and does undertake education and outreach programs on the environmental impacts of agricultural production.

⁴⁶⁴ Green Nysten, *supra* note 422, at 761.

⁴⁶⁵ *Id.*

⁴⁶⁶ Commodity Promotion, Research, and Information Act § 515(b)(1)-(2); 7 U.S.C. § 7414(b)(1)-(2) (2014) (requiring each order issued under the Act to establish a board, comprised of agricultural producers and certain other industry participants, to carry out a research and promotion program for the agricultural commodity covered by the order).

⁴⁶⁷ Commodity Promotion, Research, and Information Act § 515(c); 7 U.S.C. § 7414(c) (2014) (requiring each order issued under the Act to specify the duties and powers of the board established thereunder).

⁴⁶⁸ Commodity Promotion, Research, and Information Act § 515(e)(1); 7 U.S.C. § 7414(e)(1) (2014) (directing AMS to include, in orders issued under the Act, provisions requiring boards to submit research and promotion programs to AMS for approval).

⁴⁶⁹ The research and promotion programs relate to blueberries, honey, lamb, mangos, peanuts, processed raspberries, softwood lumber, and sorghum. Other research and promotion programs are conducted under commodity specific legislation. See U.S. Department of Agriculture Agricultural Marketing Service, Research and Promotion Programs (last updated Aug. 27, 2013),

<http://www.ams.usda.gov/AMSV1.0/ams.fetchTemplateData.do?template=TemplateB&navID=ResearchandPromotion&leftNav=ResearchandPromotion&page=ResearchandPromotion&acct=AMSPW>

⁴⁷⁰ 7 C.F.R. § 1200.16(a).

⁴⁷¹ PRICEWATERHOUSE COOPERS, GREEN PRODUCTS: USING SUSTAINABLE ATTRIBUTES TO DRIVE GROWTH AND VALUE, 2 – 3 (2010), available at http://www.pwc.com/en_US/us/corporate-sustainability-climate-change/assets/green-products-paper.pdf.

⁴⁷² GREEN AMERICA, ASSOCIATION FOR ENTERPRISE OPPORTUNITIES, AND ECOVENTURES INTERNATIONAL, SMALL BUSINESS SUSTAINABILITY REPORT 2013: THE BIG GREEN OPPORTUNITY FOR SMALL BUSINESS IN THE U.S., 25 (2013), available at <http://biggreenopportunity.org/wp-content/uploads/2013/05/Big-Green-Opportunity-Report-FINAL-WEB.pdf>.

⁴⁷³ *Id.*

⁴⁷⁴ *Id.*

⁴⁷⁵ MARTIN C. HELLER AND GREGORY A. KEOLEIAN, LIFE CYCLE-BASED SUSTAINABILITY INDICATORS FOR ASSESSMENT OF THE U.S. FOOD SYSTEM 41 (2000), available at http://css.snre.umich.edu/css_doc/CSS00-04.pdf.

⁴⁷⁶ PATRICK CANNING, AINSLEY CHARLES, SONYA HUANG, KAREN R. POLENSKE, AND ARNOLD WATERS, U.S. DEPARTMENT OF AGRICULTURE, ENERGY USE IN THE U.S. FOOD SYSTEM 1 (2010), available at www.ers.usda.gov/media/136418/err94_1.pdf.

⁴⁷⁷ Nathan Pelletier, Eric Audsley, Sonja Brodt, Tara Garnett, Patrik Henriksson, Alissa Kendall, Klaas Jan Kramer, David Murphy, Thomas Nemecek, and Max Troell, *Energy Intensity of Agriculture and Food Systems*, 23 ANNU. REV. ENVIRON. RESOUR. 223, 239 (2011) (indicating that agricultural production is “heavily reliant on nonrenewable energy resources”); David Pimental, Sean Williamson, Courtney E. Alexander, Omar Gonzalez-Pagan, Caitlin Kontak, and Steven E. Mulkey, *Reducing Energy Inputs in the U.S. Food System*, 36 HUM. ECOL. 459, 459 (2008) (finding that “[t]he American food supply is driven almost entirely by non-renewable energy sources).

⁴⁷⁸ U.S. DEPARTMENT OF AGRICULTURE, *supra* note 229, at 83.

⁴⁷⁹ Assuming that, on average, passenger vehicles emit approximately 4.8 metric tons of carbon dioxide annually. U.S. Environmental Protection Agency, *Clean Energy: Calculations and References* (last updated Sep. 18, 2013), <http://www.epa.gov/cleanenergy/energy-resources/refs.html>.

⁴⁸⁰ The Role of Agriculture and Forestry in Global Warming Legislation: Hearing Before the S. Comm. on Agriculture, Nutrition, and Forestry, 111th Cong. 6 (2009) (statement of Roger Johnson, President, National Farmers Union).

⁴⁸¹ *Id.*

⁴⁸² Edenhofer et al., *supra* note 31, at 19 (indicating that, on a lifecycle basis, electric generation from biofuels emits an average of thirty-two grams of carbon dioxide equivalent per KWh of electricity generated, while electric generation from coal emits an average of 1001 grams of carbon dioxide equivalent per KWh of electricity generated).

⁴⁸³ Section 9001(a) of the Food, Conservation, and Energy Act of 2008 amended Title IX of the Farm Security and Rural Investment Act of 2002 (“**2002 Farm Bill**”) (7 U.S.C. 8101 et seq.) to, among other things, provide for the use of federal funds to encourage biofuels production.

⁴⁸⁴ Sections 9003, 9004, and 9005 of the 2014 Farm Bill amended Title IX of the Farm Security and Rural Investment Act of 2002 (7 U.S.C. § 8101 et seq.) to provide additional funding for programs aimed at encouraging biofuels production.

⁴⁸⁵ Press Release, USDA Announces Support for Producers of Advanced Biofuels (Sep. 12, 2013), <http://www.usda.gov/wps/portal/usda/usdahome?contentid=2013/09/0177.xml&contentidonly=true>.

⁴⁸⁶ *Id.*

⁴⁸⁷ TAXPAYERS FOR COMMON SENSE, BIOREFINERY ASSISTANCE PROGRAM FACT SHEET (2013), available at http://www.taxpayer.net/images/uploads/downloads/Biorefinery_Assistance_Program_Fact_Sheet_Final.pdf.

⁴⁸⁸ Press Release, Agriculture Secretary Announces Funding to Support Small Socially Disadvantaged Producers and Renewable Energy Projects (Apr. 15, 2014), <http://www.usda.gov/wps/portal/usda/usdahome?contentid=2013/09/0191.xml>.

⁴⁸⁹ RD is comprised of the Rural Housing Service, Rural Business-Cooperative Service, and Rural Utilities Service. The Rural Utilities Service provides funding for the development of electricity and other utilities infrastructure in rural areas.

⁴⁹⁰ Rural Electrification Act § 4(a); 7 U.S.C. § 904(a) (2014) (authorizing the Secretary of Agriculture to make direct loans to finance the construction and operation of electric generation, transmission, and distribution facilities required to provide electric services in rural areas).

⁴⁹¹ Rural Electrification Act § 305(a); 7 U.S.C. § 935(a) (2014) (authorizing the Secretary of Agriculture to provide insured loans for rural electric systems).

⁴⁹² Rural Electrification Act § 306; 7 U.S.C. § 936 (2014) (authorizing the Secretary of Agriculture to guarantee loans made to rural electric suppliers by legally organized lenders).

⁴⁹³ Farm Security and Rural Investment Act of 2002 § 9007(c); 7 U.S.C. § 8107(c) (2014).

⁴⁹⁴ Farm Security and Rural Investment Act of 2002 § 9007(b); 7 U.S.C. § 8107(b) (2014).

⁴⁹⁵ As discussed in Chapter 1, NEPA, section 102(2)(C) (42 U.S.C. § 4332(2)(C)) requires federal agencies to prepare an EIS for all “major federal actions significantly affecting the quality of the human environment.” 40 C.F.R. § 1508.15 defines a “major federal action” to include “actions with effects that may be major and which are potentially subject to Federal control and responsibility.” Under 40 C.F.R. § 1508.15, an action is considered to be “subject to Federal control” if it is undertaken by a federal agency or by a private party with the consent of a federal agency.

⁴⁹⁶ 7 C.F.R. § 1794.41 (2014) (requiring a borrower to prepare and submit to RD a BER in support of its loan application). See also 7 C.F.R. § 1924.21(b) (2014) (setting out certain circumstances in which a BER is not required).

⁴⁹⁷ 7 C.F.R. § 1710.152 (2014).

⁴⁹⁸ See U.S. DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION, FINAL ENVIRONMENTAL IMPACT STATEMENT – DEER CREEK STATION ENERGY FACILITY PROJECT BROOKINGS COUNTY, SOUTH DAKOTA (2010), available at <http://www.rurdev.usda.gov/UWP-Deer%20Creek%20Power.html> [hereinafter U.S. DEPARTMENT OF ENERGY, DEER CREEK STATION EIS]; U.S. DEPARTMENT OF AGRICULTURE RURAL UTILITIES SERVICE AND U.S. DEPARTMENT OF ENERGY WESTERN POWER ADMINISTRATION, FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE SOUTH DAKOTA PRAIRIE WINDS PROJECT – DOE/EIS #0418 (2010), available at <http://www.rurdev.usda.gov/UWP-PrairieWinds%20ProjectSD.html> [hereinafter U.S. DEPARTMENT OF AGRICULTURE ET AL., PRAIRIE WINDS EIS]; U.S. DEPARTMENT OF ENERGY AND U.S. ARMY CORPS OF ENGINEERS, KEMPER COUNTY IGCC PROJECT – FINAL ENVIRONMENTAL IMPACT STATEMENT – DOE/EIS-0409 (2010), available at http://www.netl.doe.gov/technologies/coalpower/cctc/EIS/eis_kemper.html [hereinafter U.S. DEPARTMENT OF ENERGY ET AL., SUPRA NOTE KEMPER IGCC PROJECT EIS]; PUERTO RICO INDUSTRIAL DEVELOPMENT COMPANY, PRELIMINARY ENVIRONMENTAL IMPACT STATEMENT – RENEWABLE POWER GENERATION AND RESOURCE RECOVERY PLANT (2010), available at <http://www.rurdev.usda.gov/UWP-AreciboPuertoRico.html>; MINNESOTA DEPARTMENT OF COMMERCE OFFICE OF ENERGY SECURITY AND U.S. DEPARTMENT OF AGRICULTURE RURAL DEVELOPMENT, BEMIDJI-GRAND RAPIDS 230 kV TRANSMISSION LINE PROJECT – FINAL ENVIRONMENTAL IMPACT STATEMENT (2010), available at <http://www.rurdev.usda.gov/UWP-MinnkotaElectricBemidji.html>; U.S. DEPARTMENT OF AGRICULTURE RURAL UTILITIES SERVICE, FINAL ENVIRONMENTAL IMPACT STATEMENT – FINANCING ASSISTANCE FOR PROPOSED BIOMASS POWER PLANT – OGLETHORPE POWER CORPORATION (2011), available at <http://www.rurdev.usda.gov/UWP-OglethorpePower.html> [hereinafter U.S. DEPARTMENT OF AGRICULTURE, OGLETHORPE POWER EIS]; U.S. DEPARTMENT OF AGRICULTURE RURAL UTILITIES SERVICE, FINAL ENVIRONMENTAL IMPACT STATEMENT – FINANCING ASSISTANCE FOR PROPOSED HAMPTON-ROCHESTER-LA CROSSEE 345 kV TRANSMISSION SYSTEM IMPROVEMENT PROJECT – DAIRLAND POWER COOPERATIVE (2012), available at <http://www.rurdev.usda.gov/UWP-CapX2020-Hampton-Rochester-LaCrosse.html>; U.S. DEPARTMENT OF AGRICULTURE RURAL UTILITIES SERVICE, SUPPLEMENTAL FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE RESTART OF HEALY POWER PLANT UNIT #2 (2013), available at <http://www.rurdev.usda.gov/UWP-HealyPowerPlan.html> [hereinafter U.S. DEPARTMENT OF AGRICULTURE, HEALY POWER PLANT EIS].

⁴⁹⁹ Five of the eight final EISs issued between 2009 and 2014 quantified the change in greenhouse gas emissions associated with the rural energy project under review. See U.S. DEPARTMENT OF ENERGY, DEER CREEK STATION EIS, *supra* note 498, at 4-6; U.S. DEPARTMENT OF AGRICULTURE, PRAIRIE WINDS EIS, *supra* note 498, at 265; U.S. DEPARTMENT OF ENERGY ET AL., KEMPER IGCC PROJECT EIS, *supra* note 498, at 6-3; U.S. DEPARTMENT OF AGRICULTURE, OGLETHORPE POWER EIS, *supra* note 498, at 155; U.S. DEPARTMENT OF AGRICULTURE, HEALY POWER PLANT EIS, *supra* note 498, at 3-38.

⁵⁰⁰ See U.S. DEPARTMENT OF AGRICULTURE, HEALY POWER PLANT EIS, *supra* note 498.

⁵⁰¹ *Id.* at 3-38.

⁵⁰² *Id.*

⁵⁰³ *Id.*

⁵⁰⁴ Lauren Giles Wishnie, *NEPA for a New Century: Climate Change and the Reform of the National Environmental Policy Act* 16 N.Y.U. ENVTL. L. J. 628, 644 (2008) (noting that most projects, regardless of their size, will not result in significant greenhouse gas emissions).

⁵⁰⁵ National Environmental Policy Act § 102(2)(E); 42 U.S.C. § 4332(2)(E) (2014) (requiring agencies to identify alternatives to projects with unresolved environmental impacts); 40 C.F.R. § 1502.14(a) (2014) (requiring agencies to “[r]igorously explore and objectively evaluate all reasonable alternatives”).

⁵⁰⁶ *Calvert Cliffs’ Coordinating Committee, Inc v. U.S. Atomic Energy Comm.*, 449 F.2d 1109 (D.C. Cir. 1971) (finding that NEPA aims to “ensure that each agency decision maker has before him and takes into proper account all possible approaches to a particular project (including total abandonment of the project) which would alter the environmental impact”).

⁵⁰⁷ 7 C.F.R. § 1940.318(g).

⁵⁰⁸ See *supra* section 7.1.

⁵⁰⁹ It should be noted that, in some circumstances, the production and installation of devices to increase energy efficiency (e.g., high efficiency water heaters and other appliances) may generate greenhouse gas emissions.

⁵¹⁰ 7 C.F.R. § 4280.108(e) (2014) (indicating that, in providing grants and loans for renewable energy and energy efficiency projects, RD will comply with the environmental procedures and requirements in 7 C.F.R. part 1940, subpart G); 7 C.F.R. § 1940.303(a) (2014) (requiring RD to consider environmental, economic, social and other relevant factors in program development and decision-making processes).

⁵¹¹ 7 C.F.R. § 4280.106(e)(1) (2014).

⁵¹² 7 C.F.R. § 4280.116(a)(2) (2014) (indicating that “each application must include all environmental review documents with supporting documentation in accordance with 7 C.F.R. part 1940, subpart G”); 7 C.F.R. § 1904.309(b) requiring applicants for financial assistance “to provide information necessary to evaluate their proposal’s potential environmental impacts”).

⁵¹³ 7 C.F.R. § 1940.309(c) (2014) (requiring applicants whose proposals meet the definition of a Class I Action to complete the face of Form 1904.20 “Request for Environmental Information”); 7 C.F.R. § 1940.211(c)(4) (2014) (defining “Class 1 Actions” to include “the provision of financial assistance for the construction of energy producing facilities designed for on-farm use”); Form 1940-20 “Request for Environmental Information” (requiring applicants to indicate whether their proposal will affect air quality).

⁵¹⁴ As discussed in section 3.2.4 above, in February 2010, CEQ issued a draft guidance memorandum advising federal agencies to consider climate change in environmental reviews under NEPA. Memorandum from Nancy H. Sutley, Chair, Council on Environmental Quality, to the Heads of Federal Departments and Agencies (Feb. 18, 2010), *available at* <http://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance>.

⁵¹⁵ 7 U.S.C. § 931a (2014) (providing that “no funds...shall be available to carry out loan programs...at levels other than those provided for in advance in appropriations Acts”).

⁵¹⁶ 7 C.F.R. § 1710.106(e)(1) (2014) (indicating that RD may limit the size of all loans if “the amount authorized for lending...in a fiscal year is substantially less than the total amount eligible for...financing”).

⁵¹⁷ Fredric Beck and Eric Martinot, *Renewable Energy Policies and Barriers*, in 5 ENCYCLOPEDIA OF ENERGY 366 (Cutler J. Cleveland ed., 2004).

⁵¹⁸ *Id.*

⁵¹⁹ 7 C.F.R. § 1721.104(b) (2014).

⁵²⁰ 7 C.F.R. § 1710.400(a) (2014).

⁵²¹ 7 C.F.R. § 1710.405(a)(1) (2014).

⁵²² 7 U.S.C. §§ 1710.405(b) and 1710.406(c) (2014).

⁵²³ 7 U.S.C. §§ 1710.405(a)(2) and 1710.406(b) (2014).

⁵²⁴ Energy Efficiency and Conservation Loan Program 78 Fed. Reg. 73,356, 73,356 (Dec. 5, 2013).

⁵²⁵ Farm Security and Rural Investment Act of 2002 § 6407(h); 7 U.S.C. § 8107a(h) (2014).

⁵²⁶ Farm Security and Rural Investment Act of 2002 § 6407(c)(1); 7 U.S.C. § 8107a(c)(1) (2014).

⁵²⁷ Eligible “loan commodities” are wheat, corn, grain, sorghum barley, oats, upland cotton, extra long staple cotton, graded and nongraded wool, mohair, long and medium grain rice, peanuts, soybeans, other oilseeds, honey, dry peas, lentils, and small and large chickpeas. See *infra* section 5.2.3(b).

⁵²⁸ See, for example, *Mich. v. U.S. Evtl. Prot. Agency*, 213 F.3d 663 (2000). See *infra* section 5.2.3(a).

⁵²⁹ *Id.* at 678.

⁵³⁰ *Id.* at 678 – 679.

⁵³¹ U.S. DEPARTMENT OF AGRICULTURE FARM SERVICE AGENCY, *supra* note 394, at 1.

⁵³² *Id.*

⁵³³ Walsh et al., *supra* note 8, at 29.

⁵³⁴ *Id.* at 33 – 45.

⁵³⁵ 2013 States of the Union Address, *supra* note 36 (urging Congress to “pursue a bipartisan, market-based solution to climate change”); President Barack Obama, Remarks by the President on Climate Change (Jun. 25, 2013) (calling on Congress to “come up with a bipartisan, market-based solution to climate change”).

⁵³⁶ EXECUTIVE OFFICE OF THE PRESIDENT, *supra* note 37.

⁵³⁷ Press Release, Agriculture Secretary Announces Funding to Support Small Socially Disadvantaged Producers and Renewable Energy Projects (Apr. 15, 2014), <http://www.usda.gov/wps/portal/usda/usdahome?contentid=2013/09/0191.xml> (stating that, since 2009, USDA has funded over 8000 projects through its Rural Energy for America Program). See *supra* Chapter 1.

⁵³⁸ Press Release, USDA Announces Support for Producers of Advanced Biofuels (Sep. 12, 2013), <http://www.usda.gov/wps/portal/usda/usdahome?contentid=2013/09/0177.xml&contentidonly=true> (indicating that, through its Advanced Biofuels Payment Program, USDA has provided grants to almost 300 producers of advanced biofuels to enable increased production thereof). See *supra* Chapter 1.

⁵³⁹ U.S. DEPARTMENT OF AGRICULTURE FARM SERVICE AGENCY, *supra* note 282 (indicating that USDA may provide funding for projects that increase carbon sequestration by, for example, expanding vegetative covers). See *infra* section 4.2.3.